

Spring 2018



Growing

A HEALTHY FUTURE



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FOOD • FUEL • WATER • LANDSCAPES • PEOPLE

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES | UNIVERSITY OF NEBRASKA-LINCOLN



GROWING NEBRASKA



Michael J. Boehm

As I strolled through Maxwell Arboretum the other day the sun was shining brightly through the towering oak trees and the first flowers were beginning to bloom. All of the sudden it dawned on me — spring has arrived!

It may have been a long winter here in the Midwest, but it was a productive one at the Institute of Agriculture and Natural Resources. Just like the beauty exposing itself in the Arboretum, I feel IANR is beginning to bloom and show its allure to the world. This can be attributed to our palpable momentum, as evidenced by the great work you can learn about in this issue of Growing. From our efforts to enhance the nutrient levels in crops to creating a space for innovation and creativity in rural communities, the breadth of IANR's work across the state is vast.

All of these incredible efforts have continued to strengthen despite ongoing and difficult discussions concerning our funding. Over the past several months, the University of Nebraska has faced an enormous challenge to close a significant budget gap. It has not been easy, and the budget measures have impacted our people and our communities.

The fiscal challenges facing our state and university are tough, but they pale in comparison to the challenges facing our world. We can't afford to let up in the face of the challenges concerning sustainable food production, environmental stewardship, human nutrition, business development and youth engagement. IANR has a vision for a prosperous land and we refuse to let the budget stand in our way.

Late last year we welcomed over 300 Nebraskans to Lincoln for a daylong "Growing Nebraska" summit. Topics discussed included creating a better quality of life, educating tomorrow's leaders, igniting a passion and feeding a growing world. Provocative speakers and leading researchers motivated participants to join together to find sustainable solutions, while thinking globally and acting locally.

Your passion for your farms and ranches, your children, communities, and economy were evident at the summit, and it's also what drives the roughly 1,900 talented men and women who work at IANR come to work each day. You inspire us to discover and create solutions to your greatest challenges, and we're doing so at unprecedented levels.

With record enrollment, an expanding global presence, increased research expenditures and our unique outreach efforts, IANR is in an ideal position to address the needs discussed at the summit. We have all experienced "The Good Life," but IANR is striving to help you live a better life. Thank you for your continued support of these efforts.

I hope you can all take time to enjoy the beauty that comes with springtime in Nebraska.

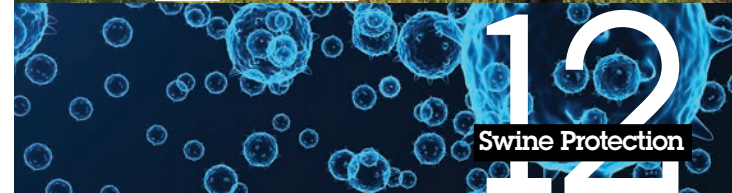
Go Big Red!

Michael J. Boehm, Ph.D.
Vice President, Agriculture and Natural Resources
University of Nebraska
IANR Harlan Vice Chancellor,
University of Nebraska-Lincoln

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Plant Science Innovation



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GROWING
A HEALTHY FUTURE

Spring 2018

Volume 7, Number 1

Growing A Healthy Future is published twice a year by the University of Nebraska-Lincoln under the auspices of the University of Nebraska Vice President and Harlan Vice Chancellor of the Institute of Agriculture and Natural Resources.

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Cover photo:
A July sunset highlights a center pivot irrigating corn in southeast Lancaster County.

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By: Haley Apel

From the lab to the field: Center for Plant Science Innovation is transforming agriculture

While basic plant science research is at the core of the Center for Plant Science Innovation (PSI) at the University of Nebraska-Lincoln, what the Center actually does is anything but basic. PSI faculty are making groundbreaking discoveries in the areas of metabolic biochemistry, stress biology, and genetics and epigenetics. While the research is groundbreaking, PSI Director Edgar Cahoon believes the ability to bring these findings to the field is what makes the center unique.

“The Center for Plant Science Innovation has a strong foundation in basic research and we really value that, but we also realize that this basic research has to be translated into new products and new technologies to have real impact,” said Cahoon. Outcomes from PSI research have led to improved stress tolerance, more nutritious crops, improved bioenergy qualities and enhanced yields.

PSI originated from a call in the late 1990s from then University of Nebraska President L. Dennis Smith to develop a major signature program in plant science research that would bring together faculty between the university’s City and East Campuses. The Plant Science Initiative was launched in 1999 with the goal of enhancing plant science research in support of Nebraska’s agricultural industry.

Sally Mackenzie, Ralph and Alice Raikes Professor of Agronomy and Horticulture, provided leadership for the initiative and began laying the foundation to establish PSI as a center. The University of Nebraska Board of Regents approved the Center for Plant Science Innovation in January 2008.

Fast-forward 10 years and PSI has evolved into a multifaceted plant biology center with 23 faculty members and their labs, spanning four different departments across the university.

“The center provides us with the framework to promote collaboration among the different disciplines within plant sciences while training students and postdoctoral researchers who will be the next generation of academic and industrial scientists,” said Cahoon, who has served as PSI director since 2010.

PSI comprises faculty from the departments of agronomy and horticulture, biochemistry, plant pathology and the School of Biological Sciences. It also has active collaborations with other university centers and initiatives such as the Food for Health Center, Water for Food Global Institute, Industrial Agricultural Processing Center, Quantitative Life Sciences Initiative and the Consortium for Integrated Translational Biology.

