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Fall 2014

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## MEET THE FACULTY

### Jenny Dauer, Ph.D.

Jenny Dauer is an assistant professor of practice in Science Literacy in the University of Nebraska-Lincoln's School of Natural Resources. Dauer has been with UNL just over a year.



Jenny Dauer

#### Education:

Ph.D., Biogeochemistry, Oregon State University, 2012  
M.S., Ecology, Penn State University, 2005  
B.S., Secondary Education (with honors), 2000

#### Examples of Current Research:

Dauer's research interests are in the area of Science Literacy and disciplinary-based science education research (DBER). She is interested in how students learn about science. In other

*continued on page 3*

## Nebraska Water Center Symposium and Water Law Conference: High Plains Aquifer: Sustainability for Food Production and Water Supply Coming in March

Steve Ress, Nebraska Water Center

Water use, sustainability and supply in the critical High Plains aquifer will be the theme for presentations and discussions at the Nebraska Water Center's annual water symposium and water law conference this coming March.

"High Plains Aquifer: Sustainability for Food Production and Water Supply" will be Thursday, March 19, 2015. The symposium will be followed by a one-day law conference on Friday, March 20, 2015. Both events will be held at the University of Nebraska College of Law on UNL's East Campus in Lincoln.

The symposium will feature the latest research, programming and policy on water in Nebraska and the Great Plains, this time focusing on current issues, challenges and solutions in sustainable use of the High Plains Aquifer.

The aquifer is one of the world's largest and most heavily utilized groundwater resources in the world. It underlies about 174,000 square miles of land in portions of South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico and Texas.

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## June Water Tour Heads to Republican River Basin

The 2015 Water and Natural Resources Tour will visit the Republican River basin in Nebraska, Kansas and Colorado.

June 23-25 have been selected as the dates for the annual tour that examines current water and natural resources issues that are important to water users in Nebraska and surrounding states.



*The Republican River in Nebraska (Steve Ress, Nebraska Water Center).*

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**Water for Food**  
ROBERT B. DAUGHERTY INSTITUTE  
NEBRASKA WATER CENTER  
*at the University of Nebraska*

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## From the Director

Chittaranjan Ray

# Travels, Activities, Collaborations and Research

On college campuses, summer is often a time where we have the luxury of switching gears and putting some time normally devoted to the classroom and laboratory into other endeavors. In the case of the Nebraska Water Center, that often means time to travel to build partnerships and collaborations and mutual understanding and to plan for upcoming fall events.

Since arriving in Nebraska, I have kept an early commitment to myself to spend time traveling to key University of Nebraska facilities outside of Lincoln to seek partnerships with faculty and staff that can be of immense mutual benefit.

Over the summer I was able to visit UNL's Panhandle Research and Extension Center in Scottsbluff and also the North Platte Natural Resource District where I presented key capabilities of the NWC and talked with faculty and staff at both locations about future partnerships.

I also presented key areas for mutual cooperation and funding to managers at the Tri-basin, Upper Big Blue, Lower Big Blue and Lower Platte North NRDs to discuss key water issues in each of those districts, where the challenges and opportunities are quite varied and often quite specific to a given area or basin. In some areas of the state, for example, there are clearly projects on vadose zone water

storage, nitrates in groundwater and the unsaturated zone, and uranium issues in water wells, where we can work more closely.

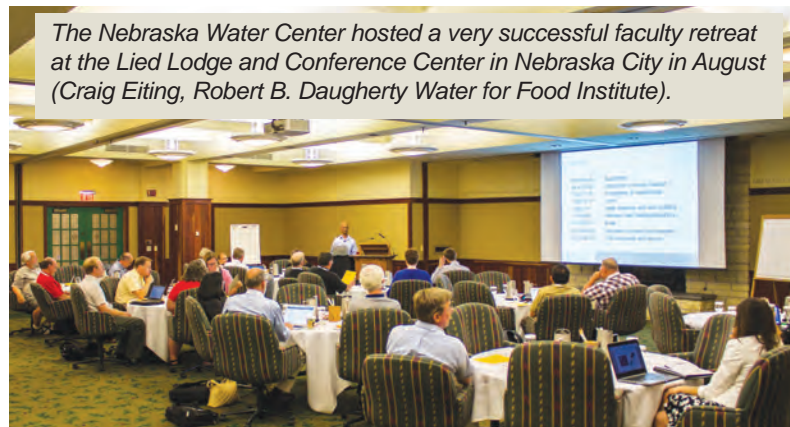
In this same vein, I also visited municipal water systems of Kearney, Grand Island, and Hastings for a better understanding of their systems and to find out what their key water issues are.

Among these, naturally occurring uranium in drinking water wells seems to be a major issue for small to mid-size cities and its link to nitrate in aquifers is being investigated.

Also as a result of these visits, we are working with the City of Hastings to develop a project to understand the fate of nitrate in the vadose zone and are investigating a number of possible funding sources to help with that work.

Additionally this summer, we partnered with Colorado State University; Oklahoma State University; the USDA-ARS in Ft. Collins, Colo.; and the U.S. Geological Survey's Nebraska Water Science Center to submit a proposal to USDA to examine the sustainability

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*The Nebraska Water Center hosted a very successful faculty retreat at the Lied Lodge and Conference Center in Nebraska City in August (Craig Eiting, Robert B. Daugherty Water for Food Institute).*

### Karen Hansen

**K**aren M. Hansen is the proposal development coordinator for the University of Nebraska's Robert B. Daugherty Water for Food Institute, part of NU's Institute of Agriculture and Natural Resources. She was previously associated with UNL as an extension educator from 1995-2000. Hansen began her new position with DWFI earlier this year. Her professional career has focused on engaging representatives of diverse agencies and organizations, decision-makers, and the public in community-based planning for protecting water quality and other natural resources. Her work has provided her with experience in generating grant proposals to obtain support for operating costs, environmental projects and programs, and assisting with research proposals. In her new position with DWFI, Hansen is looking forward to contributing to the important work of global water conservation and food security.

#### Education:

M.S., Forestry, Fisheries and Wildlife, University of Nebraska–Lincoln, 1992

B.S., Biology Comprehensive (biology and chemistry), Kearney State College, 1989



Karen M. Hansen

#### Examples of Past Extension Programs:

- Coordinated four grant-funded water quality projects
- Facilitated effective project coalitions of agency representatives, project sponsors and the public
- Provided technical assistance for the Omaha Audubon Society Heron Haven Wetland Restoration Project
- Coordinated a three-year series of stormwater management workshops for professionals
- Coordinated and presented at a two-day volunteer monitoring workshop for Middle school teachers

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### Jenny Dauer, Ph.D. *continued from page 1*

words, what is difficult about these topics and how do we teach them better? She uses educational research methods like interviews, written assessments and surveys to characterize student learning and then use these results to inform better teaching strategies. Right now I'm particularly interested in how undergraduate students view the role of science in socio-scientific issues related to food, energy, water and landscapes. How does their science knowledge play a role in creating a sound scientific argument? What is challenging for students as they attempt to link evidence to a claim? How do students use science in their everyday life?

#### Teaching:

Dauer teaches AGRI/NRES 103 Introduction to Agriculture and Natural Resources, where she recently took over from Jim Brandle as lead instructor. The course has new learning objectives (see below). One of the topics is the issue "should we restrict (or further restrict) the amount of water that we use for agriculture in Nebraska?" Students are learning science related to this issue, considering what personal values they possess about the issue, and using both to formulate an opinion about what we should do. She has been gathering information about Nebraska hydrology and water policy to use in the course and is looking forward to continuing to learn more over the years and connect with those who are doing research in this area on campus.

The objective of the course is for a student to be able to evaluate socioscientific issues that are relevant to agriculture and natural resources using issues in Nebraska as examples. As a result of the course a student will be able to:

1. Distinguish between questions that can be answered solely by scientific inquiry and socioscientific questions that include both science questions and factors of values, ethics, culture, economics and politics,
2. Identify and evaluate claims and evidence in media and journal articles including:
  - a. recognize what qualifies as scientific evidence and when evidence supports a claim
  - b. distinguish between types of sources; identify authority and reliability
  - c. identify strength and weaknesses in research design related to bias, sample size, randomization and experimental control
  - d. identify sources of uncertainty associated with claims and evidence,
3. Explain the science and arguments from scientific evidence surrounding socioscientific issues such as organic food, biofuels, mountain lions and water resources,
4. Ask a big question about a socioscientific issue related to agriculture and natural resources and use a scientific argument to support a position,
5. Recognize and respect the diversity of opinions on each socio-scientific issue, and be cognizant by what means they and others have attained their particular opinions /conclusions.

