



# Water Current

PART OF THE ROBERT B. DAUGHERTY WATER FOR FOOD INSTITUTE

## Ray Named Nebraska Water Center Director; Neale Joins DWFI as Director of Research

Two eminent water resources experts are bringing their broad experience and leadership to the Robert B. Daugherty Water for Food Institute at the University of Nebraska. Dr. Chittaranjan Ray will join the DWFI in August as Director of the Nebraska Water Center, and Dr. Christopher M. U. Neale will join the DWFI in October as Director of Research. The two will be members of Founding Executive Director Dr. Roberto Lenton's leadership team for the Institute.

Dr. Ray is Professor of Civil Engineering at the University of Hawaii at Monoa, and is

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## 2013 Water and Natural Resources Tour Is Two Days in June

By Steve Ress

"Managing Nebraska's Water Resources" will be the theme for a two-day water and natural resources tour in June jointly conducted and sponsored by the University of Nebraska's Nebraska Water Center, the Kearney Area Chamber of Commerce, and Central Nebraska Public Power and Irrigation District.

The Nebraska Water Center (NWC) is part of NU's Robert B. Daugherty Water for Food Institute.

The tour will be June 25 and 26, leaving from and returning to Lincoln, but based primarily in the York and Clay Center areas.

The tour will examine the present and future management of surface and groundwater resources in Nebraska from both rural and urban perspectives.

"In terms of current and future demands and with the impacts of ongoing drought conditions fresh in everyone's minds, we thought the time was right to revisit these topics," said tour coorganizer Steve Ress, NWC communications coordinator.

To keep costs in check and help accommodate work schedules that sometimes have difficulty fitting around the traditional three-day tour, organizers thought a two-day format

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## October Water Symposium and Water Conference At Lincoln's Cornhusker Hotel

By Steve Ress

The University of Nebraska's back-to-back one-day water science symposium and water law conference will be Oct. 15 and 16 at Lincoln's Cornhusker Hotel.

Tuesday, Oct. 15's symposium will focus on "Changes: Climate, Water and Life on the Great Plains," while the following day's water law conference will be aimed primarily at the latest in Nebraska water law for practicing attorneys and water professionals.

The events are cosponsored by NU's Nebraska Water Center (NWC), which is part of the Robert B. Daugherty Water for Food Institute; the NU College of Law and

the Natural Resources and Environmental Laws Section of the Nebraska State Bar Association.

At the Tuesday symposium, morning sessions will take a look at the bigger picture of water issues that are of current interest to Nebraska and the Great Plains.

"We will be looking at water and planning, with climate change and variability as a key driver in planning, along with factors such as population growth, and agriculture, industry and ecosystem needs," said organizer and NWC assistant director Lorrie Benson.

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This newsletter is published with partial financial support from the Department of the Interior; U.S. Geological Survey. The content does not necessarily reflect the views and policies of the Department of the Interior, nor does mention of trade names or commercial products constitute endorsement by the U.S. Government.

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From the Interim Director  
**Suat Irmak**

## As Spring Semester Ends, Summer and Fall Events Take Shape

As the spring academic semester draws to a close and faculty, staff and students look forward to summer and its changes of pace for many of us, there is a full slate of activities and changes ahead of us here at the Nebraska Water Center.

One pending change that has not yet occurred is a changing of the guard in terms of my being replaced by a new permanent director. Two excellent candidates were interviewed in late January. They were Richard C. Peralta, a groundwater management specialist at Utah State University and Chittaranjan Ray, interim director of the Water Resources Research Center and Environmental Center at the University of Hawaii and chief environmental engineer, U.S. Navy Applied Research Laboratory, University of Hawaii. We will keep you posted on this situation as it unfolds.

In the meantime, planning for the June Water and Natural Resources Tour, in cooperation with the Kearney Area Chamber of Commerce and Central Nebraska Public Power and Irrigation District, is nearly complete and you should be seeing a detailed itinerary and registration materials very soon. Please refer to our web site at [watercenter.unl.edu](http://watercenter.unl.edu) for the latest information on this activity. If you plan to attend, register as soon as possible, as tour seating is always limited.

