



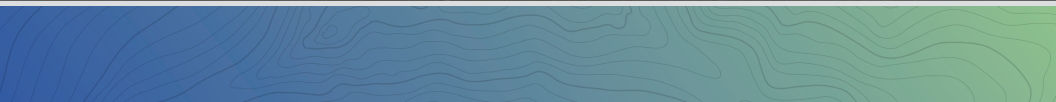
2023

ANNUAL REPORT



**Nebraska
Water Center**

Daugherty Water *for* Food Global Institute



The Nebraska Water Center

The Nebraska Water Center (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:

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

NWC is part of the Daugherty Water for Food Global Institute (DWFI) at the University of Nebraska and part of the University of Nebraska–Lincoln’s Institute of Agriculture and Natural Resources. Financial support for NWC and Water Sciences Laboratory comes from a combination of state, local and federal funding, as well as through partnerships with NGOs and industry.

For more information >>> watercenter.unl.edu



NWC 2023 SNAPSHOT



24

Undergraduate
Student
Interns



3

Postdoctoral
Researchers



\$2,983,031

in Grants to
Water Faculty
and Staff



35

Journal
Articles
Published



8,780

YouTube
Views



2,104

Water
Current
Readers



28

Events
Hosted or
Co-Hosted



USGS small grants support big ideas in water.

»» USGS 104b and 104g Awards

NWC awarded U.S. Geological Survey (USGS) 104b funding to five Nebraska-based research projects in 2023. 104b awards are geared towards early-career faculty who are conducting research in Nebraska that has unique applications both within and outside of the state. In 2023, a total of \$95,460.74 was awarded.

- › *Fire and Lakes*. Jessica Corman and Daniel Gschwentner. **\$29,841**
- › *Synergistic effect of biochar and biosolids to limit nitrate leaching beneath cropland*. Arindam Malakar and Michael Kaiser. **\$10,000**
- › *Managing irrigated cropping systems for drought resilience and vadose zone nitrate control: field evaluations and modeling*. Abia Katimbo, Sahila Beegum, Daran Rudnick, Arindam Malakar, Hope Njuki Nakabuye, and Nicolas Cafaro La Menza. **\$29,962**
- › *Growing groundwater science*. Chris Huber, Daniel Snow, and Dick Ehrman. **\$14,358.74**
- › *Metal oxide precipitate on irrigation center pivots as a non-invasive screening tool for redox sensitive trace metals in groundwater*. Jeffrey Westrop. **\$11,299**

Each year, USGS holds a nationally competitive grant application for 104g funding. 104g awards are asked to tackle projects that align with the national research priorities of the USGS. In 2023, only 11 projects were awarded throughout the country. Nebraska received funding for one of these eleven 104g awards.

- › *Release, adsorption, and biotransformation of biosolid-borne PFAS at the water-sediment interface in agricultural watersheds*. Xu Li. **\$278,969**

For more information visit »» go.unl.edu/USGS.



Soil cores are collected at Homestead National Monument.

»» **NWC Researchers Publish Work in Water Quality Research**

New Publication Considers the Connection Between Uranium and Nitrate in Groundwater

A Nebraska Water Center project funded by the USGS 104G competitive grant program has been published in the journal *Environmental Science and Technology*. This manuscript, led by Karrie Weber, Associate Professor in UNL's School of Biological Sciences and Department of Earth and Atmospheric Sciences and Director of the Microbiology Program, synthesizes all the work from the 104G project.

Read the full study at »» go.unl.edu/683.

New Publication on Legacy Nitrogen, Arsenic, and Uranium in the Vadose Zone


A new study from a Nebraska Water Center research team discusses the relationship between legacy nitrogen and inputs on arsenic and uranium in the vadose zone. Titled "Interplay of legacy irrigation and nitrogen fertilizer inputs to spatial variability of arsenic and uranium within the deep vadose zone," this article was published in *Science of the Total Environment* and continues the work the research team has been conducting on the vadose zone in Nebraska.