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## WRAP Hears Slate of Good News at September Meeting

Steve Ress, Nebraska Water Center

Members of the University of Nebraska's Water Resources Advisory Panel (WRAP) got a comprehensive and positive rundown on how water and natural resources programs, research funding and student enrollment are all "trending" at NU.

NU Vice President and Institute of Agriculture and Natural Resources Harlan Vice Chancellor Ronnie Green told panel members with pride that faculty and staff of the Daugherty Water for Food Institute and Nebraska Water Center (NWC) recently became charter residents of the newly opened Nebraska Innovation Campus (NIC) at the former state fairgrounds and that they will soon be followed by other IANR programs, including the Food Innovation Center.

Green said that IANR programming and advancements at NIC will fit well into expanding food, food processing, and sanitation and safety initiatives that will be good fits for both businesses and career-minded students.

He noted that several large clients are looking at NIC and that the facility has so far exceeded expectations in nearly every regard.

Green also told WRAP that IANR is on schedule in hiring the largest group of tenure-track faculty members in its 40-year history, completing strategically planned hiring phases that will result in more than 100 new faculty hires and filling of open positions since 2012.

Over the past year, IANR has experienced a seven percent increase in student enrollment resulting in a four-year enrollment high of more than 3,500 students in all IANR programs. IANR research expenditures have also topped \$80 million and are growing, he said.

Roberto Lenton, Founding Executive Director and Robert B. Daugherty Chair of the Robert B. Daugherty Water for Food Institute noted DWFI's and NWC's recent moves to NIC and said he was pleased that the program's faculty and staff are now in one place. He noted the recent hiring of economist Nick Brozovic as DWFI's Director of Policy and of Molly Nance as Director of Public Relations and Communications essentially has completed DWFI staffing for the immediate future.

Lenton told the group that Brozovic's extensive experience,

in particular, would be a perfect fit for Nebraska/international collaborations and interfaces as DWFI's missions advance.

He noted that DWFI's annual conference was moving out of Lincoln for the first time and was to be held in Seattle, Wash. Oct. 19-22.

He also said that DWFI is completing the last year of its first five-year funding increment (2010-2015) and had secured its second, five-year funding increment (2015-2020) from the Robert B. Daugherty Charitable Foundation.

A report from NWC Director Chittaranjan Ray noted a string of successful collaborations over the past few months, including the annual water and natural resources tour, visits to several of the state's

Natural Resource Districts and visits to key municipal water districts in Kearney, Grand Island and Hastings.

NWC is also partnering with Colorado State University, Oklahoma State University, the U.S. Geological Survey and the U.S. Department of Agriculture on a number of water supply and crop production research proposals.

Ray's report also noted that NWC hosted a very

successful and well-attended research retreat at the Lied Lodge in Nebraska City in August.

NWC's annual water symposium and water law conference will be held March 19 and 20 at the NU College of Law, he reported.

Monica Norby of UNL's Office of Research and Economic Development noted that the quality of the new faculty hires in IANR is impressive and will be key to developing the interdisciplinary teams that are so important to UNL's research success.

UNL's total research expenditures topped \$266 million in fiscal year 2013 and are on the rise in 2014, Norby said.

WRAP members toured facilities at the new NIC campus and heard faculty research presentations by Brozovic; NU Water Sciences Laboratory Director Dan Snow; Craig Allen, Leader of the Nebraska Cooperative Fish and Wildlife Research Unit; and hydrogeophysicist Trenton Franz of UNL's School of Natural Resources.

The WRAP, which meets three times annually, will next meet Jan. 22, 2015 from 1:30 to 4:30 p.m.



*Trenton Franz presents on soil water monitoring at the Sept. 25 Water Resources Advisory Panel meeting, held for the first time at Nebraska Innovation Campus (Steve Ress, Nebraska Water Center).*

# Kuzelka Receives Kremer Award

**R**obert D. Kuzelka, who has spent most of his professional life educating others about groundwater and natural resources, received The Groundwater Foundation's 2014 Maurice Kremer Groundwater Achievement Award.

Kuzelka accepted the award in early October at The Groundwater Foundation's National Forum in Las Vegas, Nevada. The Kremer Award was established in 1985 to recognize Nebraskans who have made a substantive contribution to the conservation and protection of Nebraska's groundwater.

"Bob has been a consistent advocate for good things in Nebraska. He has always been a supporter for common sense relating to groundwater problems and is richly deserving of the Kremer Award," said Kremer selection committee member and past Kremer award winner Jim Goeke.

Kuzelka is an Associate Professor Emeritus in the School of Natural Resources at the University of Nebraska–Lincoln. As a full-time faculty member from 1979 to 2004, he was affiliated with UNL's Conservation and Survey Division; Department of Community and Regional Planning; Department of Forestry, Fisheries and Wildlife; University of Nebraska Water Center; and School of Natural Resources.



Bob Kuzelka receives the Maurice Kremer Groundwater Achievement Award from The Groundwater Foundation President Jane Griffin.

From 2001 to 2008 he was director of UNL's interdisciplinary Environmental Studies program. Kuzelka has co-authored two state water policy issue studies, developed handbooks on groundwater management planning for quantity and quality, and served as co-editor of *The Groundwater Atlas of Nebraska* and *Nitrate Contamination/Exposure, Consequence, and Control*. During his time at CSD, he served as project manager and contributing author for *Flat Water: A History of Nebraska and its Water*.

But that's not where Kuzelka's contributions end. Kuzelka became involved with The Groundwater Foundation from almost the very beginning, believing wholeheartedly in the importance of educating people about groundwater. His biggest contribution to the foundation and to groundwater across the nation has been his role in the design, development, and implementation of the Groundwater Guardian program.

Groundwater Guardian is a program that provides support and encouragement for communities to begin groundwater awareness activities, motivation to continue these efforts, and recognition for their achievements.

"I am proud to say that I introduced Bob Kuzelka to Susan Seacrest. Through their efforts the Groundwater Guardian program came into being and became the great success that it is today," Goeke said.

A selection committee appointed by The Groundwater Foundation Board of Directors chooses the Kremer Award. Members include: Goeke, University of Nebraska; Jane Griffin, President of The Groundwater Foundation; and Don Kraus, Central Nebraska Public Power and Irrigation District.

## Past Kremer Award Recipients

**1986:** Vincent Dreeszen; **1987:** Maurice Kremer; **1988:** Eugene Reed; **1989:** Val Kuska; **1990:** Warren Fairchild; **1991:** Ralph Marlette; **1992:** Ted Filipi; **1993:** Robert B. Crosby; **1994:** Virginia Smith; **1995:** Fred Salmon and Family; **1996:** Frank A. Smith; **1997:** Robert B. Daugherty; **1998:** Les Sheffield; **1999:** Richard Harnsberger; **2000:** Wayne Madsen; **2001:** Jim Goeke; **2002:** Eugene Haarberg; **2003:** Chris Beutler; **2004:** Darrell Watts; **2005:** Roger Patterson; **2006:** Senator Ed Schrock; **2007:** Jim Cook; **2008:** Ann Bleed; **2009:** Vance Anderson; **2010:** Mike Jess; **2011:** Lee Orton; **2012:** Dayle Williamson; **2013:** Ron Bishop

## Nance Joins DWFI as Director of Communications and Public Relations

Molly Nance recently joined the faculty and staff of the Robert B. Daugherty Water for Food Institute (DWFI) as their director of communications and public relations.

Nance, who joined DWFI staff in September, has 25 years experience in marketing communications, strategic planning, advertising, public relations and event management. Most recently she was director of strategic planning and marketing for Lincoln's Madonna Rehabilitation Hospital, one of the nation's largest independent rehabilitation facilities. There she managed the marketing planning and implementation for all hospital business lines. During her tenure at Madonna, Nance launched a rebranding campaign, produced an annual awards event, created a documentary video, as well as numerous patient interview videos, implemented ad campaigns, developed a social media policy and supported rehabilitation advocacy efforts at the state and federal efforts.

Prior to her work at Madonna, Nance was director of communications for the Nebraska Hospital Association, communications manager for U.S. Central Credit Union in Overland Park, Kansas, and served as a marketing officer for two Nebraska banks.

