

Nebraska Water Center

Annual Report

2017-2018



**Nebraska
Water Center**

Daugherty WaterforFood Global Institute



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Water mingles
with every kind of
natural phenomenon;
and more than one
might imagine, it has
also mingled with
the particular destiny
of mankind.

//

— Fernand Braudel, *Memory and the Mediterranean*

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Foreword

For decades, Nebraskans have steadily built expertise in irrigated and rainfed agriculture, as well as in water issues that ripple beyond crop and livestock production. Much of the state's water research, teaching and outreach springs from the Nebraska Water Center (NWC), a hub extending the University of Nebraska's water efforts to citizens across the state.

NWC is part of the Daugherty Water for Food Global Institute (DWFI) and collaborates with the University's Institute of Agriculture and Natural Resources (IANR), straddling the water issues of Nebraska and the broader global community.

Research is only valuable when it initiates action, and people drive action. NWC has cultivated an environment of innovation, encouraging researchers and students to collaborate effectively with internal and external partners. These partnerships launch practical solutions, which are widely shared with the university's stakeholders, including Nebraska farmers and ranchers. In this report, you will read about many Nebraskans who are making a difference.

Students in UNL's College of Agricultural Sciences and Natural Resources (CASNR) are among these important difference-makers. They dedicate themselves to understanding the complex, integrated natural resource systems dependent on Nebraska's water and soil. At NWC, these students put theory into practice, learning how to become our next generation of water scientists, teachers and leaders.

Much of the state's water-related action, especially in water quality testing and analysis, happens at the Nebraska Water Sciences Laboratory (WSL). A major arm of the NWC, the lab conducts cutting-edge water research and develops future professionals in the field. The WSL is unique among U.S. water centers and one more reason the state is perceived as a paragon of water management.

In Nebraska, NWC provides critical support for production agriculture and the state's role as a supplier of nutritious and safe food, fuel, feed and fiber for the U.S. and the world. Ultimately, water matters because it is intertwined with other sustainability issues, such as food security, energy and the environment.

Nebraska has demonstrated globally what it takes to grow more food more efficiently. And it has shown how to do it while still preserving water, soil and the economic vitality of local communities. As recent flooding events have shown, new challenges emerge, and NWC will continue to work with partners and stakeholders to overcome these trials and help develop solutions based on local area needs.



Michael J. Boehm

Vice President

Agriculture and Natural
Resources at the
University of Nebraska

Harlan Vice Chancellor

Institute of Agriculture and
Natural Resources at the
University of Nebraska–Lincoln

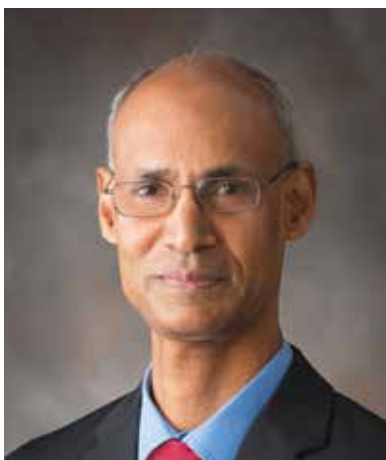


Peter G. McCornick

Executive Director

Robert B. Daugherty Water
for Food Global Institute at
the University of Nebraska





Director's Letter

Chittaranjan Ray

Director

Nebraska Water Center
University of Nebraska

Many have called Nebraska a living laboratory for the study of water. The vast groundwater reserves and boundless, braided miles of rivers and streams that we channel for agriculture, ecosystems, power generation, tourism, recreation and communities, provide both challenges and opportunities to better manage our most crucial resource. The Nebraska Water Center (NWC) — part of the Daugherty Water for Food Global Institute — is brimming with water research, education and outreach with stakeholders across the state. In your hands is the synopsis of two years' worth of work from all corners of our state.

In 2017 and 2018, NWC and DWFI became further integrated. Our staffs have changed and new faces, expertise and talents are amplifying the impacts of the organizations. Profiles of new NWC team members begin on page 36.

In partnership with four Natural Resources Districts (NRDs), and together with Nebraska Extension, we are ramping up efforts in the Bazile Groundwater Management Area (p. 20). These efforts — aimed at cooperatively addressing rising groundwater nitrate levels — stem from active engagement with the NRDs and the Nebraska Department of Environmental Quality. NWC is marshaling a university-wide nitrate team that includes DWFI Faculty Fellows, Extension Educators and academics from other Nebraska colleges.

We also share research priorities with DWFI, such as championing high-productivity agriculture and supporting freshwater ecosystems and public health. For example, the article on page 12 explains how NWC's Vadose Zone Monitoring Program helps municipalities proactively address agrichemical contamination of drinking water. Likewise, the Know Your Well project (p. 32) works with nearly 20 rural Nebraska high schools to educate students and private well owners on how to measure drinking water quality.

As the national leader in irrigated acres, Nebraska must continue to identify and develop sustainable agricultural water management practices. Our involvement in the USDA-funded Ogallala Aquifer Coordinated Agriculture Project (p. 14) is helping growers exchange best practices while mobilizing an interdisciplinary team of 70 researchers from nine universities across six Ogallala Aquifer states.

Nebraska's Water Sciences Laboratory is another type of living laboratory and an integral part of what we do. Its recent growth is detailed on page 10.

Though our state is fortunate to have an abundance of natural resources, if it weren't for contributions from dedicated stakeholders like yourself, we would not benefit so richly from them. I hope you will take a few minutes to read ahead and learn how our Nebraska partners enrich endeavors to make our state and university an international leader in water.

Thank you for helping us continue our mission and serve all Nebraskans for years to come.

A handwritten signature in black ink that reads "Chittaranjan Ray". The signature is fluid and cursive, with the first name and last name clearly legible.

The Nebraska Water Center

The NWC was established by Congressional mandate as one of 54 state-based Water Resources Research Institutes in 1964. We coordinate research and programs that support the University of Nebraska as an international leader in water research, teaching, extension and outreach.

Our fundamental goals are to:

- Coordinate a wide range of research impacting water issues
- Foster a deeper understanding of water and its many beneficial uses
- Help develop new water researchers
- Train future water researchers and engineers
- Extend water research results to water professionals and the public through publications, seminars and conferences, electronic media, lectures and tours

1964

1968

1971

1972

1990

1964

Water Resources Research Act establishes NWC as one of 54 water centers nationwide

1968

Spring Water Seminar Series launched

1971

Annual Nebraska Water Conference inaugurated

1972

Nebraska Water and Natural Resources Tour started

1990

University of Nebraska Water Sciences Laboratory established

2003

University of Nebraska–Lincoln's Water Resources Research Initiative launched



To achieve these goals, we:

- Work collaboratively with our Advisory Panel, University of Nebraska Water Resources Advisory Panel and local, state and federal stakeholders to direct and share research with water professionals and the public
- Support research and extension activities by connecting faculty to external collaborators and stakeholders, fostering interdisciplinary teams, informing faculty of funding opportunities and providing grants
- Aid new scientists through mentoring, seed grants and assistance in building their research portfolios
- Train future leaders in water science and management through educational programming, professional development, internships and fellowships

NWC is part of the Robert B. Daugherty Water for Food Global Institute at the University of Nebraska and part of the University of Nebraska–Lincoln’s Institute of Agriculture and Natural Resources.

Financial support for the NWC and WSL comes from a combination of state, local and federal funding, as well as partnerships with DWFI, non-governmental organizations (NGOs) and industry.

For more information about NWC, visit watercenter.unl.edu.

2003

2006

2012

2013

2014

2018

2019

2006

Water Resources Advisory Panel (WRAP) established

2012

NWC becomes a part of the Daugherty Water for Food Global Institute (DWFI)

2013

Chittaranjan Ray becomes NWC director

2014

NWC and DWFI move to Nebraska Innovation Campus offices

2018

In partnership with the National Institutes for Water Resources, NWC hosts regional symposium

2019

Water Tour travels to Wyoming and Montana

Nebraska's Top 10 Water Challenges

(Revised Nov. 22, 2017)

Water Quantity

1. Effects of water consumption and conservation practices on instream-flows, groundwater recharge and water supplies (municipal and industrial); realizing the maximum water use efficiency for irrigation
2. Potential effects of climate change, especially impacts of increased climate variability, on the availability and use of water resources of Nebraska
3. Potential for high efficiency irrigation to improve sustainability of production agriculture in Central/Western Nebraska
4. Development of tools and technologies for sensing soil moisture and measuring/estimating evapotranspiration, control of irrigation and pumping systems, and data analysis

Water Quality

5. Solutions to increasing incidence of nitrate, uranium, arsenic and other contaminants in drinking water sources
6. Management of nonpoint source (NPS) nutrient and sediment inputs in lakes, streams and reservoirs, including toxic algae treatment and prevention, and control of maximum contaminant loadings (MCLs) of nutrients in Nebraska
7. Understanding the consequences of surface and groundwater contamination from emerging contaminants such as steroids, antibiotics, new classes of pesticides, surfactants, nanomaterials and disinfectants from wastewater sources


Water Institutions

8. Alternatives and solutions for maintaining aging water infrastructure, including drinking water distribution systems, wastewater treatment, irrigation systems, dams, levees and canals
9. Improvements to economic models and policies to better manage both water quantity and quality, including establishing water markets, water banking, and maintaining recreation, wildlife habitat and drinking water supplies across Nebraska
10. Creating effective social systems to better inform and influence individual and institutional behavioral changes for promoting sustainable water resources management

This listing is unranked and it recognizes that several challenges may fit into more than one of the three subcategories.