Read the full study at »» go.unl.edu/5299.

USDA NIFA-funded Vadose Zone Study Targets Water Quality Concerns Due to Intensive Agriculture in Nebraska

Nebraska Water Center researchers are conducting a statewide study to investigate nitrogen biogeochemical transformation in the vadose zone—the portion of Earth above groundwater. To understand the anthropogenic effect on various nitrate transformation processes within the vadose zone, the researchers collected soil cores from a pristine native prairie area at Homestead National Historical Park. The study particularly aims to shed light on the complex interplay of factors influencing nitrogen transformation in the vadose zone, including the impact of fertilizer type and various irrigation practices.

To learn more, visit »» go.unl.edu/waterquality.



Improvements to crop models aid producers in on-farm decision making.

»» **NWC Researchers Make Advancements in Crop Modeling**

Under a federal cooperative agreement, two Nebraska Water Center researchers are assisting the USDA Agricultural Research Service to improve crop models for corn, soybean, cotton, rice, and potato.

As crop models are improved, producers can find more accurate data to aid their on-farm decision making. The team has been updating widely used crop simulation models to simulate photosynthesis, transpiration, and soil processes at more frequent time steps. The updates described in the new publications also allow for adaptation of the model based on climate change factors, including atmospheric CO₂ and changes in average temperature.

Read the full studies at »» go.unl.edu/modeling.

Two Agronomists Recruited for Next Generation Crop Modeling

The Nebraska Water Center is recruiting two agronomists to work with the Central Platte and Lower Loup NRDs to apply corn and soybean models for management decisions. With funding from the USDA-ARS Adaptive Cropping Systems Laboratory in Beltsville, MD, we are working together to link corn, soybean, potato, rice, and cotton growth models to soil and estimate yield as functions of nutrient, moisture, and temperature stresses. The models are being extended to estimate leaching losses of nutrients and greenhouse emissions as functions of management practices, fertilization, and water application. Field testing for corn, soybean, and potato occurred for the last two growing seasons.

Learn more at »» go.unl.edu/modeling.



Karina Schoengold became the NWC Associate Director in July.

»» Karina Schoengold Named Associate Director

The Nebraska Water Center recently named Karina Schoengold as its new associate director. In this role, Dr. Schoengold will assist the director in the administration of the Center as well as take a leadership role in coordinating multi-disciplinary grant proposals to federal/state agencies and private/non-profit donors. Dr. Schoengold will work directly with University of Nebraska faculty and staff to form teams of researchers with complementary expertise in developing large research and extension proposals to address some of the critical water problems of the state.

"One of my first priorities is to learn more about the broad range of work on water at the University of Nebraska so that I can use that knowledge to help create teams that can address relevant water issues," Schoengold said. "Decisions about water management and water policy typically have a human aspect, and one of my priorities is to include economics and other social sciences within teams to increase the impact that scientific research has on behavior, policy, and outcomes. In addition, for research to be relevant, it is important to include stakeholders such as the Natural Resources Districts and other water programs within the state in the process of defining priorities for water research."

The Associate Director position is a 20% appointment, and Dr. Schoengold will serve the other 80% of her appointment by continuing her role as a professor of Agricultural Economics.

Dr. Schoengold joined the Department of Agricultural Economics at the University of Nebraska-Lincoln in 2005. She has a Ph.D. from the University of California-Berkeley in Agricultural and Resource Economics (2005), and a B.S. from the University of Wisconsin-Madison in Economics and Mathematics (1998).

Her research program relates to a range of agri-environmental policy issues, with a significant focus on water and soil management. Specifically, she is interested in how individuals make decisions regarding the use of scarce and/or polluting inputs, and how policy design affects those decisions. Her research has been funded by a range of programs, including NSF, USDA-NIFA, USDA-ERS, USGS, and the Daugherty Water for Food Global Institute at the University of Nebraska.

Learn more at »» go.unl.edu/associatedirector.



Nebraska Water Conference attendees enjoyed field trips to sites in the Omaha area.