At DWFI, Nance is responsible for expanding the awareness of the institute as a leader in water and food sector research and policy development throughout the state, across the country and around the world.

"I am delighted to join the exceptional staff of the Daugherty Water for Food Institute and Nebraska Water Center," she said. "I look forward to sharing my marketing communications experience to help raise awareness of the Institute across the state, nation and around the world. We are very fortunate to have this network of expertise at the University of Nebraska to help develop new strategies for water and food sustainability in the years to come."

Nance earned a master of liberal arts degree from Baker University in Kansas and has a bachelor of journalism degree from UNL. She is a certified professional marketer and serves on the board of the Mary Riepma Ross Media Arts Center. She is a past chair and board member of several local philanthropic and civic organizations.



Molly C. Nance

## New Staff Join Daugherty Water for Food Institute

### Dana Ludvik, Robert B. Daugherty Water for Food Institute

#### Karen Hansen, Proposal Development Coordinator

Karen Hansen will work with faculty, administrators and staff, as well as extramural partners, to coordinate the development of competitive external grant proposals, including the development of multidisciplinary and multi-institutional proposals. Her responsibilities will include identifying potential funding opportunities and managing the proposal development process. As needed, she will organize writing and development teams, communicate with funding agency officials, arrange expert external reviews and assist in securing institutional support.

Hansen's professional career has focused on engaging representatives of diverse agencies and organizations, decision-makers and the public in community-based planning for protecting water quality and other natural resources. Her work has provided her with experience in generating grant proposals to obtain support for operating costs, environmental projects and programs and assisting with research proposals. She is very pleased to be part of the team at the Institute, and looks forward to contributing to the important work of global water conservation and food security.

Hansen has an M.S. in forestry, fisheries and wildlife from UNL and a B.S. in biology from UNK.

Email Hansen at [khansen@nebraska.edu](mailto:khansen@nebraska.edu).

#### Richael Young, Program Associate

Richael Young will help strengthen DWFI's collaborations and capacity building with overseas partners and international organizations. She'll work to identify key needs related to water management and entrepreneurship around water use for food in an international setting.

For example, Young is leading the Institute's creation of a professional development program for water resource managers and stakeholders in developing nations. The program aims to address stated needs for technical and policy analysis and for effective scientific communication by decision-makers and applied researchers.

Richael has an M.S. in agricultural and applied economics and a B.S. in civil and environmental engineering, both from the University of Illinois.

Email Richael at [ryoung@nebraska.edu](mailto:ryoung@nebraska.edu).



Richael Young

# Researchers Probe Climate's Impact on Groundwater Quality

Gillian Klucas, UNL Office of Research and Economic Development

Climate change and increasing food production demands both influence groundwater quality. To better understand the links between climate, agriculture and groundwater, UNL researchers will investigate climate's impact on groundwater contamination from chemicals used in crop and animal production.

The team received a \$600,000 Water Sustainability and Climate Program grant from a joint National Science Foundation-U.S. Department of Agriculture program that takes an interdisciplinary approach to understand and predict climate change-water system interactions. UNL's team includes faculty with expertise in engineering, economics, water science, and community and regional planning.

"We were surprised at how little information there is about how climate will impact groundwater quality," said project leader Shannon Bartelt-Hunt, UNL associate professor of civil engineering based at the Peter Kiewit Institute in Omaha. "Groundwater is used as a drinking water source and for irrigation so it's an important resource."



A UNL team is studying how climate and agricultural changes influence groundwater quality. From left: Yusong Li, civil engineering; Zhenghong Tang, community and regional planning; Shannon Bartelt-Hunt, civil engineering; Xu Li, civil engineering; Dan Snow, Nebraska Water Center; and Eric Thompson, economics. Not pictured is David Rosenbaum, economics (Craig Chandler, University Communications).

The team will study climate's direct and indirect effects on atrazine, a widely used crop herbicide, as well as the antibiotic

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## Dating Drought in Nebraska's Sandhills

Ariana Brocious, NET News / Platte Basin Timelapse

The Plains have experienced prolonged, and in some places severe, drought during the last several years. But could drought ever make Nebraska's Sandhills resemble the Sahara? Yes — and it has, several times before.

The Sandhills are a lush and complex grassland ecosystem sitting atop the massive Ogallala aquifer, supporting many cattle ranches and species of wildlife. So it's quite a contrast to visit the research sites of David Wedin, an ecology professor at the University of Nebraska—Lincoln. On a warm summer day, Wedin lead the way to one circular plot he's put through what he calls the "death and destruction" treatment, killed once every three years.

"We actually herbicide it with Roundup, glyphosate," Wedin said. "So we're simulating a severe disturbance of some kind."

Wedin's *Grassland Destabilization Experiment* has been going on for about a decade on university property in north-central Nebraska. Several test plots hold only patchy vegetation and lots of bare sand. In

addition to herbicides, he's used an agricultural disk to scrape off the grass in some places.

"We're trying to understand what happens when the system goes past its point of resilience and loses its stability, and kinda how the Sandhills falls apart," Wedin said. "What happens ecologically in that process."

Though surprised by the resilience of the grasslands, after the fourth and fifth winters, some of the patches did start to move, "and then it just went exponential on us. We went from an inch or two and before you knew it we were losing four to five inches on average, per month," Wedin said. (Photo by Ariana Brocious, NET News/Platte Basin Timelapse)

During the last 10,000 years, data point to four periods of "mega-drought"—one lasting nearly 3,000 years. That drought, possibly exacerbated by strong winds, wiped out vegetation across the

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## From the Director *continued from page 2*



*Taking notes as Bruce Dvorak, former interim director of the Nebraska Water Center, speaks at the August faculty retreat in Nebraska City (Jesse Starita, Robert B. Daugherty Water for Food Institute).*

of the High Plains/Ogallala Aquifer for crop production and water supply over north-south and east-west gradients.

Closer to home, we hosted a very successful faculty research retreat at the Lied Lodge and Conference Center in Nebr. City in August to identify some key thrust areas for research for which federal and local funding may be available. At the one-day event, faculty presented their expertise and research activities. There were about 40 in attendance and we think the day's activities could result in up to a half-dozen joint research proposals being written over the coming year. The day was so successful and productive, in fact, that we are determined to keep it as an annual event.



*Dan Snow, director of the Nebraska Water Sciences Laboratory (center) hosted visitors from Perm National Research Polytechnic University in Russia in early October. Visiting were Anna Novikova, head of foreign student exchange and professor of English; Elena Alikina, head of the Department of Foreign Languages, Linguistics and Translation; and Mokhov Victor, dean of the Faculty of Humanities (Steve Ress, Nebraska Water Center).*

At our Nebraska Water Sciences Laboratory, director Dan Snow was invited to present methods and research supported on cyanotoxins in Nebraska lakes at a U.S. Environmental Protection Agency-sponsored forum on contaminants in fish in Reston, Va. He and our long-time colleague Alan Kolok at the University of Nebraska, Omaha and University of Nebraska Medical Center also spent two weeks teaching environmental chemistry, water quality and toxicology at Al-Farabi Kazkh National University in Kazakhstan as part of a flourishing and ongoing partnership.

Dan and Alan also prepared a grant proposal through Prof. Bolat Uralbekov at that university, to the Kazakh Ministry of Education and Science. That proposal will

expand on work the two of them plan to do through 2015 on an NSF-funded workshop/pilot study on pesticide occurrence and ecological effects in the Syr Darya River basin in Kazakhstan.

Dan was also invited to become a collaborator on a proposal to the International Science and Technology Center from Al-Farabi KazNU investigating risks associated with high level tritium contamination that was deposited in the region by nuclear weapons testing that was conducted there for many years during the days when Kazakhstan was part of the former Soviet Union.

Further student exchanges between UNL and Al-Farabi KazNU are likely to occur early next year, also.

In early October, Dan and his staff at the lab hosted visitors from Perm National Research Polytechnic University, Perm, Russia. Visiting us from Perm were Anna Novikova, head of foreign student exchange and professor of English; Elena Alikina, head of the Department of Foreign Languages, Linguistics and Translation; and Mokhov Victor, dean of the Faculty of Humanities. They were looking at possible student exchanges, or opportunities to send Perm students to various University of Nebraska departments.

Late in the summer, we hosted a number of visitors from South Korea, which included city officials and agricultural producers, all of whom were interested in filtration systems for drinking water production. Because of this interest, we spent a day looking at Lincoln City Water well fields and wells near Ashland.