RESEARCH



// What can make the biggest difference is knowing what's important to water users — respecting their values and interests and creating ground-up community-driven solutions. //

— Mark Burbach, University of Nebraska–Lincoln, School of Natural Resources



Water Sciences Laboratory

As it enters its 29th year of operation, the University of Nebraska–Lincoln’s Water Sciences Laboratory (WSL) is now more than ever an integral part of the Nebraska Water Center. Nestled in the heart of East Campus, the facility opened in the summer of 1990 to provide a “convenient working environment for collaborative research on water-related projects.”

The lab is run by a technically skilled staff who together perform over 200 analytical methods on \$3 million worth of equipment for a spectrum of clients. This enables the lab to carry out cutting-edge research, while furthering the NWC’s educational mission. In recent years, the lab has become an incubator for young water scientists, training 35 students in 2018 alone. Over the past five years, the lab has trained 150 students, interns, postdoctoral fellows, international scholars and faculty.

New and veteran WSL staff have united over the last two years to take the facility to new heights. In late 2017, WSL hired Saptashati (Tania) Biswas as laboratory manager. Her presence, along with the expert leadership of WSL director Dan Snow, has increased the lab’s productivity. Several other recent hires have added the capacity to perform new types of analyses on a larger number of samples.

In addition to educational opportunities, the synergy between NWC and WSL spurs faculty engagement, scientific publications, international collaborations, grant funding and citizen science efforts. Known as a trusted resource by diverse stakeholders, the lab’s results are used to inform best water management practices locally, nationally and globally. WSL analytical services also support university research projects with funding from the National Science Foundation, U.S. Department of Agriculture, U.S. Department of the Interior, Environmental Protection Agency, National Pork Board, and Nebraska Environmental Trust.

Inside the Water Sciences Laboratory, isotope chemist Aaron Shultis adds liquid nitrogen to acetone in a small flask. Many of his experiments involve the transformation of solids into gases, which creates water as a byproduct. The water is removed from the gas through a tube immersed in liquid nitrogen and a solvent (such as acetone). The solvent maintains a temperature low enough to freeze water but high enough to allow the gas to pass through and be analyzed. This is one of more than 200 analytical methods the lab offers.



Here is a snapshot of lab achievements
in 2017 and 2018:

- 13,500+ samples analyzed
- \$380,000 in total service center income
- 35 students trained
- 150+ lab tour visitors
- 12 training videos produced
- 20 partnering countries
- \$9 million+ university user research grants

In 2019, the lab will apply for a grant to help fund the purchase of a new mass spectrometer. To increase its visibility to potential clients, WSL activities include a virtual lab tour and lunch and learn open house. More information is available on its homepage: watercenter.unl.edu/wsl.



Above: WSL technician Nathan Roddy adjusts a lab instrument.

At right: WSL staff Dave Cassada and Tong Onanong with the liquid chromatograph triple quadrupole mass spectrometer. The instrument analyzes trace levels of organic chemicals in water, soil, manure, plant and animal tissues.

Below: Staff gather for a group photo in June 2018.



Nebraska Vadose Zone Program

Helps Ensure Communities' Water Safety

In some parts of Nebraska, concentrations of nitrate and naturally occurring elements such as uranium are rising and compromising groundwater quality. This is a serious concern, because four of every five Nebraskans gets drinking water from groundwater.

If these compounds are found above regulated limits in public water systems, utilities must treat the water or find alternate water supplies, which can be cost prohibitive for small communities. However, if compounds can be identified before they reach public water systems, public officials may be able to preempt it through environmental and agricultural management practices.

Fortunately, it can take decades for these compounds to move through the vadose zone, the layer of soil between the earth's surface and the groundwater table. The more we understand how, and how fast, chemicals filter through the zone, the better we can anticipate their impact on groundwater supplies. We can then adjust to mitigate these impacts.



The City of Hastings, Nebraska, is using data from a new NWC program to determine how nitrogen and irrigation water management changes are affecting nitrate in the soil near the city's wells. According to Hastings Utilities Environmental Supervisor Marty Stange, the program's data has helped identify commercial fertilizer as the primary source of nitrate contamination. Now the city can develop solutions that specifically address the source.

NWC's Nebraska Vadose Zone Program is a one-of-a-kind data repository offering municipalities such as Hastings, and the state's 23 Nebraska Natural Resources Districts (NRDs), historical and ongoing agrichemical information to help ensure their communities' safety. The data comes from soil core samples collected throughout the state and analyzed at Nebraska's Water Sciences Laboratory.

The program's centerpiece is an interactive GIS map — the most comprehensive picture available of the way agrichemicals move through the vadose zone. State and local agencies have long monitored groundwater but have not coordinated or standardized the data.

The program has digitized soil cores from nearly 300 locations and collected cores from another 100 locations. In 2019, NWC plans to complete two monitoring studies, collect more historical data, and double the number of cores in the database.

The Nebraska Vadose Zone Program is supported by grants from the Nebraska Environmental Trust and Department of Environmental Quality. Three NRDs — Lower Platte South, Lower Loup and Central Platte — provide data and technical resources. See the database and learn more at nebraskavadose.unl.edu.

Nebraska Environmental Trust Grant Supports Nitrate Leaching Reduction

An increase in contaminants affecting water quality is of growing concern worldwide. One of the most significant water quality challenges Nebraska and the United States face is the presence of nitrate in water supplies, which can cause many health problems.

In June 2018, the Nebraska Environmental Trust awarded \$85,000 to the University of Nebraska for the NWC-led research project, “Novel approaches for controlling nitrate leaching and protecting Nebraska groundwater.” The project’s goal is to provide a cost-effective method for producers and NRDs to reduce nitrate leaching beneath fertilized cropland in areas that are most susceptible to groundwater contamination.

Daniel Snow, lead researcher and director of services at the University of Nebraska’s Water Sciences Laboratory, oversees laboratory operations funded by the award. He creates innovative methods to help stakeholders understand how water becomes contaminated and what can be done to prevent it.

Snow explains that many chemicals in the environment are potentially harmful to humans and can trigger health effects if they get into drinking water. Nitrate in drinking water form compounds that change when ingested. Nitrate is reduced to nitrite, which decreases blood’s ability to carry oxygen.

Snow said the nitrate leaching problem mainly stems from using excess water and fertilizer on crops. Furrow irrigation, for example, uses more water than pivot irrigation, and excess water flushes nitrate from the soil into groundwater and then into drinking water. Some nitrate can remain in the soil and water for months or even years.

The laboratory’s work involves subsoil injection of sawdust and wood shavings (carbon material) to remove nitrate after it has left the crop root zone. This carbon source acts as food for bacteria and converts the nitrate into a harmless gas. In other words, the carbon provides a host environment or bioreactor — a biologically active layer that intercepts and removes dissolved nitrate. “We hope this can reduce the amount of water that becomes contaminated,” Snow said.

Laboratory personnel collect water samples after injections and test them in the laboratory. Tests show the new method has been working to reduce contamination. However, Snow said many rural and metropolitan utility companies still will have to pay to treat groundwater to meet regulatory standards.

The grant will enter year two in 2019 and is funded through April 2021.

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Ideally, the new nitrate mitigation method will eventually provide a practical way for land to be highly productive without negatively impacting groundwater quality.

— Daniel Snow

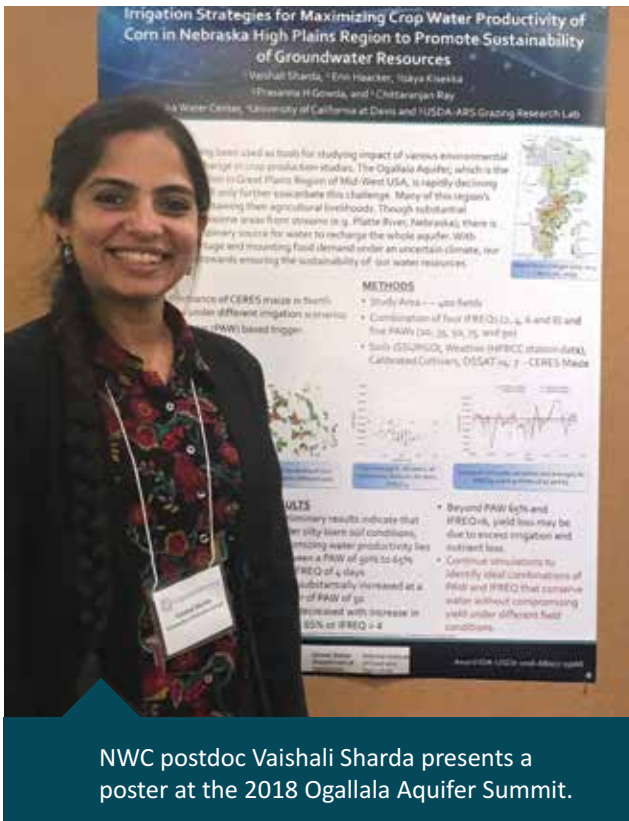
OWCAP Researchers Verify Ways to Better Manage Ogallala Aquifer Waters