"Managing Nebraska's Water Resources," will be June 25 and 26, departing from and returning to Hardin Hall on the UNL East Campus at N. 33rd and Holdrege Sts. in Lincoln.

We are trying the two-day in-state tour format to see if that better fits tight office and work schedules for many people that want to attend, as well as to control registration costs.

The tour will largely unfold in the York, Hastings and Central City areas.

It will examine the present and future management of surface and groundwater

resources in Nebraska from both rural and urban perspectives.

Two very prominent stops on the tour will be UNL-IANR's South Central

Agricultural Laboratory near Clay Center, where significant agricultural research projects will be reviewed, as well as the Nebraska Agricultural Water Management Network program that I have been leading.

We will also have an extensive tour and discussions about the livestock research and management work being done at the neighboring U.S. Department of Agriculture's Meat Animal Research Center which employs several hundred USDA and UNL people in research on beef cattle, hogs and sheep. It is one of the largest USDA facilities of its kind in the nation.

Nebraska Water Center faculty and staff just finished attending and participating in the fifth global Water for Food Conference hosted by the Robert B. Daugherty Water for Food Institute and the Bill and Melinda Gates Foundation.

This highly successful international conference focused on how we can increase the capacity of our food, water and natural ecosystems to adapt to changing climate under the title of "Too Hot, Too Wet, Too Dry: Building Resilient Agroecosystems."

At that conference, our education and outreach specialist, Rachael Herpel, led another very productive meeting of our Water Resources Advisory Panel, which I was unable



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# Fifth Global Water for Food Conference

Recent years have seen major drought, floods and extreme temperatures affecting vast areas of the globe, including some of our most productive agricultural regions.

The fifth global Water for Food Conference brought together experts from around the world to discuss how we can increase the capacity of our food, water and natural ecosystems to adapt to a changing climate.

“Too Hot, Too Wet, Too Dry: Building Resilient Agroecosystems” was May 5-8, hosted by the Robert B. Daugherty Water for Food Institute (DWFI) at the University of Nebraska and the Bill and Melinda Gates Foundation, at Lincoln’s Cornhusker Marriott Hotel.

The conference featured plenary addresses by Benedito Braga, President, World Water Council; Rosina Bierbaum, University of Michigan; Heidi Cullen, Climate Central; Christo Fabricius, Nelson Mandela Metropolitan University, South Africa; Cynthia Rosenzweig, NASA Goddard Institute for Space Studies; and others.

Additional sessions included:

- “Surviving the 2012 Drought: 80 Years of Innovation”

- “A View From the Field” panel featuring an international group of agricultural producers
- Technical sessions on “Resilience in Stressed Watersheds” and “Livestock and Water”
- “Drought Preparedness and Planning” case studies
- “Communicating about Climate” roundtable discussion
- Demonstrations of “Cool Tools and Technologies”
- Graduate student poster competition focused on conference themes
- “Farm to Table” Banquet at a working organic farm
- Networking opportunities

DWFI is a research, policy and education institute committed to efficiently using our limited freshwater supplies to ensure a reliable food supply for current and future generations. Thanks to a generous \$50 million founding gift commitment from the Robert B. Daugherty Charitable Foundation, DWFI has the resources to push forward its work on the critical issues of water and food security.

For more information on the conference, go online to <http://waterforfood.nebraska.edu/wff2013>

## Experts: Transforming Scientific Knowledge into Ag Practices, Policy is Essential

By Dan Moser, IANR News Service

Much of the scientific and technical knowledge needed to address the world’s burgeoning food needs already exists. The challenge now is to get it into small farmers’ hands in a way they can use it, and to convince governments to change policies to make it more feasible for them to do so.

That’s one of the themes that emerged from fifth annual global Water for Food Conference as it opened on Monday, May 6. The conference was hosted by the Robert B. Daugherty Water for Food Institute at the University of Nebraska and the Bill and Melinda Gates Foundation.

Experts opened the conference in a panel discussion that focused on their efforts to translate research into action in Asia, Central America and Sub-Saharan Africa, areas where increasing food production is essential to feeding a world population expected to reach 9 billion by 2050. Jeff Raikes, CEO of the Gates foundation and a native Nebraskan, said “smallholder farmers” trying to scratch out a living on 5 to 10 acres represent “a lot of the food production” in the world.