“Modern plant science research at the university has become even more robust thanks to the collaborations fostered by the Center for Plant Science Innovation,” said Archie Clutter, Agricultural Research Division dean. “Outcomes from the center’s novel research continue to transform agriculture from the lab to the field.”

The majority of research within PSI is conducted at the Beadle Center on City Campus, in addition to greenhouses on East Campus and at Nebraska Innovation Campus. The center also has access to designated field facilities for evaluation of research under divergent climactic conditions. In-house expertise in crop transformation coupled with these facilities has become the basis for an agricultural biotechnology pipeline that allows PSI to maximize the impact of its research programs and bring knowledge to the field. PSI research is also supported by computational biology that guides gene discovery efforts and new gene editing techniques to expand the capacity of the pipeline for crop improvement.

This work has the potential to impact the bottom-line of Nebraska producers, especially when commodity markets are low. In addition to developing stress tolerant, nutritious crops at higher yields, a number of research projects are focused on enhancing the quality of crops, which would enable producers to earn higher margins.

Beyond Nebraska, PSI faculty have extensive international collaborations and conduct research that impacts the production and nutritional quality of staple crops in developing countries. From the development of salt-tolerant rice genes to combatting vitamin-A deficiency in sub-Saharan Africa, the center has placed a target on the challenge of global food security.

The Center for Plant Science Innovation is a prime example of the Institute of Agriculture and Natural Resources’ commitment to sustainable food production and water use efficiency around the world.

For more information, visit unl.edu/psi.

Common bean
in the process of
being genetically
transformed.

The vision of the Center for Plant Science Innovation is to improve global well-being through innovative plant science research. Here are a few examples of how PSI researchers are contributing to this effort.

Maize root is being studied as part of an EPSCoR project aimed at developing new biological tools to enhance crop performance. Read more on page 8.



Translating research to crop improvement through a biotechnology pipeline

A centerpiece of research in the Center for Plant Science Innovation is its plant biotechnology pipeline that allows members to translate basic discoveries in model plants, to crops that are of relevance to Nebraska and beyond. This pipeline has a target on innovations for increased crop production and profitability.



A key component of this pipeline is the Plant Transformation Core Facility that is managed by Eugene W. Price Distinguished Professor of Biotechnology Tom Clemente, and operated by the Center for Biotechnology.

Following evaluation in the greenhouse, genetically enhanced crops generated by the core are evaluated in biotechnology fields at the Eastern Nebraska Research and Extension Center

near Mead, and in Sidney, near the Panhandle Research and Extension Center. This pipeline has demonstrated the effectiveness of several new technologies developed by PSI researchers, most

notably the Dicamba herbicide resistance trait, which is one of the major new biotech traits on the market.

Additional research supported by the pipeline includes soybean resistance to aphids, an insect pest in the Midwest; improving aquaculture feed, which is a growing high-value market for Nebraska soybean farmers; and engineering sorghum and the emerging

oilseed camelina for traits that increase the energy density of biomass and oil from these crops for next generation biofuels.

Not only has the pipeline benefitted PSI researchers, but it has sparked collaborations with scientists across the globe and start-up companies that lack the infrastructure for lab-to-field evaluation of their target genes.



Postdoctoral research associate Lili Hou and Tom Clemente, Eugene W. Price Distinguished Professor of Biotechnology, work in Clemente's lab at the Center for Plant Science Innovation.

Discovering new frontiers for crop improvement

The root plays a significant role in a plant's ability to withstand abiotic stresses, like drought and soil salinity. Eleven faculty from the Center for Plant Science Innovation have teamed up with scientists at the University of Nebraska Medical Center, University of Nebraska at Kearney and Doane University to form the Center for Root and Rhizobiome Innovation.

Funded by the National Science Foundation's Experimental Program to Stimulate Competitive Research, or EPSCoR, this project uses a holistic strategy to study root and soil microbe interactions and to develop new biological tools to enhance crop performance.



Graduate student

The team primarily focuses on maize, but the findings and biological tools can be applicable to studying and improving other crops, including soybeans. The team is working toward understanding the genetic and metabolic diversity across a wide array of corn varieties for the chemicals secreted by roots, known as exudates.

The researchers hope to identify exudates that attract specific microbes to the roots to improve the ability of the plant to mine the soil for water and nutrients such as nitrogen and phosphorus. This knowledge will guide efforts by the team to breed or use new technologies, such as synthetic biology, to develop new maize varieties that are able to maintain productivity with less water and chemical fertilization, which could reduce input costs by farmers and increase sustainability of crop production.

The project also aims to develop a highly skilled workforce to support and start biotechnology industries in Nebraska. Not only are undergraduate and graduate students trained in PSI faculty labs, but the research is also complemented by summer science camps for Nebraska middle and high school students to promote their interest in education and eventual careers in science, technology, engineering and math disciplines.



“Modern plant science research at the university has become even more robust thanks to the collaborations fostered by the Center for Plant Science Innovation.”
– Archie Clutter



Translating basic discoveries in model plants to crops that are of relevance to Nebraska is a cornerstone of research at the Center for Plant Science Innovation. Here Zhengxiang Ge conducts research in the Clemente lab.

Graduate student Panya Kim studies plant immunity and works in the lab of Jim Alfano, Charles Bessey Professor of Plant Pathology.





Boosting nutritional properties in crops

The challenge of population growth not only demands the production of more food, but also more nutritious food. The nexus of breeding and biotechnology within the Center for Plant Science Innovation fosters research to develop crops with improved nutritional properties.

PSI researcher David Holding, associate professor in the Department of Agronomy and Horticulture, studies Quality Protein Maize or QPM, which provides a more complete protein

In addition, a decade-long research project led by Edgar Cahoon, George Holmes Professor of Biochemistry and director of the Center for Plant Science Innovation, is focused on increasing amounts of provitamin A-beta carotene in cassava.