The High Plains Aquifer, one of the largest freshwater aquifers in the world, supports nearly 30% of U.S. irrigated agriculture. The area exemplifies a groundwater challenge found worldwide: *how to sustainably manage an aquifer at a time of increasing demands from food production, drinking water, urbanization and climate change.*

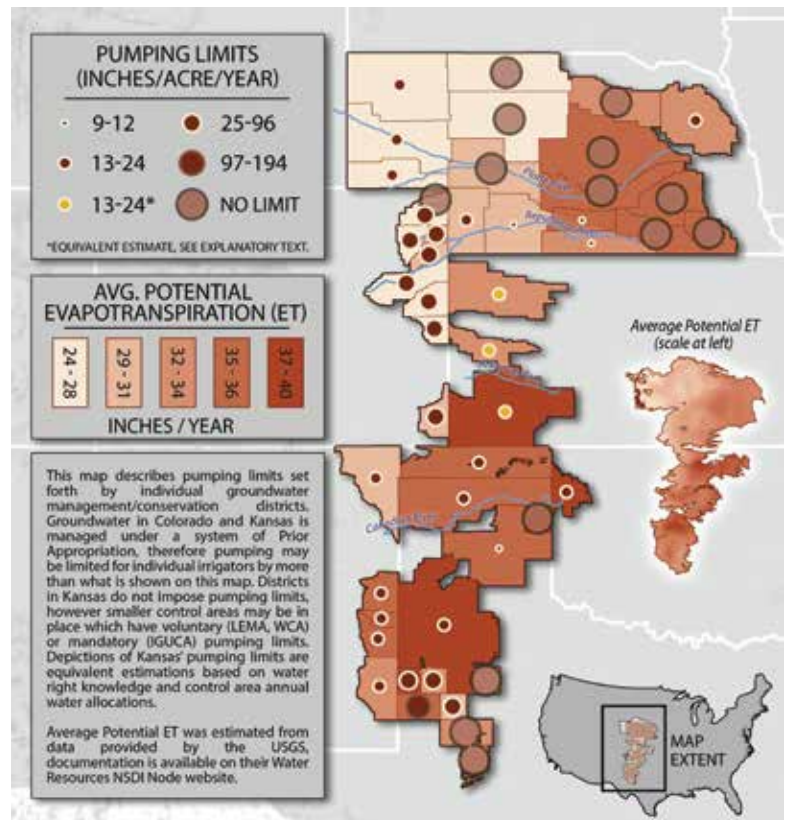
Achieving better aquifer management in the future will require a comprehensive understanding of a region's climate, soils, agronomy, hydrology, socioeconomics and water governance. For this purpose, in 2015 the U.S. Department of Agriculture gave 10 universities a \$10-million, four-year grant for a project known as the Ogallala Water Coordinated Agriculture Project (OWCAP).

The money is being used to develop and share practical, science-supported information about best practices for irrigation, crop and soil management, economics, policy, and decision-making. The Nebraska Water Center (NWC) leads the University of Nebraska's efforts in this project.

Significant strides in 2017 and 2018 included NWC welcoming two post-doctoral research associates, Erin Haacker and Vaishali Sharda, whose groundwater and crop modeling expertise strengthened the project. Their models for corn, soybean, winter wheat and groundwater hydrology are helping the project's economists run scenarios to understand the impact of future management decisions on groundwater levels. One economist is Daugherty Water for Food Global Institute (DWFI) Faculty Fellow Karina Schoengold.



NWC postdoc Vaishali Sharda presents a poster at the 2018 Ogallala Aquifer Summit.

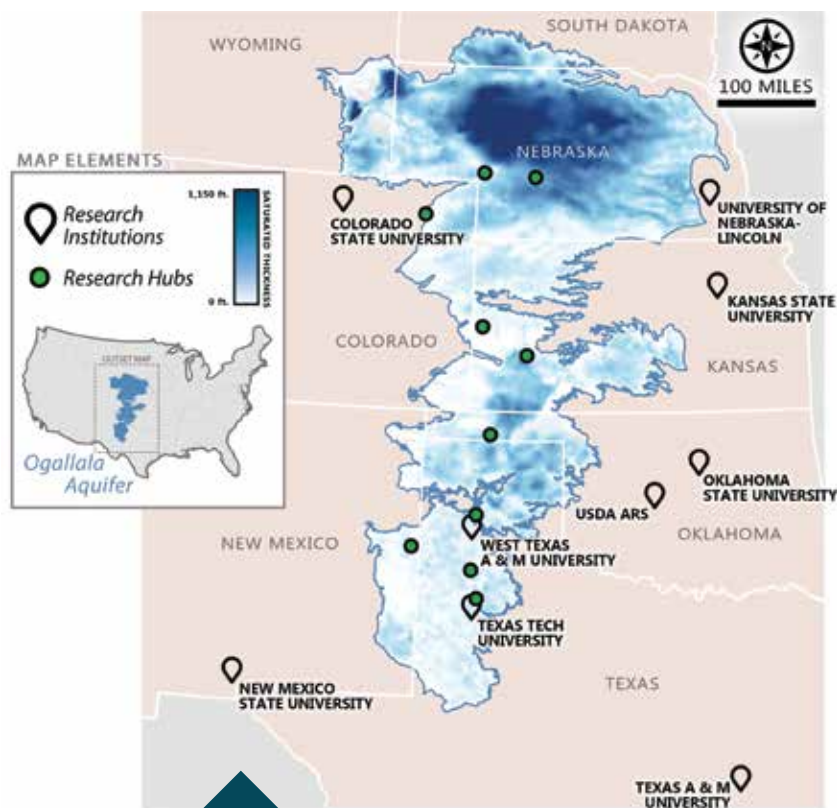
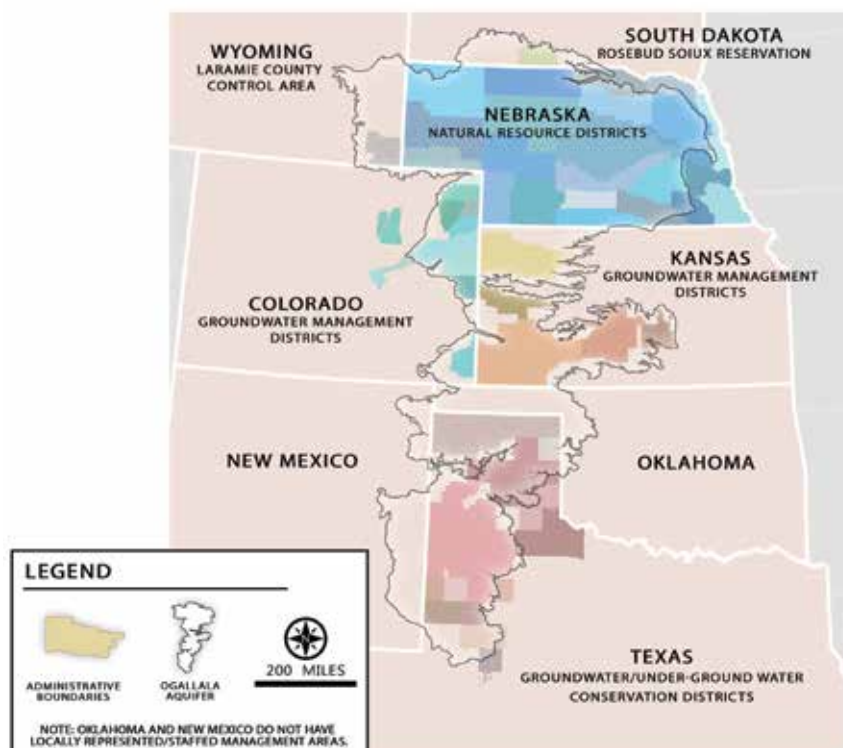


NWC director Chittaranjan Ray emphasized the work's importance: "This project identifies data-supported solutions and informs the public, including producers, so they understand the impact of their actions on their own farms and communities and on the world." Ray guides Nebraska's \$1 million portion of the award.

Models will be finalized in 2019 and results housed indefinitely in a public datahub. Team members also share findings through published articles that become a part of permanent scientific scholarship. Sharda and others including Ray, for example, recently published an article on Texas High Plains irrigation in the *Journal of the American Water Resources Association* (JAWRA).

Other OWCAP collaborators include DWF Faculty Fellows Daran Rudnick and Derek Heeren. In 2017, Rudnick and a Nebraska Extension team launched Testing Ag Performance Solutions (TAPS), an interactive competition allowing growers and non-growers to learn from each other and make better farm management decisions. The program recently expanded to Oklahoma, a partner OWCAP state.

The OWCAP consortium includes scientists, students and staff at Colorado State University, Kansas State University, Oklahoma State University, New Mexico State University, Texas Tech University, West Texas A&M University, Texas A&M AgriLife and the USDA Agricultural Research Service. For more information, visit ogallalawater.org.



Maps courtesy of Lacey Moore, Colorado State University



Nebraska Water Productivity Report Is Step Toward Improved World Water Productivity

Irrigated agriculture has greatly expanded over the past several decades, and technology has empowered producers' ability to bring water to their fields. The result? Increased yield, which is a good thing considering the world's rising demand for food. However, this has also led to a greater number of users competing for water. Drought and groundwater depletion have increased pressure on water resources even more.