»» Nebraska Water Conference Considers Urban Water

The 2023 Nebraska Water Conference, “Managing water resources in urban Nebraska: learning from the past to prepare for the future,” brought together global researchers, engineers, and water professionals in October to discuss crucial water issues in Nebraska’s cities.

This conference featured expert panelists and speakers who discussed current natural resource challenges faced by Lincoln and Omaha while providing advice on the future of water management in eastern Nebraska.

Attendees had the opportunity to tailor their conference experience by attending a variety of breakout sessions and keynote speakers.

Some conference favorites included *Tools for Water Management I and II* which discussed well monitoring research, the Nebraska Clearinghouse database, the Eastern Nebraska Water Resources Assessment project and more. Attendees also enjoyed hearing an update about Lincoln’s Water 2.0 Project to find a second reliable water supply from Steve Owen, City of Lincoln.

On the second day of the Water Conference, attendees chose to attend one of four site tours that showed attendees different water projects, research, and management locations around Omaha.

The Nebraska Water Conference celebrates the continuous ingenuity of water research while fostering a deeper understanding of water and its many beneficial uses for the state. The future of water management in urban Nebraska is bright.

Videos of each session and other conference resources are available a visit »» watercenter.unl.edu/2023-nebraska-water-conference.



The Water and Natural Resources Tour Visits Northeast Nebraska

The Nebraska Water Center with Central Nebraska Public Power and Irrigation District hosted the 49th Annual Water Tour in June featuring discussions about water issues and projects in northeastern Nebraska.

The Tour included stops about riverfront development, nitrate and sedimentation issues, wildlife and fisheries efforts, demonstration farms, water-powered manufacturing processes, and more.

The Tour would not have been possible without our sponsors. Thank you to the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources, Daugherty Water for Food Global Institute, HDR Inc., JEO Consulting Group, Reinke Irrigation, Lower Elkhorn NRD and Upper Elkhorn NRD for sponsoring the 2023 Water and Natural Resources Tour.


Spring Seminar Series

The Nebraska Water Center, in partnership with the University of Nebraska-Lincoln's School of Natural Resources, held their annual Spring Water Seminar Series again this year. The 2023 Series highlighted hot topics in Nebraska Water. The 2023 seminars included:

- › February 1: Water quality and health by Dr. Eleanor Rogan, UNMC
- › February 15: Human health and climate by Dr. Jesse Bell, UNMC
- › March 1: The value of water quality by Dr. Harshanee Jayasekera, DWFJ
- › March 22: Social sciences panel by the National Drought Mitigation Center
- › April 5: USGS research portfolio on drinking water by Dr. Kelly Smalling, USGS
- › April 19: Contaminant fate, transport, and exposure by Dr. David Walters, USGS
- › May 3: Environmental chemistry assessment by Dr. Laura McConnell, Bayer Crop

Videos of the 2023 Spring Seminar Series are available at

»» go.unl.edu/waterseminar.



The Water Sciences Laboratory has specialized equipment for emerging contaminant testing.

»» **Water Sciences Laboratory Focuses on Water Quality, Student Development, and International Partnerships**

Water Sciences Laboratory works on PFAS research in Nebraska

The Water Sciences Laboratory is a leading facility for many advanced environmental testing methods and is always developing new methods to address new contaminants of concern. Recently, a group of contaminants known as “PFAS” has become a growing concern in Nebraska and across the country.

PFAS, or per- and polyfluoroalkyl substances, originate from fluorinated compounds, such as Teflon™ and were first developed in the 1930s for industrial and consumer goods. Because PFAS are resistant to heat, water, oil, and grease, they are useful in household products, paint, non-stick pans, fabrics, food packaging, fire-fighting foam, and more.

While PFAS are effective in many uses, there are also health concerns related to long-term exposure including altered immune systems, elevated cholesterol, hormone disruption, and kidney and testicular cancer. PFAS have been detected in crops, ground and surface water, aquatic wildlife, and even human tissues. Because PFAS are found in many materials people use daily, they are difficult to regulate as a contaminant.