Also since the last Water Current went to press, we completed a very important five-year review of the Nebraska Water Sciences Laboratory. The review was extremely positive and also yielded some recommendations on how to make the lab more efficient in its core support for NU faculty. We are currently reviewing those recommendations.

Earlier this fall a request for proposals under U.S. Geological Survey Section 104b funds went out from the water center. Proposals addressing water resources priority issues in Nebraska were solicited. Start dates for projects is March 1, 2015, for a one-year period ending Feb. 28, 2016.



*Nebraska Water Center director Chittaranjan Ray (right) toured, with a delegation from South Korea to area points of interest, including the City of Lincoln's well fields near Ashland.*

Proposals will be reviewed by an advisory board and suggested reviewers and those chosen to receive funding will be contacted by November 18th to move forward with the USGS full proposal process. Full proposals will be due December 19. We will keep you apprised on how this process develops for our submitting researchers.

Coming up this spring, water use, sustainability and supply in the critical High Plains aquifer will be the theme for presentations and discussions at the Nebraska Water Center's annual water symposium and water law conference.

"High Plains Aquifer: Sustainability for Food Production and Water Supply" will be Thursday, March 19, 2015. The symposium will be followed by a one-day law conference on Friday, March 20, 2015. Both events will be held at the University of Nebraska College of Law on UNL's East Campus in Lincoln.

We are currently soliciting speakers and as details and registration information comes into focus, we will post updates online at [watercenter.unl.edu](http://watercenter.unl.edu)

Discussions on the 2015 Water and Natural Resources Tour, this coming summer, have begun and the tour organizing committee is looking at a number of fairly diverse locations and topics to present over several days in June.

As soon as we have some of the details nailed-down, we will post information online.

Likewise, we are in the midst of planning our spring semester water seminar series with our colleagues at the UNL School of Natural Resources. We will present at least seven public lectures on pertinent water issues between Jan. 14 and April 22. Each of the lectures is free and open to the public. They will be held at the normal time and

location, 3:30 p.m. on Wednesday in the first floor auditorium at Hardin Hall on the UNL East Campus. Speakers and dates will be online and on our Facebook page as soon as we have them confirmed.

Most of you are aware that the water center and our fellow faculty and staff at the Robert B. Daugherty Water for Food Institute became charter residents of UNL's new Nebraska Innovation Campus on the site of the former Nebraska State Fairgrounds in September. For the first time, we and DWFI faculty and staff are in one location and the new facilities are simply marvelous. If you are in the area, please visit us for a tour of the offices. We are now located at 2021 Transformation Drive, Suite 3220. Look for the former State Fair 4-H exhibit hall and we are in the new three-story building attached to it.

Finally, our communicator, Steve Ress, had a very successful and at the same time very challenging Husker Harvest Days week in mid-September. Steve has coordinated IANR facilities and UNL Extension exhibits at the show since 2008 and started exhibiting there for the water center in 1997, but in all those years, the show had never had to close-up for an entire day for inclement weather.

This year, torrential rains forced the show to close on Wednesday, traditionally the peak day of the three-day event. The silver lining to this was that the IANR exhibit building stayed nice and dry throughout, and that, coupled with an array of high tech research and extension exhibits, kept the overall level of visitors close to normal over the two days the show was open. Steve has already forgotten about the liquid mud at the show and is busy planning for next year's exhibits.

Best wishes to all of you over the coming holiday season. For updates on upcoming events, be sure to keep watch on [watercenter.unl.edu](http://watercenter.unl.edu) and at [facebook.com/NebraskaWaterCenter](https://facebook.com/NebraskaWaterCenter).

# Water Center Advances Programming and Accomplishments Markedly in 1990's, Moves Boldly Into the 21<sup>st</sup> Century

Karen Stork and Steve Ress, Nebraska Water Center

## End of the Century

In 1990, Dr. Bob G. Volk succeeded Dr. Roger Gold as director of the Water Center. Volk was formerly chair of the Department of Agronomy at the University of Missouri and had just finished a one-year appointment with the Cooperative State Research Service, Washington, D.C.

During his tenure at the University of Nebraska–Lincoln, Nebraska Research Initiative (NRI) funding continued to increase. NRI began as a five-year funding initiative under Governor Kay Orr the year before Volk came to Nebraska and focused on specific research areas. One of these was developing and inviting collaboration between industry scientists and university researchers.

One project NRI funded for 10 years, which was coordinated by the Water Center was Water Science. Primary objectives of this program were: 1.) Developing a Water Science Research Facility/Laboratory, including equipment and technical personnel; 2.) Providing matching or seed monies and assistantship support to faculty; 3.) Strengthening water science research capability through new faculty hires; and 4.) Purchasing scientific and support equipment to facilitate water sciences research.

Also due to increasing NRI funding was the opening of the Water Science Research Facility (WSRF) in 1990 under founding director Dr. Roy Spalding. Staff included a field manager, sampling coordinator, laboratory manager, and separations chemist. The new facility was to provide state-of-the-art laboratories and equipment to all faculty to support environmental and water-related research at UNL. The WSRF (today the Nebraska Water Sciences Laboratory) operated out of the former Wildlife Laboratory Building, adjacent to the Water Center, on UNL's East Campus. The lab remains at that location, nearly 25 years later, now under the direction of Dr. Dan Snow, who started work with the lab when it initially opened as a staff chemist.

NRI also led to hiring additional faculty with teaching appointments in the Departments of Geosciences, Entomology, Biological Sciences, School of Natural Resources and the Eppley Institute for Cancer Research and Allied Diseases at the University of Nebraska Medical Center, Omaha.

Under the Water Science portion of the initiative, additional faculty hires included: Tyler Kokjohn, aquatic microbiologist in the School of Biological Sciences; Steve Comfort, environmental soil chemist in the Department of Agronomy; and Michael Corbett, agrochemical toxicologist at the Eppley Institute.

Faculty in other UNL departments receiving direct salary support from NRI at that time included: Kyle Hoagland, Department of Forestry, Fisheries and Wildlife; Blair Siegfried, Department of

Entomology; Vitaly Zlotnik, Department of Geosciences; and Spalding, Department of Agronomy.

When Volk left UNL in 1999, after nearly 10 years as Water Center director, Dr. Edward F. Vitzthum, who was coordinator of Environmental Programs within the Water Center, was appointed interim director of the combined Water Center/Environmental Programs.

## The New Millennium

In 2000, Dr. Kyle D. Hoagland was named director of the UNL Water Center. J. Michael Jess served as acting director for two years, from 2000 – 2003, while Hoagland was acting director of the UNL's then fledgling School of Natural Resources Sciences (now School of Natural Resources, or SNR). In 2003, the Water Center again changed its administrative home, becoming part of SNR.

SNR combined UNL's School of Natural Resources Sciences (created five years previously from formerly independent departments including Meteorology and Forestry, Fisheries and Wildlife), Conservation and Survey Division and the Water Center.

In July 2006, most SNR units moved into the newly renovated Hardin Hall (formerly the Clifford Hardin Center for Continuing Education, built in 1960) at North 33<sup>rd</sup> and Holdrege Sts. at the southwest corner of UNL's East Campus.

In 2000, NU's Board of Regents began a process of targeting the highest priority programs on each of NU's four campuses. They established a program of excellence (POE) grant fund two years later and the resulting Water Resources Research Initiative (WRRI) became one of 11 POEs so funded.

WRRI was a multidisciplinary and interdisciplinary collaborative effort, coordinated by the Water Center and the Department of Geosciences. It promoted greater collaboration among researchers and disciplinary areas, coalesced efforts around key water issues facing the state, and created synergy needed to support large-scale externally funded research. WRRI also provided federal funds to hire faculty and researchers to fill key gaps in water-related research areas. Eleven new faculty positions were eventually funded by these POE funds.

One collaboration that grew from these POE funds is the ongoing one between the Water Center, the NU College of Law, and other departments, in sponsoring an annual Water Law, Policy and Science Conference since 2004 (a continuation of former annual Nebraska Water Conferences).

In 2006, the Water Center reactivated its long dormant advisory board, under the name of the Water Resources Advisory Panel. WRAP was appointed by the UNL Vice Chancellor for Research to share thoughts and opinions on water resources issues facing Nebraska The

goal of the panel is to guide UNL as it continues to invest in water research, education and outreach efforts.