The situation in Nebraska is not unlike other places in the world. In fact, by the year 2050, humanity will need to feed more than 9 billion people with finite natural resources, including water. To meet this challenge, it will be critical to make the best possible use of resources and further improve agricultural productivity.

The Nebraska Water Center is working with the Daugherty Water for Food Global Institute to use Nebraska's expertise in water and agriculture to generate water productivity insights that can help producers, communities and industry partners anywhere make better decisions. The first step is the Nebraska Water Productivity Report, which will be available on the Water for Food Institute's website: **waterforfood.nebraska.edu/resources**.

The Nebraska report assesses water productivity (WP) of crops and livestock, as well as the water, energy and carbon footprint of the state's ethanol production. The research contains good news — water application dropped and WP improved over the past decade, which means the state's efforts to improve water productivity have been successful.

Information in the report will be used to illustrate further improvements and optimize food production while ensuring water sustainability. The report also shows crop yield improvements resulting from better plant hybrids, fertilizer and soil management, and weed control.

Chittaranjan Ray of NWC said: "We have to look at two things this program has done — the technical work is one, and then there are the efforts of the program to bring the message to the public." The realities, Ray said, can be different from what most people expected. "Many have the notion that beef uses more water than chicken, for example. In Nebraska, if animals are primarily grass fed and not in a confined system, then the impact on water systems might not be as high as expected."

Mesfin Mekonnen, a DWFI postdoctoral research associate, is leading the project. The Nebraska report is a pilot for a future "Water Productivity Report" series that will provide a conduit for sharing lessons learned with other states and nations.

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We have to look at two things this program has done — the technical work is one, and then there are the efforts of the program to bring the message to the public.

— Chittaranjan Ray

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USDA-NIFA Project Allows End Users to Participate in Own Water Solutions

A few years ago, as NWC director Chittaranjan Ray and University of Nebraska scientists worked with other states on water-related projects, it became obvious one aspect of proposed research was missing: how to best communicate with water end-users (stakeholders) to ensure successful mitigation of water challenges.

Mark Burbach, an environmental scientist with the University of Nebraska–Lincoln’s School of Natural Resources, explained: “The biophysical piece is only one component. What can make the biggest difference is knowing what’s important to water users — respecting their values and interests and creating ground-up community-driven solutions.”

In July 2017, the USDA’s National Institute of Food and Agriculture awarded the multistate group \$5 million for a four-year project. The research team includes six UNL researchers, with Burbach leading the Nebraska contingent, plus 12 colleagues from Penn State University, Arizona State University, and the USDA’s Agricultural Research Service (ARS). The overall project is led by Penn State rural sociologist Kathryn Brasier.

One of the most powerful aspects of what is now called the Water for Agriculture project is its diverse case study locations representing different water issues and settings. Burbach said, “The end game ultimately is a new model of stakeholder engagement that recognizes water and ag issues are most important to people affected and leads to improved water quality and quantity in their own communities.” The team eventually will make the model available internationally.

In the past two years, researchers interviewed 50 stakeholders in Nebraska to determine their views of water issues and actions they believe should be taken locally. Countless presentations have been given to local, state and national officials. Others are conducting similar interviews and presentations in Arizona and Pennsylvania, and the team may consult partners in Israel and Australia. The research is expected to help policymakers and regulatory agencies that often lead stakeholder engagements.

In 2018, the researchers began forming local leadership teams to address future water issues. Communities will be surveyed in 2019 and again a couple of years later to identify changes that should be made in community engagements.

In addition to Burbach and Ray, other participants from the University of Nebraska–Lincoln include:

- Lilyan Fulginiti and Richard Perrin, Department of Agricultural Economics
- Jessica Grosskopf, Nebraska Extension crops-economic risk management educator
- Cheryl Burkhart-Kriesel, Panhandle Research and Extension Center
- Daran Rudnick, Department of Biological Systems Engineering
- Jason Weigle, Southeast Research and Extension Center

Water for Agriculture project collaborators at their first annual meeting at Penn State University in 2017.



NWC Disburses U.S. Geological Survey Funds to Address Water Quality and Quantity

The Nebraska Water Center awarded U.S. Geological Survey (USGS) 104b project funds to six University of Nebraska–Lincoln research teams in 2017 and 2018.

Projects awarded funding from March 1, 2017, through February 28, 2018:

1. *Utilizing Biotrickling Filters to Reduce Water Consumption at Fermentation and Dryer Stacks in Ethanol Plants*; PI: Ashraf Aly Hassan, University of Nebraska–Lincoln, Department of Civil Engineering; \$20,000
2. *Impact of Variable Rate Irrigation on Consumptive Use of Water Resources*; PI: Derek Heeren, University of Nebraska–Lincoln, Department of Biological Systems Engineering; Co-PIs: Daran Rudnick and Francisco Munoz-Arriola, University of Nebraska–Lincoln; \$20,000
3. *Spatial Variability of Streambed Hydraulic Conductivity Across Multiple Stream Orders*; PIs: Aaron Mittelstet, Department of Biological Systems Engineering, and Troy Gilmore, School of Natural Resources, University of Nebraska–Lincoln; \$19,992

Projects awarded funding from June 18, 2018, through June 17, 2019:

4. *Pesticide Exposure in Recreational Lakes*; PIs: Tiffany Messer and Aaron Mittelstet, Department of Biological Systems Engineering, and Daniel Snow, Nebraska Water Center, University of Nebraska–Lincoln; \$19,997
5. *The Chemistry and Ecotoxicology of Microplastics - Water Quality Research Experience in Nebraska Waterways*; PIs: Shannon Bartelt-Hunt, Department of Civil Engineering, and Daniel Snow, Nebraska Water Center, University of Nebraska–Lincoln, and Jerald Bricker, Department of Biology, Nebraska Wesleyan University; \$10,080
6. *Microalgae Treatment of Meat Processing Wastewater for Nutrient Removal and Water Reconditioning*; PIs: Yulie Meneses, Department of Food Science & Technology, and Ashraf Aly Hassan, Department of Civil Engineering, University of Nebraska–Lincoln; \$19,869

Tiffany Messer and collaborators work every day to find solutions to water quality issues using technologies that can be used around the world.



EXTENSION & OUTREACH

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Once we know the best combinations of management practices, the university's large faculty and extension group, including the Daugherty Water for Food Global Institute with all its international connections, is well-positioned to expand this knowledge throughout the state and other places in the world that are experiencing similar challenges.

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— Crystal Powers, Nebraska Water Center research and extension communications specialist

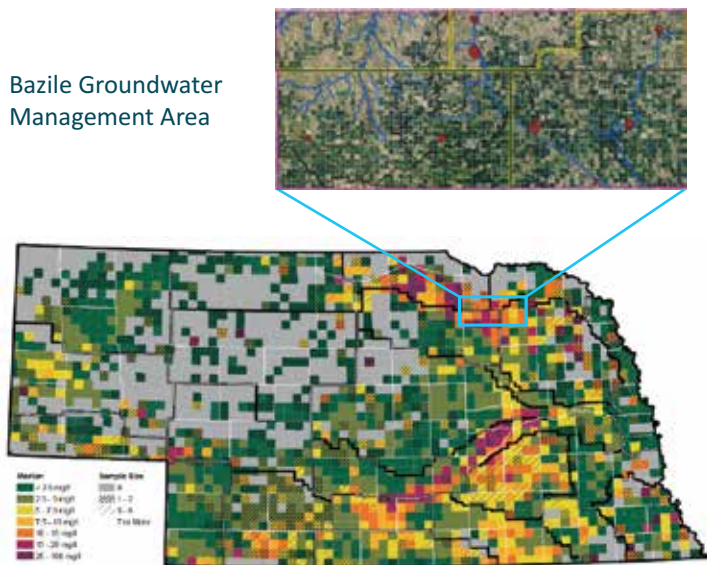
Implementing Nitrate Solutions: Bazile Groundwater Management Area

Nitrogen is an essential fertilizer for growing productive crops. However, when it enters into water it becomes a risk to human health. For decades, Nebraska's Natural Resources Districts (NRDs) and Nebraska Department of Environmental Quality (NDEQ) have been monitoring the state's water quality. With the help of University of Nebraska research, a 756-square mile area of Antelope, Knox and Pierce counties was identified as one area with high groundwater nitrate levels. Groundwater supplies much of this area's drinking water, so homeowners and small communities must treat water, but they often find it cost-prohibitive.

To help solve the problem, six years ago, area NRDs and NDEQ teamed up with local, state and federal partners to create the Bazile Groundwater Management Area (BGMA) Plan. Partners now include the NWC's Water Sciences Laboratory (WSL), Nebraska Water Center, and University of Nebraska Extension. The University is represented by NWC director Chittaranjan Ray and research and extension communications specialist Crystal Powers, along with Bill Kranz, Katie Pekarek, Amy Timmerman, and Brian Krienke from Nebraska Extension.

This work is critical for the health of more than 7,000 Nebraska citizens in the area.

Bazile Groundwater Management Area



The BGMA leadership is taking action through jointly funded research, outreach and incentivization of best practices to help lower nitrate levels, improve groundwater quality and mitigate nitrogen loss in the soil.