“PFAS testing is hard because it’s in everything”, Water Sciences Lab Director Dan Snow shared. “Lab equipment, clothing, sample vials, and more. So, samples and equipment are easily contaminated.” Another challenge in PFAS testing is the detection limit. The relevant levels of PFAS and other emerging contaminants are in the parts per trillion and even part per quadrillion. The U.S. Environmental Protection Agency currently has a proposed limit of 4 ng/L (parts per trillion) of two forms of PFAS, PFOA and PFOS, in drinking water to avoid the health-related risks. They are also considering limits for several other PFAS compounds such as hexafluoropropylene oxide dimer acid, also known as “Gen-X.”

Highly sensitive equipment that is only used for PFAS testing is required. Through funding provided by multiple sources, including the Nebraska Research Initiative,



The Water Sciences Laboratory provides research support for water sciences in Nebraska and beyond.

Institute of Agriculture and Natural Resources, and the Daugherty Water for Food Global Institute (DWFI), the Water Sciences Lab was able to purchase and install specialized equipment that is only used for PFAS testing. Having equipment used only for PFAS testing is important to avoid cross-contamination and provide highly sensitive and accurate test results.

Double Diploma Degree Program

Faculty in the Department of Civil Engineering and the College of Agricultural Sciences and Natural Resources at the University of Nebraska are working with faculty at the Polytechnic Institute of Bragança (IPB) in Bragança, Portugal to develop “double diploma” master’s degree programs in environmental science and engineering. Shannon Bartelt-Hunt, Chair of the Civil and Environmental Engineering department and WSL Director Dan Snow, were part of a project awarded to Helder Gomes, chemical engineering and technology chair at IPB earlier this year through FLAD, the Luso American Development Fund. The FLAD program aims to advance US and Portuguese academic and research cooperation in science and engineering. The project “Strengthening Portuguese Research and Academic Water Sustainability Programmes”, endorsed by DWFI and the UNL College of Engineering, includes development of “double diploma” graduate programs and a pilot research project in Bragança using methods developed at the Water Sciences Laboratory. Graduate students from IPB and UNL are participating in the pilot project through exchange visits on both campuses.

Staff Updates

- › David Cassada has retired after 33 years at the Water Sciences Laboratory. Dave will remain in an on-call status to assist with the transition.
- › The Water Sciences Laboratory employed and trained 22 interns, was used by 32 graduate students, and assisted 8 visiting faculty and post-doc users.

To learn more, visit >>> watercenter.unl.edu/water-sciences-laboratory2.



Know Your Well engages students in their community's water quality.

»» Know Your Well Continued Education in 2023

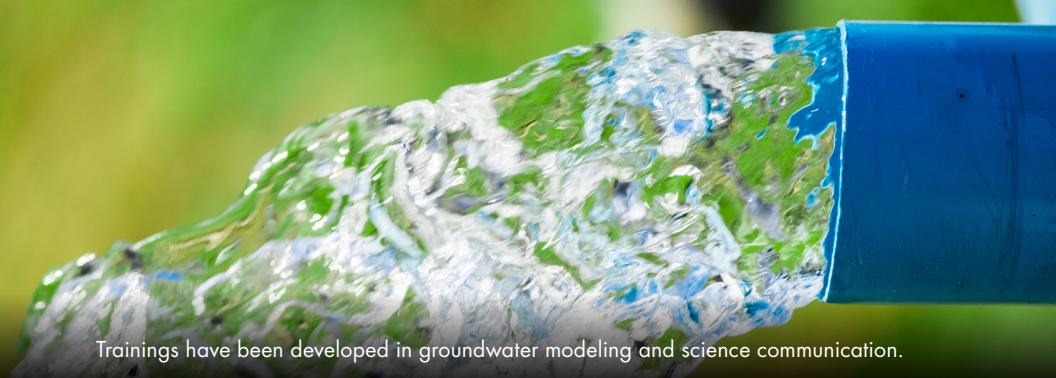
Started in 2016 with a grant from the Nebraska Environmental Trust to the University of Nebraska-Lincoln (UNL), Know Your Well emphasizes proper domestic well water sampling and encourages students to compare results from classroom test kits to standard laboratory testing at the UNL Water Sciences Laboratory. In its first two years, the project involved students and teachers from 23 schools across Nebraska who sampled almost 250 wells.