Cassava is a starch-rich root crop that is a primary calorie source for more than 250 million people in sub-Saharan Africa. Despite its dietary importance, cassava is relatively deficient in micronutrients such as provitamin A beta-carotene. As a result, childhood blindness and other health problems associated with vitamin A deficiency are problems in countries — like Nigeria — that heavily depend on cassava as a food source.

Beyond breeding and biotechnology efforts by PSI researchers for crop nutritional improvement, PSI geneticists James Schnable and David Hyten are working in collaboration with Nebraska Food for

Health Center researchers to assess diverse maize and soybean germplasm for effects on the gut microbiome composition. The goal is to identify phytochemicals from these varieties that promote desired gut microbes for human health.

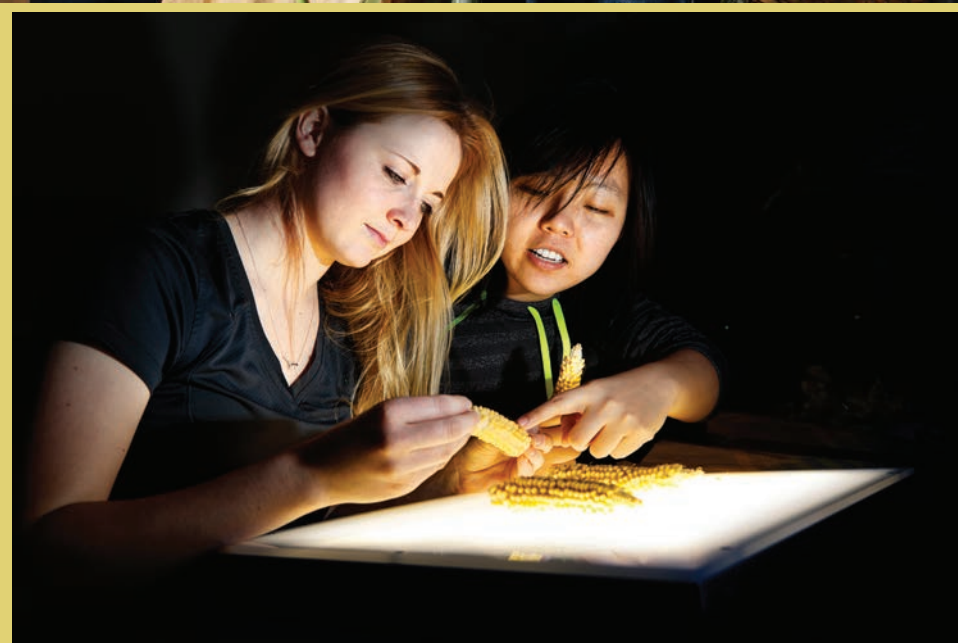
Through these collective efforts, PSI researchers are not only addressing critical nutritional needs of the developing world, but also exploring ways to develop new markets and higher returns for commodity crops produced in Nebraska.



Cassava plants

Aixia Li and David Holding, associate professor in the Department of Agronomy and Horticulture, studying high digestibility, high lysine sorghum lines.

Right: Leandra Marshall and Ying Ren looking at Quality Protein Popcorn lines.



source than conventional maize for food and livestock feed. He has developed a QPM version of popcorn that could serve as a unique nutritionally enhanced snack food and provide conventional and organic production opportunities for Nebraska. Holding is also using the new CRISPR gene editing technology to increase the protein quality and digestibility of grain sorghum, a crop with great potential for irrigation restricted agriculture.





HUSKER RESEARCHERS ON CUSP OF SWINE INDUSTRY PROTECTION

Researchers Hiep Vu and Haiyan Sun are working to develop a broad coverage PRRSV vaccine to help sustainable pork production.

By: Haley Apel

Researchers at the University of Nebraska-Lincoln are leading research to help producers across the globe fight a devastating swine virus.

Porcine reproductive and respiratory syndrome virus (PRRSV) is a viral pathogen that causes abortion when infecting pregnant sows and pneumonia in young pigs. Additionally, the virus can suppress the pig's immune system, leading to enhanced susceptibility of pigs to other infectious diseases. When a pig contracts the virus, not only does the producer lose the production of that pig, but he or she also has to spend money treating nearby pigs

and cleaning the facility. In the United States, PRRSV costs the swine industry over \$640 million per year.

Fernando Osorio and Hiep Vu, researchers in the Nebraska Center for Virology, are focused on the development of a universal or broadly protective vaccine that could protect against multiple, if not all of the variants of the virus circulating in the field.

"The challenge to make an effective vaccine is that the virus can mutate, or change very fast. This leads to the co-circulation of many variant forms of the virus in the swine herd," said Osorio. Consequently, the currently available vaccines fail to protect pigs against all forms of the virus in the field.

The researchers have employed an innovative approach in which they combined bioinformatics and molecular techniques to generate a fully synthetic PRRSV strain. Data produced by the group

demonstrate that this synthetic PRRSV strain shows tremendous promise in the possibility of developing a live-attenuated vaccine for clinical applications.

Vu grew up on his parent's pork production farm in Vietnam. He has seen firsthand the deadly consequences of PRRSV, which is why he came to the university as a master's student in 2007 to work on the PRRSV vaccine. After completing his master's, doctorate and post-doctoral research with Osorio, Vu is now an assistant professor of animal science.

"I'm hopeful that the product we're able to develop here in the lab can one day be used to help my parents and pork producers everywhere," said Vu.