NWC supports BGMA efforts in multiple ways. Last year, through the leadership of Ray, a jointly-funded Extension Educator position was established to perform BGMA-specific on-farm research and demonstrations. Ray and Powers, along with the Extension team, worked with NRD staff on a successful Nebraska Environmental Trust grant that supports the position by funding on-farm research and demonstrations.

Through another Nebraska Environmental Trust grant, the WSL will expand its Know Your Well program into BGMA high schools. This program teaches students to sample and test community wells. The two grants together provide BGMA-related support of more than \$820,000 over the next three years.

WSL will use NDEQ funding to conduct vadose zone sampling in the area to measure project progress.

In early 2019, a UNL faculty group — the Nebraska Nitrate Group — met to merge academic expertise. Next, they will meet with stakeholders to help establish consensus on methods for addressing statewide nitrate levels based in part on work in the BGMA. The group will also be a key part of a developing campus water initiative.

Powers, who has been leading NWC engagement within the BGMA, said the end goal is bigger than Nebraska. "Once we know the best combinations of management practices, the university's large faculty and extension group, including the Daugherty Water for Food Global Institute with its international connections, is well-positioned to expand this knowledge throughout the state and other places in the world that are experiencing similar challenges."

For more information about nitrates and the BGMA team's work, visit water.unl.edu.



Platte River Basin Ecosystem Symposium Returns After Lengthy Hiatus

In the summer of 2018, for the first time in 15 years, the Platte River Basin Ecosystem Symposium was convened in Nebraska. Organized by the Crane Trust and the Nebraska Water Center, the symposium was revived in time to mark an important milestone — the Crane Trust’s 40 years of operation on the Platte River.

The 2018 symposium was the 13th in the series, which began in 1995. In early June, a roomful of researchers and stakeholders gathered at the beautiful Crane Trust Nature and Visitor Center near Wood River, Nebraska. According to Crane Trust lead biologist Andy Caven, the event’s goals were to “provide a snapshot of ongoing research in the Central Platte River Valley, conduct a broad assessment of the ecosystem’s current conditions, and further clarify future conservation and research priorities.”

The Crane Trust and NWC have long been partners in furthering research and engagement centered around the Central Platte flyway. Much of the research has focused on improving outcomes for the region’s wildlife, including the endangered Whooping Crane, Piping Plover and Interior Least Tern. This involved studying the impact of changes in habitat and water flows.

Many of these efforts are achieved through the Platte River Recovery Implementation Program — an interstate effort to increase stream flows, as well as enhance, restore and protect habitat via adaptive management. At the symposium, many successes and adaptations were shared, including notable habitat improvements and modest streamflow increases.

George Archibald, founder of the International Crane Foundation, delivered a keynote speech highlighting issues facing Mongolia that are very similar to issues found in the Great Plains. The day was capped by “My Path to the River,” a moving personal narrative from Mike Farrell, co-founder of the Platte Basin Timelapse Project and a DWFI Faculty Fellow.

The focus of the symposium’s second day was strategizing next steps to address key issues facing the Basin. Invasive species, particularly Phragmites and Red Cedar, were identified as one of the primary challenges. It will be critical going forward to research more efficient methods of control to reduce the extensive investments of money and labor that have been required in the past. Another noted priority was restoring larger and better-connected areas of native habitat to benefit key species. The group would like to bring these issues together in a future Basin-wide strategic plan.

Visit the Nebraska Water Center website to access proceedings of the 13th Platte River Basin Ecosystem Symposium. View past proceedings through UNL Digital Commons.



Symposium attendees discuss habitat restoration.



TAPS Competition Promotes Water and Agricultural Education for Farmers and Nonfarmers

In the American Midwest, it's rare to find a small-town café that doesn't host weekly coffee meetings among farmers comparing yields and competing to grow more and better products. In 2016, a unique new annual event transformed this coffee talk into a science. The program, Testing Ag Performance Solutions (TAPS), began at UNL in the minds of professors Daran Rudnick and Matt Stockton, who saw it as a way to promote water efficiency and quality without negatively affecting profit. NWC and DWFI contribute financially and provide programmatic, promotional and administrative support.

TAPS results are benefitting everyone from producers and suppliers to natural resources districts and state agencies. Commercial enterprises participate as well, in part to showcase cutting-edge information and technology. During an entire growing season, TAPS teams of farmers and nonfarmers, including students and educators, manage individual plots of center-pivot-irrigated crops at the University of Nebraska–Lincoln's West Central Research and Extension Center (WCREC) in North Platte.

Program field days help cement relationships among participants as they share what did and didn't work and analyze data. Awards are given at a final banquet, and findings are disseminated to help ag stakeholders everywhere make real-life decisions about irrigation scheduling, nitrogen fertilizer, hybrid selection, seeding rate, insurance and marketing. To multiply the reach of the information, NWC shares TAPS news via its newsletter, social media, articles and emails, and encourages presentations by past participants.

This Nebraska Extension program has grown from 15 teams and one crop in 2017 to 50 teams and two different crops and irrigation systems for 2019. According to Rudnick, the real value of TAPS is in building a community of interconnected agricultural stakeholders who learn from one another. Results

TAPS contestant Ron Makovicka inspects his corn plot.



have included surprises that could change the way crops are grown. For example, competitions so far indicate the most successful producers cultivate a balance of skills as opposed to becoming super-successful in one aspect of production.

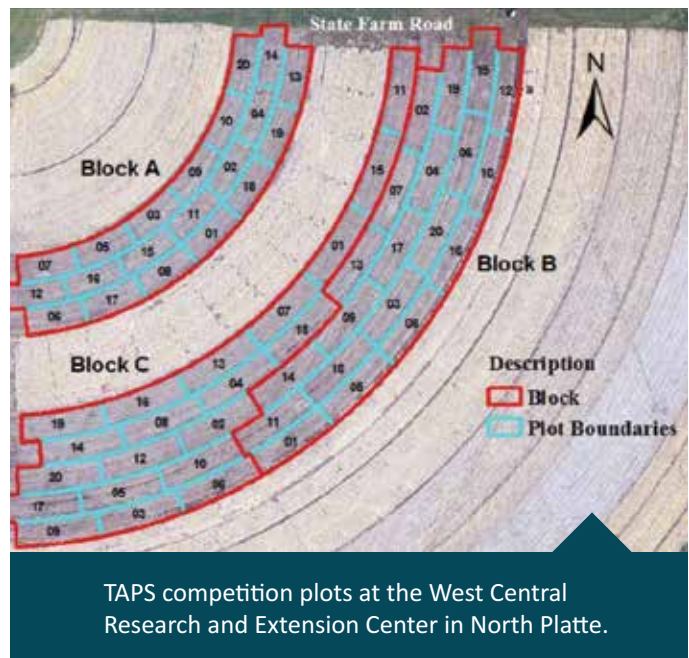
“Grower competitions have existed a long time, mostly focused on yield,” said Rudnick. “TAPS goes beyond yield to profitability and efficiency. It’s a safe experimental process that produces a ton of actual data and gets people together who might not otherwise interact.” Lessons learned could be shared nationwide — even worldwide. Rudnick and others already are helping create a similar program at Oklahoma State University in 2019.

In addition to Rudnick, other developers of TAPS from the University of Nebraska–Lincoln include:

- Chuck Burr and Matt Stockton, West Central Research and Extension Center
- Rodrigo Werle, formerly of the Department of Agronomy and Horticulture

TAPS also receives financial and in-kind resources and support from 48 sponsors and partners, including the Nebraska Water Balance Alliance (NEWBA), of which NWC is a member.

Sign up to receive the TAPS newsletter at taps.unl.edu.



TAPS competition plots at the West Central Research and Extension Center in North Platte.

Chuck Burr (R) and Daran Rudnick discuss TAPS test plots at Nebraska’s West Central Research & Extension Center.



2018 Regional Symposium: Unique and Shared Water Challenges of the Great Plains

Nearly 200 scientists, conservation leaders, graduate students, federal representatives and Great Plains citizens converged last fall at the 2018 National Institutes for Water Resources Regional Symposium, titled “Water Resources of the U.S. Great Plains Region: Status and Future.” The symposium was organized by the Nebraska Water Center (NWC) and held at the Nebraska Innovation Campus Conference Center. NWC hosts a similar state-based symposium every fall.

For the NWC, which is usually focused on Nebraska, involvement in the regional symposium marked expansion into regional Great Plains affairs. Participants heard perspectives from water leaders across the 10 states that constitute the Arkansas and Missouri River watersheds: Montana, the Dakotas, Oklahoma, Kansas, Colorado, Arkansas, Iowa, Missouri and Nebraska.

At the regional gathering, several Water Resources Research Institute directors described their unique challenges. They also discussed shared issues: surface and groundwater contamination, managing water for irrigation, industrial and municipal use, impacts of climate change, conversion to high efficiency irrigation, and harmful algal blooms.

The symposium attracted participants from the United States Geological Survey (USGS) and United States Department of Agriculture (USDA). These presenters discussed both serious challenges and innovative solutions related to Great Plains water use and supply.