“Helping these farming families increase production in a sustainable way and sell more crops is the most effective way” to deal with the looming challenge, said Raikes, who moderated the opening panel discussion. Raikes said “participatory research” needs to reflect the farmers’ concerns rather than simply presenting scientific findings and expecting farmers to adopt recommendations.

Paul Hicks, a water resources specialist with Catholic Relief Services’ Global Water Initiative, said, “We need to start where the farmer is and really understand the context they’re working in.” His organization has worked to bridge the gap between research institutions and these farmers.

Aditi Mukherji, a water and air leader with the Nepal-based International Centre for Integrated Mountain Development, said scientists traditionally have been eager to share their expertise rather than first finding out what farmers really need.

In that light, Hicks said, it’s key that scientists working with farmers accomplish some “early recognizable results,” however modest.

“Most of the solutions that are needed are known ...,” Hicks said, “but there hasn’t been consensus” among farmers or policymakers on how to implement them.

His organization has brought together policymakers, scientists and development specialists to assess the programs implemented by governments and NGOs over the last 15 years to see what’s worked and what hasn’t, with an eye toward improving future policies.

Mukherji said her organization’s experience is encouraging. In her native West Bengal, research findings have influenced government

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## UNL Hosts International Water Officials

By Monica Norby, Associate Director, Robert B. Daugherty Water for Food Institute

Dan Snow, director of services at UNL's Water Sciences Laboratory, discusses a nitrogen gas mass spectrometer with members of the Founders Committee on March 21.

International authorities are discussing ways to increase food production and improve water management in the Middle East and North Africa during a visit to the University of Nebraska—Lincoln this week.

The Founders Committee of the Middle East and North Africa Network of Water Centers of Excellence have come to UNL for the discussions after meetings in Washington, D.C. UNL Chancellor Harvey Perlman is one of seven members of the Founders Committee.

“The founding committee has quickly become a very collegial and thoughtful group, they are very open and passionate about improving the use of water resources on their region,” Perlman said. “I am honored to be associated with this effort and to explore how the Water for Food Institute at the University can contribute to their success.”

In February 2012, United States Agency for International Development (USAID) Administrator Rajiv Shah and University of Nebraska President James B. Milliken signed a memorandum of understanding to expand research and development capacities focused on water and food in the Middle East and North Africa working through the newly established Water Centers of Excellence. The Founders Committee is the governing body charged with implementing the centers network.

The water center network, known as MENA NWC, links technical institutions across the Middle East and north Africa with one another and also with U.S. institutions — such as the University of Nebraska's Robert B. Daugherty Water for Food Institute — to address water challenges confronting the region. It helps build and exchange regional science and technology capacity to improve water planning and management, expand water supply, manage demand and increase efficient and productive use of water.

Other members of the Founders Committee are Manar Fayyad, University of Jordan; Samir Ben Said, Director of the International Research and Training Institute of the National Office of Potable Water in Morocco; Muwaffaq Saqqar, Arab Fund for Economic and Social Development in Kuwait; Thameur Chaibi, Director of the Rural Engineering Department at the National Research Institute for Rural Engineering, Water and Forestry in Tunisia; Hady Amr, USAID deputy assistant administrator for the Middle East; Jill Shaunfield, Science and Technology Policy Advisor for the U.S. Department of State's Bureau for Near Eastern Affairs.

Also accompanying the group are John Wilson of USAID and Peter Reiss of Development Alternatives International.

The NU-USAID partnership focuses on reducing the use of water in agriculture while sustainably maintaining crop yields. Through collaborative research, education, and out-

reach programs, working with the NU Water for Food Institute, USAID and NU will focus on irrigation, groundwater management, rain-fed agriculture, drought risk assessment and mitigation that support Middle East and North Africa Water Centers of Excellence.



Dan Snow, director of services at UNL's Water Sciences Laboratory, discusses a nitrogen gas mass spectrometer with members of the Founders Committee on March 21.