The group meets three times annually and its current members, who serve one-to-three-year staggered terms, are:

- **Frank Albrecht**, Environmental Services, Nebraska Game and Parks Commission
- **Brian Barel**s, Water Resources Manager, Nebraska Public Power District
- **Mark Brohman**, Executive Director, Nebraska Environmental Trust
- **Senator Ken Schilz**, District 47, Agriculture Committee Chair, Nebraska Legislature
- **Eugene Glock**, Cedar Bell Farms
- **Jerry Kenny**, Executive Director, Platte River Recovery and Implementation Program
- **Marian Langan**, Director, Audubon Nebraska
- **Senator Tom Carlson**, District 38, Natural Resources Committee Chair, Nebraska Legislature
- **Pat Rice**, Interim Director, Nebraska Department of Environmental Quality

- **Jerry Obrist**, Chief Engineer, City of Lincoln Water System (retired)
- **Lee Orton**, Executive Director, Nebraska Well Drillers Association
- **Jay Rempe**, Director of State Governmental Relations, Nebraska Farm Bureau Federation
- **Lyndon Vogt**, General Manager, Central Platte Natural Resources District
- **Dayle Williamson**, Office of Senator Ben Nelson (retired)

In September 2009, Hoagland stepped-down as director of the Water Center, after nine years in the position, making him one of the longest serving directors in the Water Center's history. Bruce Dvorak, then chair of the UNL Department of Civil Engineering, was appointed as interim director of the center, seeing the NWC through a transition into becoming part of the new Robert B. Daugherty Water for Food Institute, or DWFI.

DWFI, was founded in 2010 to address global challenges of achieving food security with less pressure on water resources through improved management of water in agricultural and food systems. It is committed to ensuring a water and food secure world without compromising the use of water for other human and environmental needs.

continued on page 14

## Water Quality-Related Extension Publications

### Patrick J. Shea, Ph.D., UNL School of Natural Resources

Bernards, M.L., R.E. Gaussoin, R.N. Klein, S.Z. Knezevic, D.J. Lyon, L.D. Sandell, R.G. Wilson, P.J. Shea, and C.L. Ogg. 2008, 2009, 2010, 2011. *Guide for Weed Management in Nebraska*. (P. Shea responsible for "Environmental Considerations When Applying Herbicides" section) EC130, Univ. Nebraska-Lincoln.

Bernards, M.L., P.J. Shea, M. Milner, and T.G. Franti. 2010. *Reducing Off-Site Movement of Pesticides*. 2010 Crop Protection Clinic Proceedings, Univ. Nebraska-Lincoln.

Comfort, S.D., P.J. Shea, and F.W. Roeth. 1994. Understanding Pesticides and Water Quality in Nebraska. *EC94-135*, Univ. of Nebraska-Lincoln. 16 p.

Devlin, D. et al. (P.J. Shea). 2008. *Pesticide Management Water Quality Protection in the Midwest* "Pesticide Behavior and Movement in a Landscape." Heartland Regional Water Coordination Initiative. Kansas State University, Manhattan, KS.

Jhala, A., R.N. Klein, S.Z. Knezevic, G.R. Kruger, Z. J. Reicher, L.D. Sandell, S.L. Young, R.G. Wilson, P.J. Shea, and C.L. Ogg. 2012, 2013. *Guide for Weed Management in Nebraska with Insecticide and Fungicide Information*. (P. Shea responsible for "Environmental Considerations When Applying Herbicides" section) EC130, Univ. Nebraska-Lincoln.

Klein, R.N., M.L. Bernards, and P.J. Shea. 2008. *A Quick Test for Herbicide Carry-Over in the Soil*. NebGuide G1891, Univ. Nebraska-Lincoln.

Kuzila, M.S., N.B. Stolpe, A.R. Martin, F.W. Roeth, P.J. Shea, and S.D. Comfort. 1996, 2002. Pesticides and groundwater: An applicator's map and guide to prevent groundwater contamination. *Land Use Maps, Cons. Survey Div.*, University of Nebraska-Lincoln.

Martin, A.R., et al. (P.J. Shea). 2002, 2004, 2005, 2006, 2007. *Guide for Weed Management in Nebraska*. (P. Shea responsible for "Environmental Considerations When Applying Herbicides" section) EC130, Univ. Nebraska-Lincoln.

McNamara, J., D. Holshouser, T. Peterson, P. Shea, S. Comfort, L. Schulze, and M. Kuzila. 1996. Decision aid for selected herbicides in corn, sorghum, soybeans and wheat. *EC96-145-S*.

Shea, P.J., L.N. Mielke, and W.D. Nettleton. 1992. Estimation of relative pesticide leaching in Nebraska soils. *Research Bulletin* 313-D, Univ. of Nebraska-Lincoln. 37 p.

Wortmann, C.S. et al. (P.J. Shea). 2008. *Targeting of Watershed Management Practices for Water Quality Protection*. Heartland Regional Water Coordination Initiative. Univ. NE-Lincoln.

## UNL Report Outlines Impact of Climate Change in Nebraska

The scientific debate over whether human activities are the principal cause of climate change is over, a new report from the University of Nebraska–Lincoln says. The only debate to be had now is “precisely how these changes will play out and what actions we will need to take to adapt to and mitigate the effects of these changes.”

The report, titled *Understanding and Assessing Climate Change: Implications for Nebraska*, is being released this week. It will be available late Thursday afternoon at <http://snr.unl.edu>.



Don Wilhite

Don Wilhite, founder of the National Drought Mitigation Center, said the report was prepared by reviewing the scientific literature on the subject and interpreting scientists' current understanding of the science of climate change and its implications for Nebraska.

For all of the ongoing political debate over climate change, the science is clear, and is the subject of “overwhelming consensus” among scientists,

the report says in its executive summary.

“The body of scientific evidence confirms with a high degree of certainty that human activities in the form of increased concentrations of greenhouse gases (GHGs) since the beginning of the Industrial Revolution, changes in land use, and other factors are the primary cause for the warming that the planet has experienced, especially in recent decades,” the report says.

The report says the projected climate changes are of “vital concern” and calls for strategies to adapt to the climate changes now underway.

The report summarizes scientific research on climate change, noting that changes in climate have occurred throughout the planet's history but more accurate observations since the 1970s documented these changes and the role increasing concentrations of greenhouse gases and aerosols have played in the changes detected.

In its latest assessment report, the Intergovernmental Panel on Climate Change now states with 95 percent confidence that human influence is the main cause of the observed warming in the atmosphere and oceans. It is projected that the continued emissions of GHGs will cause further warming and changes in these components of the climate system.

Changes noted globally are reflected in Nebraska, which has experienced an overall warming of about 1°F since 1895, the report says. When this is separated into daytime highs and nighttime lows, the trend in low temperatures is greater than the trend in high temperatures, both of which show an overall warming. These trends are consistent with the changes experienced across the Plains states in general, which show a warming that is highest in winter and spring and a greater warming for the nighttime lows than for daytime highs.

By far, the majority of this warming has occurred during the winter months, with minimum temperatures rising 2.0-4.0°F per century and maximum temperature increases of 1.0-2.5°F per century. Summer minimum temperatures have shown an increase of 0.5-1.0°F per century at most locations, but maximum temperature trends generally range from -0.5 to +0.5°F per century.

Unlike temperature, however, there is no discernable trend in mean annual precipitation in Nebraska. Since 1895, the length of the frost-free season has increased by 5 to 25 days across Nebraska, and on average statewide by more than one week. The length of the frost-free season will continue to increase in future decades, the report says.

Projected temperature changes for Nebraska range from an increase of 4-5 degrees F (low emission scenarios) to 8-9 degrees F (high emission scenarios) by the last quarter of the 21st century (2071-2099). The reason for the projected range in temperature increases is largely due to the uncertainty associated with future emissions of GHGs. If climate change continues on its current path, the changes will likely be in the 8-9 degrees F range.

Whichever scenario plays out, the number of 100-degree-plus days is projected to increase significantly in Nebraska and the Great Plains. By mid-century, the increase in Nebraska would equate to summer temperatures equivalent to those experienced during the 2012 drought and heat wave. The number of warm nights — those with the temperature remaining above 80 in the southern Plains and above 60 in the northern Plains — will rise dramatically.

In Nebraska, the number of those warm nights is expected to increase by 20-25 for the low emissions scenario and 25-40 for the high emissions scenario.