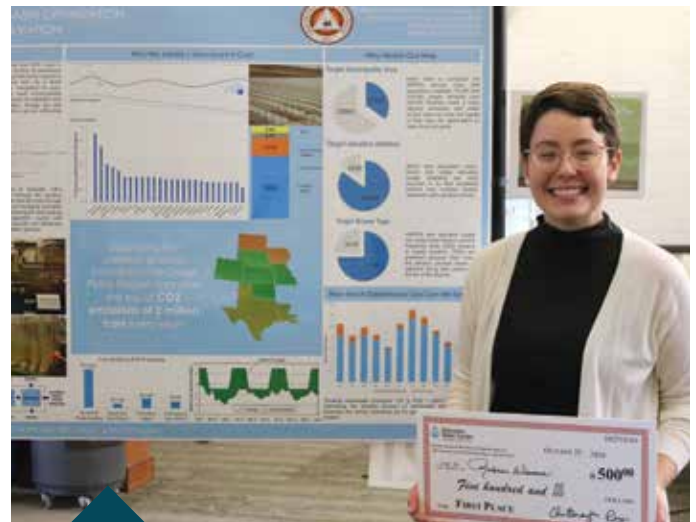
Jim Dobrowolski of the USDA National Institute for Food and Agriculture highlighted a multistate effort to better manage groundwater. “The Ogallala Water Coordinated Agriculture Project, OWCAP, is looking to improve technologies and improve the conservation of water use out of the aquifer,” Dobrowolski said. “We have about 20 years or so before the Ogallala Aquifer in the southern part will have very little water to pump out to use for agricultural irrigation.”

Water quantity in the arid plains is a perennial concern, but several presenters addressed solutions for water quality. Iowa State University agricultural engineering professor Matt Helmers described how land management strategies such as cover cropping, extended rotations and conversion to pastures are often the most effective ways to reduce nitrate infiltration.

Participants appreciated opportunities for interaction. Joyce Williamson, director of USGS Dakota Water Science Center, said she enjoyed getting to know young researchers: “They’re going to be the future.”

The symposium also featured a student poster competition with cash prizes. Two NU graduate students, Galen Richards and Jasreman Singh, took second and third places, respectively. Rabecca Wiseman, a graduate student from Oklahoma State University who finished first, said she was most excited about “being around a ton of other engineers who are trying to save ecosystems.”

For more information, visit watercenter.unl.edu/2018-water-symposium.



Rabecca Wiseman - Oklahoma State graduate student and first place winner in the poster competition.





Jim Dobrowolski, national program leader,
USDA National Institute of Food and Agriculture



Joyce Williamson, director of
USGS Dakota Water Science Center



2018 Symposium Participants



Nebraska's Citizen Scientists Test the Waters to Improve Health

In 2018, 200 citizen scientists collected 400 water quality samples from the Elkhorn and Lower Platte River basins. The ongoing project, initially funded by a Nebraska System Science seed grant, uses rapid test strips to detect nitrate, nitrite and phosphorous (commercial fertilizer nutrients) in groundwater and surface waters surrounding farms and communities. Although these nutrients promote crop growth, excess levels can compromise water quality and human health.

University of Nebraska environmental engineer Shannon Bartelt-Hunt is spearheading “Water Quality + Citizen Science,” as the project is known. Together with GC Resolve, a nonprofit grassroots community development and education organization, and the University of Nebraska Medical Center’s College of Public Health, Bartelt-Hunt and her team distributed test strips to citizen scientists in 21 eastern Nebraska counties last year. Citizen science is scientifically sound and provides a more complete picture of public health measures than complex research projects can provide on their own.

“We don’t have spatially or temporally complete measures of water quality anywhere. Even in Nebraska there are gaps. That’s my goal, to engage citizen scientists to fill some gaps,” Bartelt-Hunt said.

The inexpensive 80-cent test strips provide results in less than one minute and measure nutrients in parts-per-million (ppm). For perspective, one ppm of nitrate in one liter of water is like one grain of table salt within 1/3 c. of sugar. In 2018, 11% of citizen scientists reported well-water nitrate concentrations above the Environmental Protection Agency’s safe drinking water limit of 10 ppm. For phosphorous (no drinking water limit but leads to eutrophication and harmful algal blooms), 21% of participants reported concentrations between 5 and 50 ppm. This data aids researchers, but its value is even greater for those who need it to evaluate the health of their own water.

A pair of young citizen scientists collect a water sample during the project’s first testing period.



"It costs to send samples to a lab," Bartelt-Hunt explained. "People may not know quite how or where to do that. But citizen sampling is easy. It gives information about water quality that people otherwise may not have."

In 2019, the project will focus on drinking water quality. If citizens find elevated nitrate levels in their wells, university researchers will confirm their tests and provide educational materials with treatment recommendations. Next year, citizen scientists will measure water quality indicators around the Costco chicken processing plant near Fremont. The long-term goal is to collect and compare water quality data before and after arrival of the plant, which eventually will process more than 2 million chickens per week.

Although NWC is not contributing financially, the project uses the WSL to perform secondary testing and aligns with the center's goals to help people better understand water. Support for the project's second year comes from the National Institutes of Health.

To sign up as a citizen scientist or get more information, visit go.unl.edu/wqcs.

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Citizen sampling is easy.
It gives information about
water quality that people
otherwise may not have.

— Shannon Bartelt-Hunt

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University of Nebraska at Omaha graduate student Krystal Herrmann leads a demonstration on water quality testing in 2017.

Water and Natural Resources Tour Spreads the Word About Water

Every year since 1972, the Nebraska Water Center has organized a Water and Natural Resources Tour. The brainchild of University of Nebraska—Lincoln extension farm management specialist Les Sheffield, the tours began as an educational activity to enhance understanding and appreciation for water management in Nebraska.

Today, the tour is a critical method for spreading the word about water issues and finding potential solutions to meet water-related challenges in the region. Participants often include scientists, teachers, students, practitioners, legislators, media and others who are interested in or can impact water management.

The tours began meandering out of state in the early 1980s. Over the years, non-Nebraska destinations such as the Colorado Rockies, Columbia River Valley and U.S. Bureau of Reclamation dams in the American West have served as scenic backdrops for water education through the NWC tour.

In recent years, the tours have stayed closer to home, giving tour participants opportunities to explore the breadth and depth of water issues within the Platte, Missouri and Republican River basins.

Joining the NWC in planning and organizing the tours is the Central Nebraska Public Power and Irrigation District, the Daugherty Water for Food Global Institute and the University of Nebraska's Institute of Agriculture and Natural Resources. Businesses and organizations involved both directly and indirectly in water science and management sponsor the tours in a show of much-needed support for improving the region's water resources.

In 2017, the tour group visited Nebraska's Central Platte River basin. Highlights included visiting a family farm that grows organic greenhouse peppers and tomatoes and kayaking along a canal near Cozad.

Kayaking in central Nebraska's Gallagher Canyon State Recreation Area.





2018 Water Tour participants at Nebraska's iconic Chimney Rock.

Last year, the tour ventured further westward to explore the North Platte River basin in eastern Wyoming and western Nebraska. Natural and manmade landmarks, in particular Nebraska's Chimney Rock and Wyoming's Pathfinder Dam, left indelible impressions of the area's geologic and economic value on those who participated.

"The tour provided an excellent overview of the geography, history and present state of the North Platte River system," one participant recalled.

In 2019, the tour will travel to Montana and Wyoming, including visits to Yellowstone National Park and Missouri River Headwaters State Park.

To sign up for a tour or learn more about the water tours, visit watercenter.unl.edu/water-tour.



Wyoming's Pathfinder Dam

WRAP Members

(As of December 2018)

- **Brian Barels**
Nebraska Public Power District
- **Senator Lydia Brasch**
State Senator
- **Mark Brohman**
Nebraska Environmental Trust
- **Gordon W. “Jeff” Fassett**
Nebraska Department of
Natural Resources
- **Eugene Glock**
Cedar Bell Farms
- **Mace Hack**
The Nature Conservancy, Nebraska
- **Senator Dan Hughes**
State Senator
- **Michelle Koch**
Nebraska Game and
Parks Commission
- **Matt Lukasiewicz**
Sargent Irrigation District
- **Jim Macy**
Nebraska Department of
Environmental Quality
- **Mike Sousek**
Lower Elkhorn NRD
- **Lee Orton**
Nebraska Well Drillers Association
- **Jay Rempe**
Nebraska Farm Bureau Federation
- **Marty Stange**
Hastings Utilities
- **Dayle Williamson (retired)**
Offices of Senator Ben Nelson
and Nebraska Natural
Resources Commission

Water Resources Advisory Panel

Editor’s Note: The article below was originally written by Linda Ulrich Miller, publications editor in the IANR vice chancellor’s office. It was featured in the Fall 2018 issue of IANR’s Growing Magazine.

NWC convenes the WRAP three times per year, often in conjunction with the state legislature, Water for Food Global Conference and NWC fall symposium. Through the WRAP, the center creates a bridge between the state’s water needs and the university’s capability to address them.

The University of Nebraska Water Resources Advisory Panel (WRAP) was formed in 2006 during a severe statewide drought. WRAP comprised representatives of state agencies, NGOs (nongovernmental organizations), and constituency groups with interest in addressing the best management of water resources in Nebraska, because the state was facing increased pressure to address water issues resulting from interstate compacts, the ongoing drought, and other factors.

Collaboration among the groups represented in WRAP, adoption of technology, and university research have played a big role in addressing the concerns that led to the original formation of the group. Currently, water quality, particularly the high nitrate levels in groundwater, has emerged as a focus, said Rachael Herpel, assistant director for the university’s Robert B. Daugherty Water for Food Global Institute and the Nebraska Water Center. Herpel coordinates WRAP activities.