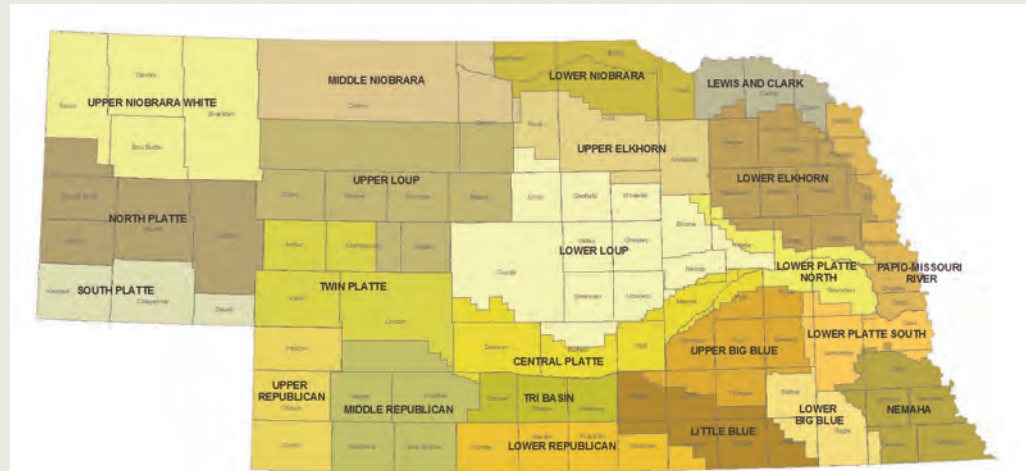
# Nebraska's NRDs: Protecting Natural Resources since 1972

By Alyssa Smola, Public Relations/Communications Director, Nebraska Association of Resources Districts

The Nebraska Association of Resources Districts (NARD) is the trade association for Nebraska's 23 natural resources districts (NRDs) and works with them to protect lives, property and the future of Nebraska's natural resources.

These districts are unique to Nebraska. NRDs are local government entities with broad responsibilities to protect our natural resources. Major Nebraska river basins form the boundaries of the 23 NRDs, enabling districts to respond best to local conservation and resource management needs.

"Since 1972, the Nebraska's NRDs have been addressing natural resources issues and concerns with local solutions," said Joe Anderjaska, NARD president. "Since the beginning, NRDs have constructed or



*The original 24 NRDs' boundaries were based on Nebraska's major river basins, which allows for better management practices to be applied to similar topography. In 1989, the Middle Missouri NRD and the Papio NRD were merged into one, becoming the Papio-Missouri NRD, which resulted in the current 23-NRD system. For more than 40 years, the 23 NRDs across the state have been addressing natural resources issues and concerns with local solutions. Nebraska's NRDs are involved in a wide variety of projects and programs to conserve and protect the state's natural resources.*



*NRDs have provided more than 85 million tree/shrub seedlings to Nebraska landowners. Most of these were planted for landowners by local NRD employees, either by hand or by machine. As part of the "Conservation Trees for Nebraska" program, each NRD manages its own conservation tree and shrub program to best benefit its district.*

maintained approximately 700 flood control structures, planted over 85 million trees, and protected groundwater quantity and quality."

State senator Maurice Kremer of Aurora introduced, and Nebraska's unicameral legislature enacted, Legislative Bill (LB) 1357 in 1969 to combine Nebraska's 154 special purpose entities into 24 NRDs by July, 1972. The original 24 NRD boundaries were organized based on Nebraska's major river basins, which allows for better management practices to be applied to similar topography.

In 1989, the Middle Missouri Tribes NRD and the Papio NRD merged to become the Papio-Missouri NRD which resulted in the current 23 NRDs. Directors are elected at the general election to govern the local district. A handful of board members, managers and staff have been a part of the system since creation of the NRDs in 1972.

"While all NRDs share the 12 main responsibilities, each district sets its own priorities and develops its own programs to best serve local needs and to protect Nebraska's

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## Research Shows Bentonite-Packed Well Annulus Can Prevent Contamination of Confined Aquifers

By Sharon Skipton and Bruce Dvorak, University of Nebraska–Lincoln

Demonstrations using a new groundwater well model and a slide show of the model being operated are being used to illustrate research results related to water well construction and groundwater contamination. The project was a collaborative effort between the University of Nebraska–Lincoln (UNL) and the Nebraska Department of Health and Human Services (DHHS.)