As the project progresses, the researchers believe partners like NUtech Ventures will be critical in bringing their discoveries to industry. NUtech facilitates the commercialization and practical use of innovations generated through research at the university. The PRRSV team is a prior winner of NUtech's Breakthrough Innovation of the Year award.

Along with Vu and Osorio, researchers Asit Pattnaik and Fangrui Ma also contribute to this project, along with post-doctoral research associate Haiyan Sun. The research is conducted at the Nebraska Center for Virology, which combines the expertise of Nebraska's leading biomedical research institutions — the University of Nebraska-Lincoln, University of Nebraska Medical Center and Creighton University — to focus on important viral diseases of humans, plants and animals.

POSTDOC SPOTLIGHT: HAIYAN SUN

Haiyan Sun is from Fuyang, a small city in eastern China, where she earned a bachelor's and master's degree. She was working with a company to develop vaccines against animal diseases before an opportunity to study with Nebraska researchers Fernando Osorio and Hiep Vu arose in 2013.

"I have a passion for designing efficient vaccines to prevent and control the infection and control diseases," the animal science postdoctoral research associate said. "Dr. Osorio is well known for research on swine diseases, especially PRRSV, so when I got the chance to study in his lab, I jumped at the opportunity."

In the lab, Sun helped Osorio and Vu characterize a synthetic PRRSV strain which has the potential to be a strong vaccine candidate with high levels of cross-protection. She continues to study host innate and adaptive immune response to PRRSV.



Haiyan Sun

Sun's work has caught the eye of the professional research community. In December 2017, the American College of Veterinary Microbiologists awarded the outstanding oral presentation she gave about PRRSV research at their annual conference. While the research she spoke about is close to resulting in an effective PRRSV vaccine, Sun has no plans of concluding her scientific efforts.

"The strategies used for designing a broad coverage PRRSV vaccine can provide important information for the development of novel vaccines against other swine diseases. This will help sustainable pork production," Sun said.

In the future, Sun hopes to follow in the path of her mentors, Osorio and Vu, by establishing her own laboratory to foster more talent in virology research.



James MacDonald

By: Linda Ulrich

RESEARCHERS DEVELOPING SYSTEM COMBINING CATTLE GRAZING WITH CROP PRODUCTION

It can be difficult for beginning farmers to get started because they may not own the land or may need to work within a family member's existing system to start their own operation.

James MacDonald, associate professor of animal science at the University of Nebraska-Lincoln, is leading a large interdisciplinary team of scientists that have identified an opportunity to increase the number of young cattle producers in the state by developing a system that combines cattle grazing with existing crop production.

"This way, current farmers could add cow-calf production without a major impact on farming acres," MacDonald said.

The overarching goal of the team's research is to help all producers maximize land use efficiency, improve soil health and reduce greenhouse gas emissions.

"We are making the best use of our resources as population growth occurs," he said.

The team is also investigating whether cover crop benefits are retained when used for livestock forage, which has not been researched much.

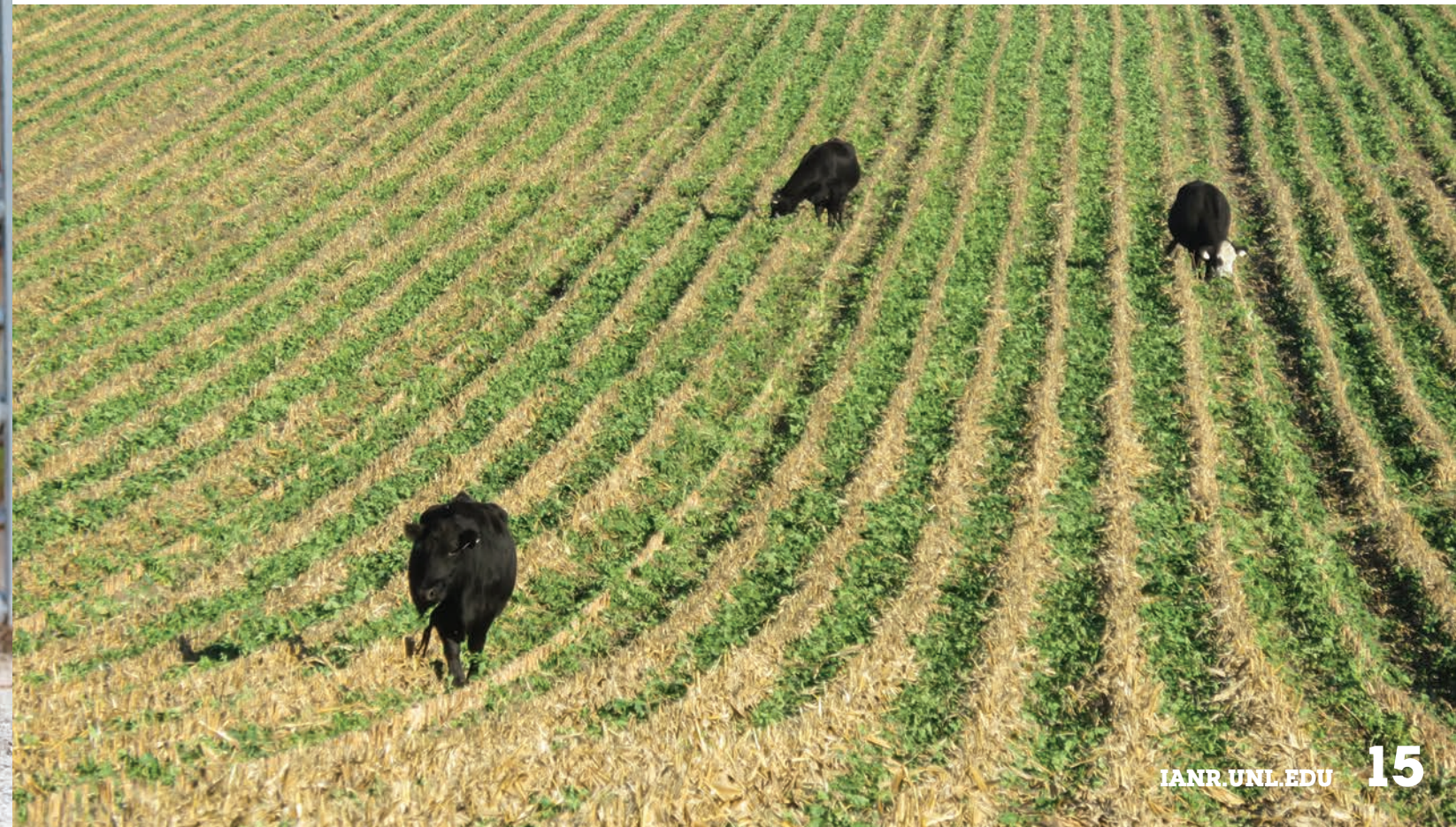
"Cover crops are a long-term investment to improve soil health and reduce erosion, but they can be difficult for producers to pay for," MacDonald said. "If producers can graze cattle on cover crops, they could increase land efficiency and mitigate costs."