As for precipitation, current trends for increases in the northern Plains are likely to become more pronounced, while the southern Plains will continue to become drier. Little change in precipitation in winter and spring is expected in Nebraska, while any summer and fall increases will be minimal. It is likely that drought frequency and severity would increase in Nebraska, the report says.

Current and continued projected reduction in snowpack in the central and northern Rocky Mountains will continue to affect Nebraska in reduced flows in the Platte and Missouri rivers.

Changes in temperatures in Nebraska as elsewhere will benefit some and harm others, the report says. “However, the changes in climate currently being observed extend well beyond temperature and include changes in precipitation amounts, seasonal distribution, intensity, and form (snow versus rain). Changes in the observed frequency and intensity of extreme events are of serious concern today and for the future because of the economic, social and environmental costs associated with responding to, recovering from, and preparing for these extreme events in the near and longer term.”

Wilhite said report authors invited experts from key sectors in Nebraska to prepare commentaries about the implications of current

and projected changes in climate on their sectors. These commentaries — from interests in water resources, energy supply and use, agriculture, forestry, human health, ecosystems, urban systems, infrastructure and rural communities — “raise serious concerns about how the projected changes in climate will impact Nebraska, and they provide a starting point for discussions about the actions that we should take to

adapt to the changes in each sector.”

These specific sectors all have a role to play in responding to climate change, the report says.

“Early adapters will be better able to cope with changes as they occur. ... Action now is preferable and more cost-effective than reaction later,” the executive summary concludes.

## Researching Climate Impacts *continued from page 7*

sulfamethazine and artificial hormone estrone, both used in animal production. Atrazine is applied directly to fields, while the other two are applied through manures used as a fertilizer.

All three organic compounds can contaminate groundwater by mixing with rainwater as it percolates through the soil. The team will investigate how different climatic conditions affect the compounds’ behavior and the characteristics of the infiltration process.

To study climate’s indirect effects, they’ll develop economic models to understand how predicted climate changes will affect land uses.

“We expect that climate change, in addition to directly affecting the environment, will also directly affect human behavior, in particular human decisions about land use,” said UNL economist Eric Thompson. “Those changes in human behavior will then also change water quality.”

Researchers expect that decreasing water availability in the southern Plains will concentrate crop and animal production farther north, including in Nebraska, intensifying the use of these compounds. This ultimately could hurt groundwater quality.

“We hypothesize that those land use changes will have a

greater impact than any direct effects of climate,” Bartelt-Hunt said. “Hopefully, at the end, we’ll have information specific to Nebraska, but we’ll also have a model linking economic and hydrological components that can be used to evaluate climate and land use changes on subsurface hydrology in other geographic areas.”

They’ll also look at the economic ramifications of increased amounts of these compounds in the environment, particularly if the compounds become regulated in the future due to health concerns. The additional costs of regulation may also alter land use.

The project is highly collaborative, bringing together UNL researchers from engineering, earth and atmospheric sciences, economics, hydrology, and community and regional planning.

“Getting all of those viewpoints focused on a single topic is really beneficial because it allows us to look at the question from a lot of different angles than one group could do themselves,” she said. “But it’s also a challenge because you have to learn how to speak a different research language.”

The team also plans to work with the Groundwater Foundation, a national organization committed to groundwater conservation, to provide public educational material about climate change effects on groundwater.

## NWC Spring Conference *continued from page 1*

In Nebraska, where the aquifer has its greatest amount of saturated thickness, the water is particularly important since the state consistently ranks at or near the top in number of irrigated cropping acres.

“Nebraska always ranks among the most irrigated states in the nation, so sustainability and best use of High Plains water are central to our state’s agricultural economy, public use, growth and overall well-being. Sustaining the aquifer for continued future use is the key,” said Chittaranjan Ray, director of the Nebraska Water Center, part of the Robert B. Daugherty Water for Food Institute at the University of Nebraska.

Conference topics currently being explored include the geology and hydrology of the High Plains/Ogallala System, current modeling studies of the aquifer by scientists at the U.S. Geological Survey and variability in water availability in the aquifer, Ray said.

Organizers are also looking at presentations on managing water for Nebraska farmers from a number of different perspectives and critical issues of aquifer use in the Texas portion of the system.

Also, drought and climate change effects on the aquifer in recent years, informed management strategies for irrigation use, Natural Resource District leadership and assistance in best management practices and how to adapt advanced technology and research practices to help ensure long-term sustainment.

Panel discussions and poster sessions will be part of the conference mix.

The one-day symposium will be followed by a one-day water law conference, also at the NU College of Law, on Friday, March 20. The law conference is designed to present the latest on Nebraska water law for practicing attorneys, but will be valuable to a wide range of water professionals and is open to all.

More details, including registration information, will be online at [watercenter.unl.edu](http://watercenter.unl.edu) as they become available.

The back-to-back events are being sponsored by the Nebraska Water Center, Robert B. Daugherty Water for Food Institute; the Natural Resources and Environmental Law Section of the Nebraska State Bar Association; the NU College of Law; and the USGS Nebraska Water Science Center.

## NWC History *continued from page 11*

DWFI's approach is to extend the University of Nebraska's expertise through strong partnerships with other universities and public and private sector organizations. It develops research, education and engagement programs in a focused effort to increase food security while ensuring sustainability of water resources and agricultural systems, working both locally and internationally, bridging the water and agriculture communities and the worlds of small- and large-holder farmers to deliver innovative solutions to this complex global challenge.

As DWFI expanded its missions and involvements in its first few years on the UNL campus, Suat Irmak, a research irrigation engineer in the UNL Department of Biological Sciences, replaced Dvorak as interim director of the NWC in January 2012.

Irmak was replaced by permanent director Chittaranjan Ray in August 2013, Ray coming to the NWC as the result of a national search for a new permanent director. Ray, tenured in the UNL Department of Civil Engineering, came to the NWC from the faculty of the University of Hawaii, where he had been serving as interim director of the Hawaii Water Resources Research Institute.

Ray's professional and research expertise extends to the areas of water quality engineering, water quality assessment with special emphasis on groundwater, pesticides, flow and transport processes in variably-saturated media, surface and groundwater interaction.

In September 2014, DWFI and the water center moved into joint offices on the new Nebraska Innovation Campus (NIC) on the site of the former Nebraska State Fairgrounds in north Lincoln. NIC, which has been under development for several years, is envisioned as an environment where university and private sector talent will be able to connect to transform ideas into innovations that will impact the world.

## National Relationships

One of the Water Center's most important connections is involvement in national water-related organizations.

Beginning in 1971, the Water Center served as home of the Universities Council on Water Resources (UCOWR). This organization today is composed of over 90 universities united to encourage research and education in water resources.

UCOWR's main objectives are to: 1.) facilitate water-related education at all levels; 2.) promote meaningful research and technology transfer on contemporary and emerging water resources issues; 3.) compile and disseminate information on water problems and solutions; and 4.) inform the public about water issues in order to promote informed decisions at all levels of society. An annual meeting is held at one of the member universities. The Water Center continued as UCOWR's home office until 1987.

Another important national organization the Water Center belonged to was the National Association of Water Institute Directors (NAWID) from 1966 until 1990. NAWID consisted of the directors of all 54 state water resources institutes. Their mission was lobbying Congress for increased funding for water resources research.

In 1990, NAWID was succeeded by the current National Institutes for Water Resources (NIWR), which cooperates closely with other state water institutes and other organizations to increase mutual effectiveness and promote regional coordination of activities. An annual meeting is held, usually in Washington, D.C. Volk was a former president of NIWR and Hoagland was the organization's executive secretary, president elect and president during their years as Water Center director.

## Jenny Dauer *continued from page 3*

The course will have three components:

1. Learning about a framework for evaluating socio-scientific issues (2 weeks)
2. Applying the framework to socioscientific issues important to agriculture and natural resources in Nebraska (8 weeks)
3. Asking a big question about a socioscientific issue and using a scientific argument to support a position (4 weeks)

Dauer also teaches LIFE 121: Fundamentals of Biology II

### Selected Publications:

Dauer JM, Doherty JH, Freed AL, Anderson CW (2014) Connections between student explanations and arguments from evidence about plant growth. *CBE-Life Science Education*, 13:397-409.

Dauer JM, Perakis SS (in press) Calcium oxalate contribution to calcium cycling in forests of contrasting nutrient status. *Forest Ecology and Management*.