The U.S. Environmental Protection Agency’s Safe Drinking Water Act regulations establish Maximum Contaminant Levels (MCL) in public drinking water supplies. Public water suppliers are obligated to keep concentrations of regulated contaminants at or below the MCL. The contaminant of highest concern in many Nebraska public water supplies is nitrate, which is very mobile and has a MCL of 10 parts per million (or milligrams per liter) as nitrate-nitrogen. The nitrate concentration in over 400 public water supply wells in Nebraska is high enough to require accelerated monitoring, and concentrations continue to rise in many wells. The Nebraska Grout Task Force, sponsored by the State of Nebraska, spent eight years researching pollution pathways that contribute to this situation.

Many public drinking water wells in Nebraska draw water from deep, confined aquifers. The first step in well construction is to drill a borehole into the aquifer. After drilling, a casing is placed in the center of the borehole. The casing is a pipe that supports the hole from collapsing and provides a conduit for water to be drawn out of the aquifer. The casing is positioned in the borehole to maintain a uniform space between the outside of the casing wall and the sides of the borehole. This space is known as the annular space or annulus. The top of the well is capped with a watertight, secure cover. Water in the saturated zone of the aquifer must have a way to enter the well casing. This is achieved with a well screen. The screen is located in the water-bearing zone of an aquifer. It has apertures (slots or louvers) in the casing that allow water to pass through. The area around the well screen is packed with clean sand or gravel that stabilizes the aquifer



*A pumping well constructed using the new state well design standards can become contaminated by pulling in surface contamination through old wells.*

material while allowing water to move into the well.

Since 2010, public drinking water wells are constructed with full-length bentonite in the annulus from just above the screened openings to the surface. It was believed the confining layer and the bentonite in the annulus would help prevent nitrate contamination of groundwater in the confined aquifers. Yet, contamination was continuing to occur in these newly constructed bentonite-packed wells. Irrigation wells may have a surface seal in the annulus within 10 feet of the surface but most have gravel-pack from the bottom of the hole to the top. These types of water wells are present in many of Nebraska’s public wellhead protection areas. The 8-year Nebraska Grout Task Force Study found that gravel-packed wells lacking a grout interval adjacent to confining layers may create contamination risks for nearby bentonite-packed community wells.

The two well construction techniques mentioned above are represented in the model; one with a bentonite-packed annulus and one

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## EPA Finds More Than Half Nation’s River and Stream Miles in Poor Condition

In March, the U.S. Environmental Protection Agency released results of the first comprehensive survey looking at the health of thousands of stream and river miles across the country, finding that more than half — 55 percent — are in poor condition for aquatic life.

“The health of our nation’s rivers, lakes, bays and coastal waters depends on the vast network of streams where they begin, and this new science shows that America’s streams and rivers are under signifi-

cant pressure,” said Office of Water Acting Assistant Administrator Nancy Stoner.

“We must continue to invest in protecting and restoring our nation’s streams and rivers as they are vital sources of our drinking water, provide many recreational opportunities, and play a critical role in the economy.”

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# Project Aims to Predict Yield Potential to Help Global Food Security

By Gillian Klucas

Resolving the debate over how best to feed a growing global population requires basic information about current and potential yields at local levels around the world, a University of Nebraska–Lincoln agronomist said.

“We need to have a much finer ability to predict the productive capacity of every hectare of land and its water efficiency. It’s fundamental to being able to prioritize the research agenda for agriculture and to determine what form agriculture should take,” said Ken Cassman, Robert B. Daugherty Professor of Agronomy at UNL.

Cassman, who also chairs the Independent Science and Partnership Council of the Consultative Group on International Agricultural Research, spoke during the “Alternative Paths to Food Security: Making the Right Choices While Feeding the World” symposium at the annual meeting of the American Association for the Advancement of Science in Boston in February.

“We were successful in the first Green Revolution precisely because there was such a strong consensus,” he said. “Everyone understood that we were running out of food and the magnitude of the problem. That’s missing today because there isn’t robust data and scientific consensus about how much food can be produced on existing farmland, and from that, where and how to increase production.”