Producers have an important role in this project by participating in surveys and focus groups to gather input about how they make decisions. Research outcomes will help farmers and ranchers understand which practices will help reduce greenhouse gas emissions while efficiently producing food in a diversified system.

"Now we have the technology to measure greenhouse gases much more accurately, and we can relate that to food production," MacDonald said. "We can determine the greenhouse gas emissions equivalent per calories of food produced per acre. We can measure how much greenhouse gas is emitted to make a 6-ounce steak."

Other team members include Tala Awanda, Agricultural Research Division; Simanti Banerjee and Jay Parsons, Department of Agricultural Economics; Humberto Blanco and Daren Redfearn, Department of Agronomy and Horticulture; Mary Drewnoski and Galen Erickson, Department of Animal Science; Jane Okalebo and Andy Suyker, School of Natural Resources; and George Burba, LI-Cor Biosciences.

The \$2.4 million project includes a \$1 million grant from the Foundation for Food and Agriculture Research. The Institute of Agriculture and Natural Resources and the Office of Research and Economic Development matched FFAR's support. The Platte River High-Plains Aquifer Long-term Agroecosystems Research Network is also a partner.



AGPOCALYPSE 2050

Agpocalypse 2050 is a video game designed to increase middle and high school students' interest in the food-energy-water nexus.

Agpocalypse 2050 helps students understand food-energy-water nexus

By: Linda Ulrich

Agriculture plus apocalypse equals Agpocalypse 2050, a video game intended to stimulate middle and high school students' interest in the food-energy-water nexus.

Developed by a multidisciplinary team at the University of Nebraska-Lincoln, Agpocalypse 2050 focuses on the projected global population increase of 9 billion people by 2050. That increase will require twice the amount of food the world currently produces. Players create sustainable agricultural systems to feed and fuel the world with limited resources under a changing climate. With each task, players have to analyze at the system level. The idea is that they will gain an understanding of the dynamics among corn, water, ethanol, beef — the major nexus found in Nebraska and the Midwest.

"This game allows us to comprehensively look at the nexus using real-world situations, but without the risk of actually implementing system changes," said Jeyam Subbiah, team leader and Kenneth E. Morrison Distinguished Professor of Food Engineering. The computational engine behind the game, which is science-based, integrates multiple state-of-the-art decision support models for crop growth, livestock and biofuels.

Jennifer Keshwani, assistant professor and science literacy specialist, is working with Omaha Bryan High School through the Urban Agricultural Career Academy to pilot the program.

Other team members: Mindy Anderson-Knott, director of evaluation and development, Social and Behavioral Sciences

Research Consortium; Jijia Chen, assistant professor, food science and technology; Bruce Dvorak, environmental engineering; Suat Irmak, Harold W. Eberhard Distinguished Professor, biological systems engineering; Deepak Keshwani, associate professor, biological systems engineering; Rick Koelsch, livestock and bioenvironmental engineer; David Rosenbaum, professor, economics; Eric Thompson, associate professor, economics; Brandy VanDeWalle, extension educator; and Haishun Yang, associate professor, agronomy and horticulture.

A three-year, \$999,644 National Science Foundation grant funds this project.

Increasing participation of women, underrepresented students in agriculture

By: Linda Ulrich

Many high school students want a career that enables them to help others so they focus on the "helping professions" such as nursing or social work. They may not realize that careers in agriculture and science, engineering, technology and math (STEM) can help people, too.

The team coordinating a new University of Nebraska-Lincoln program — Cultivate ACCESS: Agriculture Career Communities to Empower Students in STEM — wants to change that. The program's long-term goal is to increase participation of rural Nebraska women and other underrepresented students in STEM-related agricultural college majors and careers.

Why Cultivate ACCESS is important:

- A predicted 35 percent shortage of employees with the education and experience to fill food, agriculture and natural resources jobs in the next decade.
- The underrepresented cultural and ethnic minorities include Hispanics, a population expected to double in Nebraska by 2050.

Reasons vary as to why more students do not consider careers in agriculture, said Jenny Keshwani, the program's director and Biological Systems Engineering assistant professor. One is that students may not see anyone who looks like them in an agricultural career field. Another is that students may stereotype agriculture as limited to growing corn and cows.