Covitt BA, Dauer JM, Anderson CW (in press) The Role of Practices in Scientific Literacy. In *Supporting Next Generation Scientific and Engineering Practices in K-12 Classrooms*. Eds Reiser, Schwarz & Passmore. NSTA publication.

Dauer, J., Miller, H. & Anderson, C. W. (2014). Conservation of energy: An analytical tool for student accounts of carbon-transforming processes. In R. Chen, A. Eisenkraft, D. Fortus, J. Krajcik, K. Neumann & A. Scheff (Eds.), *Teaching and Learning of Energy in K-12 Education*. New York: Springer

Dauer JM, and S Perakis (2013) Contribution of calcium oxalate to soil exchangeable calcium. *Soil Science*, 178:671-678.

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Sandhills. Wedin said during the most recent mega-drought 800 years ago, “you would have been standing at this point and looking at the largest set of moving sand dunes in the western hemisphere.”

UNL scientists have spent the last 15 years dating the Sandhills through a process called optically-stimulated luminescence, which measures the energy held in sand grains. UNL Professor Paul Hanson, a geologist with the *Nebraska Geological Survey*, uses this technique to study how and when the sand dunes last moved.

Hanson said to think of each sand grain as an individual rechargeable battery. “The sand grains are exposed to sunlight, they lose their electrical charge. And when those sand grains are buried in the ground they’re gaining that electrical charge again. So the length of time they’re buried dictates how full that battery is,” Hanson said.

Hanson and his colleagues drill down 60-80 feet to take core samples of the dunes, then return to their lab to study them.

On the UNL campus, Hanson leads the way through a rotating door of darkness to enter the lab lit by red and amber lights. Inside, Hanson and his students remove the outer edges of the core sample to work with the unexposed sand grains in the middle. After sieving the sand down to the right grain size, they treat it in several different acids to concentrate the quartz. Then they load the individual grains of sand onto disks into a machine that reads the luminescence — like what you see from fireflies.

“So if your eyes were more sensitive and could actually see smaller quantities of light, you could actually see the sand grains give off the light under the right conditions,” Hanson said. But since our eyes aren’t that sensitive, this machine runs 24/7, dating sand one individual grain at a time. By averaging the useful data from enough grains of sand, “you can use that as a clock to tell how long the grains have been buried,” said Hanson, and thus the last time the dune was bare and moving.

The geologic history Paul Hanson constructs provides context for the ecological research Dave Wedin is doing — trying to understand what conditions are necessary to make a healthy grassland destabilize and fall apart, and how long it takes to recover. Wedin said he’s been

quite surprised by the plots killed every three years, particularly given the extreme drought in 2012.

“Our goal was to get the vegetation reestablished in a couple years to study how an ecosystem with woody vegetation worked with an ecosystem with grasses. And the brutal lesson was: we weren’t going to restore this vegetation in a couple years,” Wedin said. After four years of that effort, he’s finally started to see the new plants take root, with the help of erosion mats and shredded hay.

“I never would have thought you could completely kill the vegetation out here and it could go another four years before you started to see erosion. And by saying there wasn’t significant erosion I mean less than an inch,” Wedin said.

Even with surface vegetation killed, the stressed grasslands proved far more resilient than Wedin imagined, retaining their root systems, sand and organic matter

for years. He’s now trying to revegetate the plots, which he said has been even harder:

“It’s a situation where the professors come out and learn something that everybody that lives out here already knew: that it’s easier to destroy the stability out here in the Sandhills than it is to restore it once it’s lost,” Wedin said. “And that was humbling.”

Ultimately, Wedin and Hanson agree droughts capable of making the Sandhills resemble the Sahara are very long — probably on the order of decades or a couple hundred years. They’d have to be far more severe than what we’ve seen in the last two hundred years — but not in the last millennium.

“If we know that in the last 1,000 years this landscape produced droughts that destabilized the whole landscape, it seems prudent to think that can do that again. And that discussion is without human-caused climate change. But we don’t even need to invoke human-caused climate change to say, it’s a reasonable prediction sometime in the next couple hundred years we’re going to see droughts out here that the whole thing falls apart,” Wedin said.

And long before things reach that point, he pointed out a few hard years with no grass could be devastating for the Sandhills ranching economy.

*“If we know that in the last 1,000 years this landscape produced droughts that destabilized the whole landscape, it seems prudent to think that can do that again.”*



## NEWS BRIEFS

### Irmak Receives Awards

Suat Irmak, H. W. Eberhard Distinguished Professor in BSE, received the John Deere Gold Medal, which honors achievement through engineering for improved manipulation, use and conservation of soil water, and that has resulted in applications of a new concept, art or science that advanced agriculture. Irmak also received the Heermann Sprinkler Award, which honors professionals in research, development, extension, education or industry that have made significant contributions to the improvement of efficient and effective sprinkler irrigation.

Irmak is a former interim director of the Nebraska Water Center, part of the Robert B. Daugherty Water for Food Institute at the University of Nebraska.

He and his colleagues also recently received an Award of Excellence from the Western Association of Agricultural Experiment Station — Extension and Research Directors for outstanding progress and impacts of their regional project “Microirrigation for Sustainable Water Use.”

The West is home to some of the fastest growing communities in the nation, and these communities are putting additional strain on already overdrawn water supplies in the region. As a Multi-State Regional committee member, Irmak has been working with colleagues from western states to research, develop and implement water management strategies as well as educational programs related to microirrigation.

Irmak is part of a multi-state committee that was founded by researchers in 1972 to coordinate microirrigation research across the United States. Over the last several years, the group has made

remarkable improvements to microirrigation systems and their management that have had significant environmental, economic, and social impacts. Irmak is the first researcher who initiated large scale microirrigation research and educational programs in Nebraska more than a decade ago.

### NWC Social Media

Like and follow the Nebraska Water Center on Twitter and Facebook



[twitter.com/NebrWaterCenter](https://twitter.com/NebrWaterCenter)



[facebook.com/NebraskaWaterCenter](https://facebook.com/NebraskaWaterCenter)

### New Mailing Addresses

Daugherty Water for Food Institute  
2021 Transformation Drive, Suite 3220  
P.O. Box 886203  
Lincoln, NE 68588-6203

Nebraska Water Center  
2021 Transformation Drive, Suite 3220  
P.O. Box 886204  
Lincoln, NE 68588-6204

## Spring Seminars Begin in January

The University of Nebraska–Lincoln’s spring semester water and natural resources seminar series will begin in January and run through April at Hardin Hall on UNL’s East Campus

Seminars are free to the public and can be taken for undergraduate and graduate student credit through a number of UNL departments. The lectures are presented by UNL’s School of Natural Resources in cooperation with the Nebraska Water Center, part of the Robert B. Daugherty Water for Food Institute.

Lectures will be presented on a variety of the latest water and environmental research and topics of interest in Nebraska and the Great Plains.

Some of the topics being looked at for lectures include the NCORPE pipeline in Western Nebraska, groundwater monitoring

programs, uranium in municipal water supplies, high-tech water cycle observation and prediction system research at UNL, the value of groundwater, wellhead protection programs and others.

Lectures are Wednesdays Jan. 14 and 28, Feb. 11 and 25, March 11 and April 8 and 22, 3:30 to 4:30 p.m. in the first floor auditorium of Hardin Hall on the UNL East campus at N. 33<sup>rd</sup> and Holdrege St., Lincoln.

Students registered to take the series for classroom credit will meet with course instructors Pat Shea and Martha Rhoades from the School of Natural Resources during off-lecture weeks.

Speakers, dates and topics will be posted online at [watercenter.unl.edu](http://watercenter.unl.edu) and on Facebook at [facebook.com/NebraskaWaterCenter](https://facebook.com/NebraskaWaterCenter).

# Franz Engages Students With New Cosmic-Ray Sensor

Mekita Rivas, UNL School of Natural Resources

Trenton Franz is much more than a Princeton-educated academic and hydrogeophysicist who joined UNL's School of Natural Resources last year as an assistant professor. He's also a competitive disc golf player.

"When I'm not chasing around my one- and four-year-old girls, I like to play disc golf," Franz said. "I'm a member of the Professional Disc Golf Association and often play in competitive tournaments around the country."

At his best, Franz had a player rating of 975, which is 2.5 strokes per 18 holes below a world-class professional.

"With the new job and my daughters, that rating has slipped," Franz said. "But someday, I will get it back up and resume playing in tournaments."