To provide that foundational data, Cassman and an international research team are developing the Global Yield Gap Atlas, a tool to estimate food production capacity and the gap between current and potential farm yields on every hectare of existing farmland using the best available science and data.

Unlike other efforts to estimate yield potential, the atlas uses a bottom-up approach. Working with colleagues at Wageningen University in the Netherlands, the team is recruiting agronomists worldwide to identify key agricultural areas and collect data about local conditions and farming methods.

These data are then scaled to national, regional and global levels.

Researchers also are developing the necessary methodologies, such as accurately converting short-term weather data into long-term patterns and scaling up local yield estimates. All information and methodologies are shared on the new public website [www.yieldgap.org](http://www.yieldgap.org).

Detailed yield gap information will help reconcile widely differing views over how agriculture will feed the 9 billion people expected to populate the planet by 2050, Cassman said.

Some people advocate organic or regionally based production systems, arguing that reliance on a few major crops and cropping systems is unsustainable and environmentally destructive.

Others believe that modifying current systems through incremental scientific innovations would suffice and that alternative systems are inefficient and would require destroying rain forests and grasslands to increase production.

Cassman said that if global analysis of food production potential indicates it will be possible to meet food production demands on existing farmland, it would provide justification for alternative crops and cropping systems, which require considerable time and effort to develop. In contrast, if the global analysis indicates a tight race to meet future demand on existing cropland, the incremental approach to improve current crops and cropping systems would gain sway because there would be little margin for error.

In both cases, Cassman said, the answer won’t be one-size-fits-all: some areas are best suited to intensive, high-yield systems, while other locations’ soil and climate favor less intensive “alternative” farming methods.

Countries must look ahead to 2050 and determine if they have the potential to self-sufficiently feed their people, he said. If not, they must adopt an effective agricultural strategy based on a fundamental understanding of their productive capacity, including knowing where they can obtain additional food through trade with other countries.

With adequate funding, the Global Yield Gap Atlas will help answer those questions within three to four years. The team received a \$2 million grant from the Bill & Melinda Gates Foundation to work in India, Bangladesh and 10 Sub-Saharan African countries. The University of Nebraska’s Robert B. Daugherty Institute funds collaborations in Brazil and Argentina.

“If we’re serious about helping to resolve this debate, we must have certain information, basic information. Otherwise, the debate goes on ad infinitum,” Cassman said. “Obviously, we’ll never eliminate all of the disagreements, but what [the atlas] will do is help focus the debate on a more defensible set of assumptions about potential supply to meet the estimated demand, where it can be produced and the variability of that production.”

## Daugherty Water for Food Institute Extending Nebraska's Reach

New programs and partnerships through the Robert B. Daugherty Water for Food Institute (DWFI) at the University of Nebraska are extending the reach of NU faculty expertise beyond Nebraska to other regions around the globe.

One of the cornerstones of DWFI's growing reputation, its successful global Water for Food Conference, returns to Lincoln May 5-8 at the Cornhusker Marriott. The fifth annual conference, "Too Hot, Too Wet, Too Dry: Building Resilient Agroecosystems," will examine how to increase the capacity of food, water and natural ecosystems to adapt to a changing climate. For more information visit the DWFI website.

Roberto Lenton, who is beginning his second year as DWFI's executive director, cited other examples of DWFI's global engagement, including:

**The Global Yield Gap and Water Productivity Atlas**, funded by the DWFI and the Bill & Melinda Gates Foundation, is growing fast. Work is under way in South America, South Asia and Sub-Saharan Africa and is expanding to Jordan, Morocco and Tunisia in collaboration with USAID's Middle East and North Africa Network of Water Centers of Excellence. The yield gap team includes Ken Cassman, Haishun Yang, Patricio Grassini and Justin van Wart, all of the UNL Department of Agronomy and Horticulture. The first complete yield gap assessments — for Argentina and Ghana — will be launched in

February and will be available on the yield gap website.