WRAP is made up of 15 individuals representing a cross section of Nebraska’s water decision-makers, including agricultural producers, representatives of many of the state’s water-related agencies, and others who serve as the “voices of Nebraska” for water issues, Herpel said. The goal is to better connect the university with the wisdom of outside experts and those who often rely on the university’s water-related research, education, and outreach to make decisions that affect Nebraska’s water resources.

Panel members agree that the university should support technologies and efforts that make water conservation easier and water safer, but producers need to know what technologies are worth their investment, particularly in the current economy. Stakeholders also want the university to model the sustainable behavior it believes in. Those are just a couple of the many water issues the panel has identified, Herpel said.

WRAP helps the university learn about stakeholder concerns, work on those issues, and be responsive to their needs, she said. “The panel takes this responsibility very seriously.”



TEACHING



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This program helps water users understand what's going on in their own communities without preaching to them. That means people are more likely to understand the problems and help implement treatment — it gives everyone an opportunity to be a part of the solutions.

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— Christopher Olson, Know Your Well program manager



Know Your Well: Trickledown Effects of Hands-On Water Education

Scientists haven't always successfully communicated knowledge to the public, and it sometimes keeps communities from taking action to protect and manage resources. When it comes to groundwater and community drinking water, that gap is being filled within several Nebraska communities by a three-year Water Sciences Laboratory (WSL) citizen science program called Know Your Well.

In 2017 and 2018, Chris Olson, the program's manager, drove 17,000 miles to meet with students and teachers in 10 Nebraska towns to help them understand and participate in the science of groundwater and drinking water. The program, supported by the University and a Nebraska Environmental Trust (NET) grant, provides testing kits and teaches students to test their own communities' well water, analyze it, and then compare results with duplicate samples sent to WSL water scientists. Olson said the value of hands-on learning, as opposed to classroom lectures, is immeasurable.



Nicole Schumacher and Christopher Olson
at the WSL.

Madison High School students uncover and
prepare to test a water well.



For the past year, Nicole Schumacher, a UNL undergraduate student in environmental engineering, has assisted Olson and managed the program's social media. "I've learned a lot about groundwater and water sampling, and it will help me in my future work," she said.

According to Olson, program benefits go beyond testing and student education. Citizen science programs help scientists collect valuable data in higher quantities than they could gather on their own. Also, students are encouraged to share results through community presentations, allowing the program to spill over into policymaking to help community leaders make important water-related decisions.

"This program helps water users understand what's going on in their own communities without preaching to them," Olson explained. "That means people are more likely to understand the problems and help implement treatment — it gives everyone an opportunity to be a part of the solutions."

A happy side effect of the program is cultivation of interest in water-related careers. Faith Santana is one such student from Auburn, Nebraska. Next fall, she'll be studying water sciences at UNL. "Before taking part in this program, I never would have given thought to what is in water," Santana said. "It changed the way I look at things."

In 2019, the Know Your Well program will guide student testing in nine more Nebraska communities. However, Olson said testing drinking water is not a skill needed only in Nebraska. "Everyone needs water," he explained. "From those who drink it to those in agriculture who rely on it to grow our food." He believes the Know Your Well program and lessons learned could be expanded to communities anywhere.

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Before taking part in this program, I never would have given thought to what is in water. In fact, I wouldn't have thought it was interesting when it really is. Being informed of water quality gives people the ability to focus on what they can change to help themselves or their land."

— Faith Santana

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Auburn High School senior Faith Santana's participation in Know Your Well inspired her to major in water and natural resources at the University of Nebraska–Lincoln.



IRES program participant
Jordan Shields

IRES Program Sparks International Exchange through Water Science

For the first 27 years of his life, Jordan Shields never set foot outside the United States. That changed in May 2018 when the University of Nebraska–Lincoln graduate student packed his bags and curiosity and set off for Prague, capital city of the Czech Republic.

The trip was part of the International Research Experience for Students (IRES), a three-year program funded by a \$250,000 National Science Foundation grant. The program — *Research on Vadose Zone for Understanding Water and Chemical Transport at Various Scales* — enabled a dozen UNL students to conduct collaborative research with Czech students and faculty. NWC Director Chittaranjan Ray led this group in the program's final year, working alongside counterparts Michal Snihota and Martin Sanda from Czech Technical University (CTU).

The trip provided the 2018 group, which included two Nebraska students and one from the University of Texas, with enriching opportunities and insights. During the eight-week program, they took advantage of their geographic good fortune by traveling to a number of nearby locations. One project led them to the Czech-Polish border, where the two countries are divided only by a small meandering stream. On weekends, they made the easy hop to Vienna or Zurich. Prague's historic cathedrals, squares, and bridges left their mark on the students, and they returned the favor by tagging the iconic, graffiti-laden Lennon Wall.

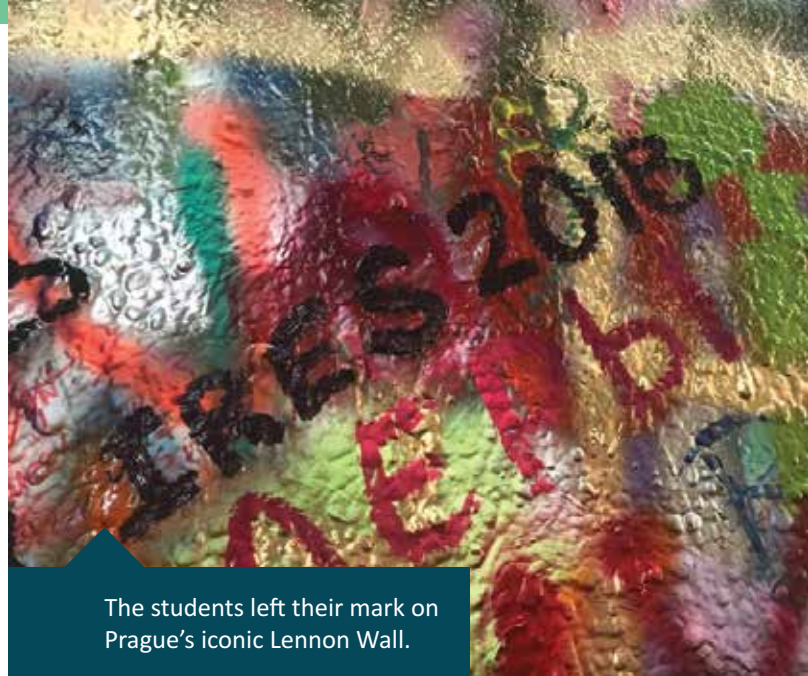
Shields said the experience left its mark on him both personally and professionally. The personal: his Palestinian roommate bought him a bath towel when his command of Czech and credit card faltered — a gesture of hospitality he will long remember. The professional: he was able to observe how a different country approaches research.

IRES students sample groundwater in the Czech Republic's Jizera Mountains.



Research is a daily part of Shields' natural resource sciences major at Nebraska. He examines how contaminants work their way through the vadose zone — the soil layer between land surface and groundwater table. The vadose zone acts as a skin of the earth, regulating groundwater recharge and chemical movement. Shields also works with the Nebraska Vadose Zone Program.

In the Czech Republic, Shields and fellow students looked at water infiltration in the Jizera Mountains and a lower-lying rural area. Using stream gauges and lysimeters to measure evapotranspiration, they added to an extensive CTU data set that records impacts of local logging on water movement. Ultimately, it was the modeling aspects of the research that left the biggest impression on Shields.



The students left their mark on Prague's iconic Lennon Wall.



The modeling is what really stuck out and how useful this could be when applied to our vadose zone projects here.

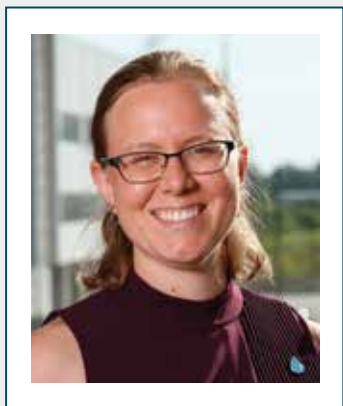


— Jordan Shields

Prague, capital city of the Czech Republic



Nebraska Water Center Postdoc Profiles



Erin Haacker

Erin Haacker arrived at the Nebraska Water Center along a winding road. The research associate has two bachelor's degrees — zoology from the University of Montana and geology from University College Cork

in Ireland. She ventured to Michigan State University for her Ph.D., double majoring in environmental science and policy. Originally, Haacker wanted to work in dinosaur paleontology, so she spent a few summers at a Montana dinosaur museum. But her first hydrology class got her hooked on water. She decided the practical applications of hydrology would make a bigger impact than paleontology. As a doctoral student, Haacker participated in a large, interdisciplinary collaboration studying the High Plains Aquifer in Texas. She used models linking groundwater, surface-water, economics, atmosphere and other factors. At NWC, Haacker combines the modeling of groundwater and surface-water interactions with statistical data analysis. Her skills include integrating tools such as GIS (Geographic Information Systems) and Python, a cross-platform, open-source programming language, to improve models. She is interested in groundwater management, especially in terms of profit and risk. Haacker likes to ask thought-provoking questions such as how do people adapt to natural resources and how can that be represented in physical and statistical models. A Nebraska native, Haacker was raised in Washington State and moved to Montana. Now back in Nebraska, when she isn't working on her distinguished career, she enjoys gardening and spending time with her daughter. In early 2019, Haacker accepted a faculty position in UNL's Department of Earth & Atmospheric Sciences, where she plans to capitalize on the skills and knowledge she gained at NWC.