Through online mentoring, Cultivate ACCESS highlights the broad range of STEM careers in agriculture and includes women and minority role models.

The program also includes employability skills such as leadership and teamwork, said Sydney Everhart, Plant Pathology assistant professor.

The program's primary components include

- **Scholars:** High school sophomores and juniors interested in learning more about STEM careers, particularly women and cultural and ethnic minorities.
- **Ambassadors:** Nebraska undergraduates majoring in agriculture STEM fields. They provide peer-to-peer mentoring.

- **Mentors:** Career professionals who can relate to the Scholars because of similarities in experience or background and who have practical STEM experience in their careers.

The Scholars are not necessarily the students with the highest grade point average, said Deepak Keshwani, associate professor in Biological Systems Engineering.

"We're not thinking about grades. We're thinking about potential," he said.

Cultivate ACCESS is a new program designed to increase the participation of rural women and other underrepresented students in agricultural college majors and careers.



In addition to Jenny and Deepak Keshwani and Everhart, the team includes Lindsay Hastings, director, Nebraska Human Resources Institute; Matt Kreifels, director, agricultural education, Nebraska Department of Education; Jamie Loizzo, assistant professor, Agricultural Leadership, Education and Communication; Julie Obermeyer, director, career development and corporate relations, College of Agricultural Sciences and Natural Resources; and Leah Sandall, online and distance education coordinator, Agronomy and Horticulture.

For more information, contact any of the team members or visit the website, cultivate.unl.edu.

This three-year project is supported by the Women and Minorities in STEM Fields Program of the National Institute of Food and Agriculture, USDA, Grant #2017-38503-27167.



Helping preschoolers eat healthy can help combat childhood obesity

By: Linda Ulrich

Nebraska ranks 5th nationally in childhood obesity.

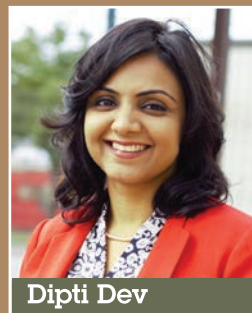
One of the ways Dipti Dev and her team are working to prevent childhood obesity is through an innovative, research-based curriculum to help children eat healthy foods.

Obesity prevention needs to start in early childhood, said Dev, Nebraska Extension child health behaviors specialist. That is why her research focuses on children ages 2 to 5 in childcare settings, where many young children spend the majority of their day.

“Children develop their likes and dislikes of food early,” she said. If preschoolers are offered a variety of fruits, vegetables, whole grain, dairy, and lean protein foods while in childcare and enjoy them, they are more likely to eat healthier foods as teenagers and adults.

The curriculum, Ecological Approach to (EAT)-Family Style Dining, focuses on improving the childcare mealtime environment and family engagement.

Childcare providers sit and eat meals together with the children. The children select their own portions and serve themselves, which, research indicates, makes children more likely to try new foods and to eat based on their hunger cues.



Dipti Dev

The curriculum includes engaging videos that illustrate seven topics. Extension educators serve as “coaches” for the childcare providers.

Assistant professor in Child, Youth and Family Studies at the University of Nebraska-Lincoln, Dev is nationally known for her obesity prevention work. She has received several grants, including a USDA grant to implement the curriculum statewide and evaluate its effectiveness.

Through the grant, Dev is also working with collaborators in the College of Engineering and the Raikes School of Computer Science to develop a Sensi-Plate that will measure a child’s food consumption electronically. This plate will serve as an objective method to evaluate the impact of childhood obesity prevention programs.

“Two of the primary reasons for obesity are an unhealthy diet and lack of physical activity,” Dev said. “By improving the nutrition and physical activity environment and paying attention to children from low-income families and rural contexts, we can promote children’s healthy behaviors.”

Her research underscores the role of childcare providers in shaping children’s healthy behaviors and improving the nutrition and physical activity environment.

“I am very passionate because I feel that I can improve the lives of young children.”

– Dipti Dev

Dev is the recipient of the 2017 National USDA Family Life and Human Development State Extension Specialist Early Achievement Award.

4-H programs focus on making healthy food choices

Nebraska 4-H has a variety of programs that focus on healthy living, including nutrition, diet, food preparation and making healthy choices.

Of youth in these programs

- 89 percent said they know the value of a healthy diet.
- 85 percent reported plans to encourage their families to eat meals together.
- 84 percent of youth in the iCook afterschool program reported that by participating they learned that they really liked to cook.
- 87 percent of those participating in the Food Smart Families program said they learned what makes a balanced diet, and 91 percent reported learning how to make healthier food.



A Nebraska Extension program focuses on preventing childhood obesity by working with childcare providers and parents to develop healthy eating habits in preschoolers.

MAKERSPACE BOOSTING INNOVATION AND OPPORTUNITY IN RURAL NEBRASKA

While you might expect Silicon Valley, don't be surprised if the next high-tech innovation stems from Sidney, Neb. A new project from Nebraska Extension has established a makerspace at the Sidney Public Library.

A makerspace is a community-oriented physical space that serves as a hub for innovators, artists and entrepreneurs. It often features a variety of equipment, like the laser cutter, router and 3D printers found in Sidney. Youth and adults use the space to work with and learn from each other in pursuit of their next creation.

The project is funded by a grant from the National Science Foundation. Nebraska Extension and Nebraska 4-H are partnering with the Sidney Public Library, the Department of Biological Systems Engineering at the University of Nebraska-Lincoln and the College of Education at the University of Nebraska Omaha to develop a network of makerspaces around the state in small towns where they wouldn't normally exist, leveraging the resources from Innovation Studio, the makerspace at Nebraska Innovation Campus in Lincoln.