**Master of Science dual degree program** developed by DWFI and the UNESCO-IHE Institute for Water Education in Delft, Netherlands, will be offered in September. IHE students will again visit Nebraska during this summer for a field methods course. Dean Eisenhower, a professor in UNL's Department of Biological Systems Engineering, leads this effort.

**A partnership with Jain Irrigation Systems Ltd. in Jalgaon, India**, is focusing on collaborative research and training programs in biotechnology research techniques and improving crop drought and salt tolerance, crop water productivity and irrigation management practices. Tom Clemente, UNL Department of Agronomy and Horticulture and Center for Plant Science Innovation; Harkamal Walia, UNL Department of Agronomy and Horticulture; and Suat Irmak, interim director of the Nebraska Water Center and a professor in the UNL Department of Biological Systems Engineering, lead these efforts.

**DWFI has signed an agreement with the Food and Agriculture Organization of the United Nations** to collaborate on mapping, modeling and information systems to improve agricultural water management, and on applied research projects that will support evidence-based decision-making in agricultural water management policies and practices and apply them to field programs.

### EPA *continued from page 6*

The 2008-2009 National Rivers and Stream Assessment reflects the most recent data available, and is part of EPA's expanded effort to monitor waterways in the U.S. and gather scientific data on the condition of the nation's water resources. EPA partners, including states and tribes, collected data from approximately 2,000 sites across the country.

EPA, state and university scientists analyzed the data to determine the extent to which rivers and streams support aquatic life, how major stressors may be affecting them and how conditions are changing over time.

Findings include:

**Nitrogen and phosphorus are at excessive levels.** Twenty-seven percent of the nation's rivers and streams have excessive levels of nitrogen, and 40 percent have high levels of phosphorus. Too much nitrogen and phosphorus in the water—known as nutrient pollution—causes significant increases in algae, which harms water quality, food resources and habitats, and decreases the oxygen that fish and other aquatic life need to survive.

**Streams and rivers are at increased risk due to decreased vegetation cover and increased human disturbance.** These conditions can cause streams and rivers to be more vulnerable to flooding, erosion, and pollution. Vegetation along rivers and streams slows the flow of rainwater so it does not erode stream banks, removes pollut-

ants carried by rainwater and helps maintain water temperatures that support healthy streams for aquatic life. Approximately 24 percent of the rivers and streams monitored were rated poor due to the loss of healthy vegetative cover.

**Increased bacteria levels.** High bacteria levels were found in nine percent of stream and river miles making those waters potentially unsafe for swimming and other recreation.

**Increased mercury levels.** More than 13,000 miles of rivers have fish with mercury levels that may be unsafe for human consumption. For most people, the health risk from mercury by eating fish and shellfish is not a health concern, but some fish and shellfish contain higher levels of mercury that may harm an unborn baby or young child's developing nervous system.

EPA plans to use this new data to inform decision-making about addressing critical needs around the country for rivers, streams, and other waterbodies. This comprehensive survey will also help develop improvements to monitoring these rivers and streams across jurisdictional boundaries and enhance the ability of states and tribes to assess and manage water quality to help protect our water, aquatic life, and human health.

Results are available for a dozen geographic and ecological regions of the country.

For more information go online to <http://www.epa.gov/aquatic-surveys>



was worth exploring for this year's in-state tour. They also agreed to move-up the normal tour dates by about three weeks to take advantage of the probability of cooler temperatures.

"We've held the tour in June in past years and we're hoping it's a better alternative again in terms of cooler weather. Temperatures for last year's tour in July were pretty brutal on everyone," Ress said.

"The tour will encompass several watersheds and Natural Resource Districts, and will look at both rural and urban water management issues. There will be one overnight at York."

Anticipated tour stops include:

- The Jayne Snyder Trails Center, Lincoln, with discussions hosted by the Lower Platte South NRD on the Antelope Creek project.
- Spring Creek Prairie Audubon Center near Denton.
- Monsanto Research Center near Waco for discussions on crop research and genetics.
- Preferred Sands of Genoa for viewing and discussion of sands used in the fracking industry.
- Crop demonstration sites and public works water projects in the Upper Big Blue NRD and York areas.
- Ag water management and research projects at the University of Nebraska—Lincoln's South Central Agricultural Lab near Clay Center
- A tour and discussion of the missions of the U.S. Department of Agriculture's Meat Animal Research Center near Clay Center.