Arindam Malakar

Arindam Malakar is a postdoctoral research associate at the University of Nebraska's Water Sciences Laboratory. Arindam received his undergraduate degree in chemistry (Hons.) from the University of

Burdwan and a master's in chemistry from Banaras Hindu University in Varanasi, India. During his master's studies, he completed a project on the coordination of polymers and took materials chemistry, sparking a personal passion for material science. This interest led him to the Indian Association for the Cultivation of Science where he pursued a Ph.D. in materials science focused on developing nanotechnology-based tools for addressing water quality issues. He then parlayed the findings of a collaborative project in Sardinia, Italy, into developing a simple method that eliminates arsenic from contaminated water. This discovery — which led to a patent — was one major landmark in his professional career. In 2016, he was selected to become a WARI scholar (p. 35) at the University of Nebraska, where he spent six months researching the mineralization of arsenic in groundwater using specialized nanostructures. Arindam currently works on ways to improve water, soil and food quality using nano-engineering solutions that mimic natural systems. He thinks one should never stop asking questions in search of improvements and says in science, one gains knowledge from both failures and successes. He feels inter-disciplinary collaborative research is needed to solve contemporary environmental issues. The collaborative research environment that he experienced first hand as a WARI scholar fueled him to carry out his postdoctoral research here. Arindam's position at the NWC has helped him diversify his expertise and utilize his materials science knowledge in answering environmental research questions. Although he has been in the U.S. for less than two years, he feels comfortable in Nebraska and says he enjoys interacting and working with new people.

D'Alessio Transitions from Postdoc to Professor



Jahangeer

Jahangeer is a postdoctoral fellow at the Nebraska Water Center in Lincoln, where he models contaminant transport in groundwater. He first participated in this type of contaminant transport modeling

a few years ago as a Ph.D. student in his native India. He received his undergraduate degree in biotechnology from Sardar Vallabh Bhai Patel (SBVP) University of Agriculture and Technology located in his hometown of Meerut, India. He then completed a master's degree in environmental engineering at the National Institute of Foundry and Forge Technology (NIFFT) in Ranchi, India. In 2017, Jahangeer received a WARI fellowship — a joint program between India and the University of Nebraska that provides fellowships to students and early-career professionals in the water sector. As a WARI fellow, he came to Nebraska to study nitrate transportation modeling and land management scenarios designed to minimize contamination. His work as a WARI fellow sparked a collaboration with NWC director Chittaranjan Ray and Water Sciences Lab (WSL) director Dan Snow, ultimately leading to his return to Nebraska and UNL as a postdoctoral fellow in June of 2018. He currently works on a project in Hastings, Nebraska, that involves nitrate contamination in groundwater. For that project, Jahangeer uses modeling skills to generate various scenarios addressing groundwater problems. In addition, he works on other WSL projects, including the calculation of soil water properties in a variety of regions. Jahangeer said he enjoys working hard and developing his research for varied water-related purposes. He believes Nebraskans and other Americans are successful because they are hardworking, driven and committed to their work, and he aspires to do the same. He wants to publish as many projects as he can now to pave the way to becoming a hydrology professor in the future.



Matteo D'Alessio

Matteo D'Alessio is a research assistant professor with the NWC, a role he began in summer 2018 and has actively fulfilled since joining the University of Nebraska–Lincoln faculty. During his NWC tenure, he has led two Nebraska

Environmental Trust grants and taught two undergraduate Fundamentals of Environmental Sampling courses.

Before becoming a professor, D'Alessio was a post-doctoral research fellow with NWC. He conducted field, laboratory and greenhouse research into creative methods of addressing water quality concerns. This included examining the impact of injected air on the transport of pharmaceutical compounds in recycled agricultural water, riverbank filtration, and leachability of treated wastewater. He published 15 journal manuscripts, presented at 10 conferences and served as a reviewer for 10 peer-reviewed journals.

D'Alessio came to Nebraska from Hawaii shortly after his Ph.D. advisor, Chittaranjan Ray, left the University of Hawaii at Manoa to become NWC's director. D'Alessio earned his bachelor's and master's degrees from La Sapienza University in his native Italy. He is originally from Sgurgola, Italy, a small town 50 miles southeast of Rome. A scholarship allowed him to conduct research with Ray in Hawaii, where they investigated the transport of endocrine disruptive compounds and explosive chemicals in Hawaii's soils.

OUR PEOPLE

Nebraska Water Center Advisory Board

The Advisory Board's purpose is to advise and strengthen the Nebraska Water Center as it carries out its mission of supporting water-related research, education and outreach, and to share information with constituent groups. This Advisory Board combines many existing advisory functions into one board. Examples of issues on which advice may be sought include research needs, particularly in Nebraska; events and programs for facilitating interdisciplinary research; shaping of academic programs; seed grant awards; and outreach event topics.

Current members of the board are:

Shannon Bartelt-Hunt, UNL Department of Civil Engineering

John Bender, Nebraska Department of Environmental Quality

John Berge, North Platte NRD

Dana Divine, UNL School of Natural Resources/
Conservation and Survey Division

Tom Franti, UNL School of Natural Resources and
Department of Biological Systems Engineering

Richard Holland, Nebraska Game and Parks Commission

Suat Irmak, UNL Department of Biological Systems Engineering

Peter McCornick, Daugherty Water for Food Global Institute

Dan Miller, USDA-Agricultural Research Service (ARS)

Jennifer Schellpeper, Nebraska Department of Natural Resources

Steve Thomas, UNL School of Natural Resources

Karrie Weber, UNL Earth and Atmospheric Sciences and School
of Biological Sciences



Nebraska Water Center Staff

Nebraska Water Center

Chittaranjan Ray, Ph.D., P.E., director
Matteo D'Alessio, research assistant professor
Craig Eiting, web developer & graphic design specialist
Erin Haacker, research associate
Rachael Herpel, assistant director
Jahangeer, research associate
Num Juntakut, visiting scholar (until August 2018)
Sushil Kanel, Ph.D., adjunct professor
Patricia Liedle, program assistant
Arindam Malakar, research associate
Crystal Powers, research & extension communications specialist
Mohanasundaram Shanmugam, research associate (until June 2018)
Jesse Starita, PR & engagement coordinator

Water Sciences Laboratory

Daniel D. Snow, Ph.D., director of services
Saptashati (Tania) Biswas, Ph.D., research lab manager
David Cassada, separations chemist and network administrator
Sathaporn (Tong) Onanong, research technologist II - LC/MS
Suzanne Polzkill, research technician
Nathan Roddy, research technician
Aaron Shultis, isotope scientist
Victoria Wickham, research technician

Nebraska Water Center Undergraduate Interns

Bassey Arikpo, University of Nebraska—Lincoln broadcasting major
Varun Vidyashankar, University of Nebraska—Lincoln business major

NWC Team Expansion

During 2017 and 2018, the Nebraska Water Center added team members in a number of critical areas to strengthen communication and collaboration, expand outreach, and advance research through the Water Sciences Laboratory. Current and past NWC staff are the people behind the scenes who have sustained NWC's and the university's role in water issues and solutions for more than a half-century.

New to our team in 2017-2018 are Crystal Powers, Jesse Starita, Rachael Herpel, Craig Eiting, Saptashati (Tania) Biswas, Suzanne Polzkill, Victoria Wickham, Nathan Roddy, Varun Vidyashankar and Bassey Arikpo.

For more on our new hires, visit watercenter.unl.edu/administration-and-staff.

Daugherty Water for Food Global Institute

2021 Transformation Drive, Suite 3220
P.O. Box 886203
Lincoln, NE 68588-6203
(402) 472-9510
waterforfood@nebraska.edu
waterforfood.nebraska.edu

Nebraska Water Center

2021 Transformation Drive, Suite 3220
P.O. Box 886204
Lincoln, NE 68588-6204
(402) 472-3305
waterinfo@unl.edu
watercenter.unl.edu

Nebraska Water Sciences Laboratory

202 Water Sciences Laboratory
1840 N 37th Street
University of Nebraska—Lincoln
Lincoln, Nebraska 68583-0844
(402) 472-7539
(402) 472-9599 (FAX)
dsnow1@unl.edu
watercenter.unl.edu/wsl

Credits

Editor: Jesse Starita

Writers: Kindra Foster, Jesse Starita, Crystal Powers, Molly Nance, Linda Ulrich Miller, Steve Ress, Varun Vidyashankar

Photography: Erik Johnson (erikjohnsonphotography.com), Jesse Starita, Craig Eiting, Crystal Powers, Frances Hayes, Shawna Richter-Ryerson, Steve Ress, Erin Haacker, Craig Chandler, Morgan Spiehs, Mark Burbach, Daran Rudnick, Jordan Shields, Andy Caven

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Nebraska Water Center
Robert B. Daugherty Water for Food Global Institute
2021 Transformation Drive, Suite 3220
P.O. Box 886204
Lincoln, NE 68588-6204

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