In 2023, Know Your Well received \$14,358.74 from the USGS 104b program to expand the program leadership to additional undergraduate institutions. This year, Know Your Well also received \$99,795 in EPA Environmental Education funding to develop classroom curriculum to help teachers become part of the growing Know Your Well network in high schools.

In the next two years, Know Your Well plans to recruit at least 50 schools and test over 1,000 domestic wells through shared leadership among partners across the state, including Nebraska NRDs working with schools in their area. By recruiting more NRD staff to participate, and in turn recruiting more schools who will use the curriculum made possible by the US EPA grant, Know Your Well is growing the network statewide and providing a sustainable program involving multiple organization and stakeholders.

For more information, visit »» knowyourwell.unl.edu.





Trainings have been developed in groundwater modeling and science communication.

»» **NWC Offers Professional Development Trainings**

In 2023, NWC staff and researchers developed trainings to provide professional development skills for Nebraskans. These trainings will continue in 2024.

Groundwater Modeling Training for Nebraska Natural Resources Districts

The Nebraska Water Center is partnering with the Nebraska Department of Natural Resources to provide trainings for Natural Resource District staff who want to learn more about groundwater modeling. Sorab Panday is leading these trainings. Sorab is a Research Professor in UNL's Biological Systems Engineering program, a modeling consultant for the Nebraska Department of Natural Resources, and the lead author of MODFLOW-USG, a groundwater modeling software released by the U.S. Geological Survey. He is a member of the National Academy of Engineering.

The training consists of two parts: basic modeling overview for those unfamiliar with MODFLOW and groundwater modeling, and a more in-depth modeling instruction for those who would like to make small changes to a groundwater model.

If you would like to participate in an upcoming workshop, contact Sorab Panday at
»» sorab.panday@unl.edu.

Science Communication Workshops

Increasing the adoption of sustainable agriculture innovations will require conservation professionals to not only understand and convey the technical aspects, but to understand how to best foster a communication environment that supports behavior change. NWC is offering training that will build participants' confidence and motivation to use social science tools in their programming. The training will increase participants' understanding of the basic social science and practical tools for reducing barriers for adopting sustainable agriculture practices.

Crystal Powers and Ann Briggs will be hosting applied and interactive workshops over the next two years. For more information, contact Crystal at
»» cpowers2@unl.edu.



Nebraska Water Center staff.

»» Nebraska Water Center Staff

Chittaranjan Ray, Ph.D., P.E., Director

Karina Schoengold, Ph.D., Associate Director

Rachael Herpel, Assistant Director

Ann Briggs, Public Relations and Engagement Coordinator

Craig Eiting, Web Developer and Graphic Design Specialist

Patricia Liedle, Program Assistant

Crystal Powers, Research and Extension Communication Specialist

Daniel Snow Ph.D., Water Sciences Laboratory Director

Contact Us

2021 Transformation Drive, Suite 3220

Lincoln, NE 68588-6204

402.472.3305

waterinfo@unl.edu





Our Impact

NWC was established by an act of Congress in 1964. Part of the Daugherty Water for Food Global Institute, we coordinate research and programs that support the University of Nebraska as an international leader in water research, teaching, extension and outreach.

Learn more >>> watercenter.unl.edu



UNIVERSITY OF
Nebraska
System



NebrWaterCenter



NebraskaWaterCenter

watercenter.unl.edu

The University of Nebraska does not discriminate based upon any protected status.
Please see nebraska.edu/nondiscrimination. ©2023 The University of Nebraska Board of Regents. All rights reserved.