4-H science and technology specialist and professor Bradley Barker is serving as the project leader. Barker also serves as outreach coordinator for the university's Center for Science, Math and Computer Education. He has spent a great deal of time studying makerspace models across the globe. One of his key findings is that most thriving makerspaces are found in highly populated areas. His idea is to create a new model, which will extend the resources of Innovation Studio in Lincoln to people across the state, regardless of community size.

"What we're trying to do is take the knowledge and expertise found at Innovation Studio and share it with these rural communities so they have the same opportunities for creativity and innovation," Barker said.

To bridge the resources of Innovation Studio with rural communities, the team uses telepresence robotics. There are matching robots in Lincoln and Sidney that live stream a feed of the activity in each location. Users of the makerspaces are able to interact and talk to each

other through the robots, which are driven by humans using computer controls.

Shane Jones has been using the Sidney makerspace since it opened in late 2017. He uses the space multiple times a week and has created a number of small boxes, name plaques and Christmas ornaments.

"I think the makerspace is an absolutely fantastic

opportunity for a rural community like Sidney," Jones said. "I tell people about it all of the time. I've created my own competition for time on the laser machine."

Learning to use new machinery such as the laser cutter could result in bringing new prototypes to market quickly, which is one of the goals of the makerspace.

"Giving people the opportunity to create their own products and businesses could really be an economic engine for these communities," said Barker.

Barker and the rest of the team are using Sidney as an example, and plan to study the outcomes to determine what a network of similar makerspaces could look like across Nebraska.

"What we're trying to do is take the knowledge and expertise found at Innovation Studio and share it with these rural communities so they have the same opportunities for creativity and innovation."

- Brad Barker

Nebraska 4-H professionals Brad Barker and Dagen Valentine use telepresence robotics to bridge the resources of Nebraska Innovation Studio with makerspace users in Sidney, Neb.



SURPLUS GARDEN PRODUCE SHARED WITH PEOPLE IN NEED

By: Linda Ulrich

Nebraska Extension Master Gardeners love to garden, and when their vegetable plots produce too much of a good thing, they love to share that surplus produce.

Last year, two Nebraska Extension programs, SNAP-Ed (Supplemental Nutrition Assistance Program-Education) and the Nebraska Extension Master Gardener Volunteer Program, joined forces to start Cultivating Health Our Way (CHOW). This program provides a conduit between surplus produce and people in need.



Forty Master Gardeners tended five CHOW gardens across the state in 2017. Together, the gardens donated more than 18,000 pounds of produce worth approximately \$24,000, said Terri James, Nebraska Extension educator and coordinator of the Nebraska Master Gardeners. This year, the number of gardens participating in CHOW is increasing to nine, sparked by the interest of Master Gardeners and clients across the state.

One CHOW affiliate is tied to the Backyard Farmer television show. The University of Nebraska-Lincoln Backyard Farmer Garden on East Campus donated its harvest to needy Lincolniters nearby last year. Extension

Master Gardener volunteers teamed with the nonprofit group Produce From the Heart to deliver produce to area food banks and other food distribution sites.

Produce From the Heart was an integral part of the program's success, said Margo Young, Master Gardener volunteer. "Produce From the Heart solved the problem of knowing who needs what where and when they are open for deliveries," she said. "And it was gratifying to hear Produce From the Heart deliver feedback on how popular certain crops were ... especially fresh sweet corn!"



The Nebraska Extension Master Gardener Volunteer Program and SNAP-Ed are helping people in need gain access to surplus garden produce.

It can be difficult for SNAP participants to get fresh fruits and vegetables, said Morgan Hartline, Nebraska Extension educator working with SNAP-Ed. "It's something not everyone gets. Through CHOW, this produce is going to people who want it." Another benefit of CHOW is that SNAP-Ed can provide education about nutritional values and ways to use and enjoy new foods, she added.

NEBRASKA MASTER NATURALISTS WORK TO CONSERVE NATURAL RESOURCES

By: Linda Ulrich

Nebraska Master Naturalist volunteers restore habitat, teach kids to fish, provide environmental education at nature centers, serve as citizen scientists and engage in myriad other projects designed to conserve Nebraska's unique natural resources.

Since its beginning in 2010, the Nebraska Master Naturalist program has trained nearly 400 adults statewide. Their backgrounds vary widely — "everything from big game hunters to tree huggers" — but they share a desire to explore Nebraska's natural areas, contribute their time and expertise, and connect with fellow Nebraskans to promote, educate and conserve the state's natural environment, said Matt Jones, program coordinator.

Master Naturalists have contributed more than 57,000 volunteer hours valued at \$1.3 million from 2010 through 2017.



Training in the Nebraska Master Naturalists program includes hands-on field experiences.

"A lot of their willingness to donate their time and their dedication to the program and the state is ongoing," Jones said.

The cost of training ranges from \$150 to \$350. Natural resources experts lead indoor presentations and hands-on field experiences. This training encompasses a variety of natural science disciplines, including grasslands, woodlands, wetlands and aquatic ecosystems.

Upon completion of the training and 20 hours of volunteer work, individuals become certified Master Naturalists. They must continue to volunteer and complete eight hours of continuing education annually to maintain their certification. Volunteer opportunities are vast and tailored to individual interests.

The Nebraska Master Naturalist program is part of the School of Natural Resources at the University of Nebraska-Lincoln. It is supported by the university, the Nebraska Environmental Trust, the Nebraska Game and Parks Commission and 30 other natural resource agencies.