For now, Franz is competing in other arenas through opportunities offered by the university. In October, he was one of 13 UNL faculty members selected for the 2013-2014 Research Development Fellows Program. The initiative helps pre-tenure faculty successfully compete for grants.

"The school has been an extremely welcoming place with excellent facilities to conduct research," Franz said.

That research — centered on hydrology and water resources — has taken Franz on a unique, ever-winding path that spans across several states and a few countries.

"I grew up in Fort Collins, Colorado (and) attended the University of Wyoming to play football," Franz said. "I helped lead the Cowboys to a 24-21 victory over UCLA in the 2004 Las Vegas Bowl."

After Wyoming, Franz headed to Princeton University in New Jersey where he earned master's and doctoral degrees.

"The field work for my dissertation, 'Characterizing Dryland Surface Hydrological Dynamics Using Ecohydrological Modeling and Geophysical Observations,' was completed over six different trips to central Kenya," he said.

In 2011, Franz joined the University of Arizona in Tucson to work on COSMOS, an NSF-supported project to measure soil moisture on the horizontal scale of hectometers and depths of decimeters using cosmic-ray neutrons.

When SNR hired him in 2013, Franz said he was excited about the research possibilities that the new position presented. "I was looking forward to being able to buy all the cool research toys that I got to dream up while being a postdoc," he said. "I was also really looking forward to being a mentor to students, as I had some great ones along the way."



Trenton Franz (right) and his two student workers, William Avery and Catie Finkenbiner, with the new cosmic-ray sensor. (Mekita Rivas, UNL School of Natural Resources)

Both of those aspirations have already come to fruition with the arrival of a new cosmic-ray sensor (CRS) housed in Franz's lab.

The CRS measures soil moisture every minute with a horizontal footprint of a 300-meter radius circle and a penetration depth of 30 centimeters. Two students working in Franz's lab will conduct a majority of the hands-on data collection, Franz said.

"This research excites me for two reasons," said William Avery, an environmental studies major who graduated in December and will begin his master's degree program in the fall. "Firstly, when applied to questions of water use efficiency, this technology has the potential to improve precision agriculture and ultimately grow food with less water. Second, the novelty of this project means that there may be other as of yet undiscovered applications that could be significant."

Catie Finkenbiner, a senior water science major from Omaha, said that she hopes working with the CRS and alongside Franz will complement her postgraduate plans.

"I am really interested in grad school, so I hope the experience I gain this summer working with (Franz) and on this project will enhance my grad school application," she said. "I am excited about the new equipment because it means I will get to go out in the field a lot this summer, and I love field work."

Franz, Avery and Finkenbiner collected their first data set in early May, and will continue through the summer.

"We are exploring ways to use the sensor data to help manage hundreds of center pivots simultaneously," Franz said. "This data, combined with remote sensing products, will be very beneficial for helping trigger irrigation at optimal times and in optimal amounts."

## 2015 Water Tour *continued from page 1*

Only the dates and venue have so far been selected by the tour's two managing co-partners: Central Nebraska Public Power and Irrigation District in Holdrege and the University of Nebraska Water Center, part of the Robert B. Daugherty Water for Food Institute. Nebraska Public Power District is also a major co-sponsor of the annual event, which began as UNL Extension "irrigation tours" in the 1970's.

"There are a myriad of water issues in the basin that have remained contentious between Colorado, Kansas and Nebraska for more than 15 years, since Kansas initiated litigation against Nebraska in 1998 for non-compliance with terms of the three-state compact," said tour co-organizer Steve Ress of the Nebraska Water Center.

Litigation stemming from the three-state basin compact has been in-and-out of the news ever since.

The 1943 compact allocates 49 percent of the river's water to Nebraska, 40 percent to Kansas and 11 percent to Colorado.

The river itself starts in the high plains of Colorado, flows east across northwestern Kansas and into Nebraska, then dips back into Kansas where it joins with the Smokey Hill River, forming the Kansas River.

"Basin waters are used by agricultural producers, municipalities and others in all three states and meeting the stipulations of the compact have often been difficult in the often water-strapped basin," Ress said, noting that the tour last visited there in 2008. "It's time we took a close look at the issues again."

This coming June's tour will likely begin and end in Holdrege and there will not be a shortage of issues and points of interest to visit in each of the three states.

Among these could be the implementation of Integrated Management Plans (IMPs) by Nebraska's Natural Resource Districts in the basin, the new NCORPE (Nebraska Cooperative Republican Platte Enhancement) pipeline, Bonnie Reservoir in Colorado, recent U.S. Army Corps of Engineer work on Harlan County Dam near Alma, producer issues in the Frenchman-Cambridge Irrigation District, how irrigator circumstances and attitudes in the basin have changed in the last 10 years, how groundwater irrigation wells may affect flows in the basin, and how the basin affects municipal water use in Kansas, among many other issues.

"Obviously we will want to hear perspectives on basin water and compact implications from each of the three states involved," Ress said.

Joint efforts in the basin by University of Nebraska, Kansas Geological Survey, and Kansas State University researchers could also be part of the mix, as well as work being done there by the Kansas Geological Survey and others.

Detail tour planning will begin in January. Tour host will be Mike Jess, former director of the Nebraska Department of Water Resources and retired UNL faculty member and associate director of the Nebraska Water Center.

Additional information will be posted online at [watercenter.unl.edu](http://watercenter.unl.edu) and at [facebook.com/NebraskaWaterCenter](https://www.facebook.com/NebraskaWaterCenter) as it becomes available.



*Harlan County Dam, near Alma, will likely be a stop on the June water tour (Steve Ress, Nebraska Water Center).*

the Syr Darya River basin in southern Kazakhstan, and water basins within Nebraska and across the Midwestern U.S. Both regions face enormous and complex water quality issues arising from numerous, virtually invisible non-point-sources that enter the waterways across wide geographies that can dramatically vary over time.

Furthermore, in both landscapes, people and agriculture depend on highly stressed surface waters despite uncertain futures for those resources.

Environmental issues focusing on water are expanding in their extent and complexity, despite the fact that funding for environmental monitoring is not expanding in kind. While developed countries such as the U.S. have been grappling with

this problem for years, it is even more difficult to deal with in developing countries such as Kazakhstan where contamination is historically more pronounced and the resources to deal with it limited.

Despite these daunting limitations, the future for environmental stewardship in Kazakhstan seems bright, as the country and the University appear to be thematically investing in education and the scientific infrastructure such stewardship entails. We both agree that the University of Nebraska is in a great position to help Al-Farabi KazNU achieve its goals academically and scientifically, and it seems that together our two great Universities can chart a path toward long and productive collaborations.



*Chemistry meets Biology: Alan Kolok, director of the Nebraska Watershed Network at the University of Nebraska, Omaha, and Dan Snow, director of the Nebraska Water Sciences Laboratory at the University of Nebraska–Lincoln (center, standing) recently visited Al-Farabi Kazakh National University in Kazakhstan to teach a nine-day workshop in ecotoxicology.*



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## Chemistry meets Biology in Kazakhstan

**Dr. Dan Snow, director, Nebraska Water Sciences Laboratory, UNL; and  
Dr. Alan Kolok, director, Nebraska Watershed Network, UNO**

While rewarding in the extreme, interdisciplinary research presents challenges and international interdisciplinary research can be more challenging still. Delivering an interdisciplinary, international workshop can be relatively easy and even enjoyable, however.

This was the case when two Nebraska scientists visited Al-Farabi Kazakh National University in Kazakhstan to teach a nine-day workshop in ecotoxicology.

While the students and faculty at "KazNU," as it is affectionately termed, are very motivated to learn the techniques we have used to elucidate water quality issues, the science and methodologies can be quite difficult to master even when all of the scientists are located in the same country.

International difficulties can arise due to limitations in equipment and infrastructure, and are further exacerbated when

the watershed of interest is a full day's train ride from the host University.

Despite these limitations and challenges, we, the authors were met with great enthusiasm by the KazNU students. We found that describing innovative methods for studying the occurrence and effects of water contamination was very rewarding when dealing with such a positive and responsive group of students.

They were not only attentive to the substantive content of the lectures, but were also attentive to our English pronunciation. All Kazakh college students are to one degree or another tri-lingual, communicating in Russian, Kazakh and English. Despite the mild language barrier, teaching such eager and intelligent students was a real bonus to an otherwise notable trip.

The workshop was successful in helping Kazakh students better understand the similarities in water quality issues between

*continued on page 19*