For more information, visit the website: naturalist.unl.edu.

FIELDWORK FUN FOR MASTER NATURALIST

Not everyone would enjoy spending a lot of time outdoors locating plains pocket mice, but Mike Schrad does. He likes it a lot.

Plains pocket mice are common in the Sandhills, and he is trying to find populations of them in other parts of the state.

Schrad is a Nebraska Master Naturalist whose volunteer work focuses on small mammals. The plains pocket mouse is, he said, one of the small mammals that needs more research.

A retired wildlife ecologist and environmental manager, Schrad lives on an acreage near Omaha.

As a citizen scientist, he enjoys spending time in nature doing work that benefits the study and conservation of Nebraska's natural resources.

"I have fun," Schrad said.



During her time at Nebraska, Abendroth was a member of the Cornhusker Marching Band, resident of Love Memorial Hall and leader for the Berean "Campus Impact" college ministry. Her current interests include hosting dinner parties, traveling and spending time outdoors, competing in triathlons and participating in various activities at her church.

"Our greatest challenge and opportunity is producing a nutritious, abundant food supply to an ever-growing population, with less land and in a changing climate."
 – Julie Abendroth



Julie Abendroth, a College of Agricultural Sciences and Natural Resources alum, is global lead for integrated seed product strategy for DowDuPont (Corteva Agriscience). Photos supplied by Abendroth

Give her the country — and city — life

By: Linda Ulrich

Julie Abendroth has always had one foot in the country and one foot in the city. She and her identical twin sister, Lori, grew up living and going to school in Omaha. During summers, they lived in the country, helping with fieldwork on their mother's family farm near Lyons and their dad's family farm near Bancroft. Their parents straddled both city and rural spheres because of their mom's professional career in Omaha and their dad's passion to farm.

Earning her undergraduate and master's degrees, both in agronomy from the University of Nebraska-Lincoln, gave Julie opportunities to pursue her interest in science and math.

In addition to developing a strong foundation in science as an undergraduate, Abendroth said her graduate studies helped her develop critical thinking skills.

"I loved my time at Nebraska," she said.

After receiving her graduate degree, Abendroth was an extension agronomist for the University of Missouri.

After six years with MU extension, she began working for DuPont Pioneer. She was an agronomy trial manager/field agronomist for two years and research scientist for five years.

Abendroth currently is the global lead for integrated seed product strategy for DowDuPont (Corteva Agriscience). She is passionate about better understanding the underlying factors responsible for yield stability and variability on a micro and macro scale. In her current role, she is focused on evaluating product concepts that utilize multiple technologies, including germplasm, native and transgenic traits, and chemistries.

"Our greatest challenge and opportunity is producing a nutritious, abundant food supply to an ever-growing population, with less land and in a changing climate," she said.

"I am excited about what I can do in my own small way to help farmers globally to be able to continue their livelihoods and farm sustainably."





IANR faculty and administration, together with State of Nebraska officials, participate in talks with Chinese partners across research, industry and government in Yangling.



By: Britanne Wolf

Engaging strategically for maximum global impact

“So many of the global challenges that we are facing relate to areas where Nebraska has unique expertise,” said Josh Davis, assistant vice chancellor for global engagement for the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska-Lincoln.

This expertise draws partners from around the world, from higher education and governments to private industry and nonprofit organizations. To ensure maximum impact of those efforts, international activity across IANR’s 1,900 faculty and staff and nearly 3,000 students needs to be strategic and coordinated. IANR’s Office of Global Engagement strives to meet the need by synthesizing policies, programs and initiatives to create a more internationally connected institution where global perspectives are interwoven throughout education, research and outreach.

In addition to the hundreds of IANR faculty engaged in research collaborations and educational programming in over 120 countries, there is also strategic depth in key areas around the world. For example, engagement in Brazil and partnership with the São Paulo Research Foundation (FAPESP) continue to strengthen. IANR faculty received joint collaborative research funding this spring for the second consecutive year, and convened Brazilians and Nebraskans across research, extension and nonprofit realms with a FAPESP WEEK symposium last fall.

With over 100 (and counting) undergraduate scholars from Rwanda studying in the College of Agricultural Sciences and Natural Resources and an IANR team on the ground this spring working with local partners developing curriculum in conservation agriculture, Nebraska is helping contribute to agricultural capacity-building in the nation.

The university’s multidimensional engagement in China spans teaching, research and extension. While Nebraska students continue to benefit from educational opportunities at Northwest Ag and Forestry University, a dual degree program through the Department of Food Science and Technology, called the “3+1 Program,” allows Chinese students to begin their degrees in China and finish them in Nebraska. The first class will arrive this fall. The Nebraska-Yangling Demonstration Farm pools the expertise of research and extension faculty from the two universities, as well as expands economic opportunity for Nebraska-based farm machinery manufacturers and related industry.

“We are working hard to engage strategically with key partners around the world to ensure that Nebraska is playing a role in finding solutions to global challenges,” said Davis.

To learn more about IANR’s global efforts, visit ianr.unl.edu/global-engagement.

IANR AT A GLANCE

6 Communities promoting bold collaboration and thinking to propel Nebraska forward.

18 Nebraska Extension issue teams supporting the state’s youth, families, farms, ranches, communities and economy.

22 Percent increase in externally sponsored research expenditures from 2015-2017.



37 Nebraska’s ranking in a listing of top agriculture and forestry universities worldwide by QS World University Rankings.

120 Countries across the globe where IANR faculty are engaged in research, extension and teaching.

700 CASNR undergraduate students working side-by-side with faculty recognized worldwide for innovation and creativity.



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