- Reinke Manufacturing Co. near Deshler

Since the tour is only two days long, it is anticipated that tour completion and return to Lincoln will be around 7 p.m., Ress said.

"This is a little later than we usually end a tour and we are aware that some participants have longer drives home ahead of them after getting off the bus, but we think the later completion time is justified since we are keeping it to a two-day event."

Longer term planning is to possibly take the tour out of state in 2014 or 2015 with organizers discussing possibilities in Idaho, Oregon, Tennessee and other locations.

Tour organizers are Ress, Jeff Buettner of Central Nebraska Public Power and Irrigation District, Jennie Nollette of the Kearney Area Chamber of Commerce and retired UNL senior lecturer Mike Jess, who also hosts the tour.

This year's tour sponsors include Monsanto Company, Kearney Area Chamber of Commerce, Nebraska Public Power District, Central Nebraska Public Power and Irrigation District and the Nebraska Water Center.

Registration is \$400 per person single occupancy or \$350 per person double occupancy. To register, contact Nollette at the Kearney Chamber at (308) 237-3168 or email [jnollette@kearneycoc.org](mailto:jnollette@kearneycoc.org). Space is limited and registrations are first-come, first-served.

"Tour co-sponsors are always welcome, as are suggestions for future tour subjects and venues. If you would like to cosponsor, or have ideas email me at [sress1@unl.edu](mailto:sress1@unl.edu) or call (402) 472-9549," Ress said.

## Dr. Ray and Dr. Neale *continued from page 1*

currently the Interim Director of the Water Resources Research Center at the University of Hawaii, which like the Nebraska Water Center is part of a network of more than 54 water resources research institutes at Land Grant Universities nationwide.

He also serves as Director of the University's Environmental Center and as Chief Environmental Engineer for the Applied Research Laboratory, a U.S. Navy sponsored facility at the University of Hawaii.

Prior to joining the faculty at the University of Hawaii in 1997, Dr. Ray held positions in industry and at the Illinois State Water Survey. The holder of a Ph.D. in Civil Engineering from the University of Illinois, he has extensive experience in many facets of managing both water quantity and water quality issues.

Dr. Neale is Professor in the Irrigation Engineering Division of the Civil and Environmental Engineering Department at Utah State University, and has been a leader in remote sensing and management of agricultural water resources since joining the faculty there in 1988. The holder of a Ph.D. in Agricultural Engineering from Colorado

State University, Dr. Neale has extensive experience working in water research and management projects in the western U.S., and in South America, Africa, and the Caribbean.

He is currently president-elect of the International Commission on Remote Sensing of the International Association of Hydrological Sciences, and will assume the presidency in July 2014.

"I am delighted by the appointment of Drs. Neale and Ray," said Roberto Lenton, Executive Director of the Water for Food Institute. "They will play critically important roles in advancing the work of the water for Food Institute in Nebraska and other parts of the world facing critical water for food challenges."

The Robert B. Daugherty Water for Food Institute at the University of Nebraska is a research, education and policy analysis institute committed to helping the world efficiently use its limited freshwater resources, with particular focus on ensuring the food supply for current and future generations.

## Nebraska's NRDs *continued from page 5*

natural resources for the future generations,” said Ron Bishop, who has managed the Central Platte NRD since 1972.

NRDs were created to solve flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues. They are involved in a wide variety of projects and programs to conserve and protect the state’s natural resources. Under state law, NRDs are charged with 12 areas of responsibility including flood control, soil erosion, groundwater management and others.

“NRDs have local leadership and are primarily responsible for protecting groundwater from overuse and pollution. To accomplish this, each district also has developed and maintains a plan to protect groundwater,” said Bishop.

Groundwater management plans are supported by State law that provides districts with a variety of regulatory tools, to deal with contamination, shortages or user conflicts. Two recent examples of NRD projects highlight groundwater management through the use of conjunctive water management.

The first project by the Central Platte NRD (CPNRD), located in Grand Island, has reached agreements with three canal companies in Dawson County to implement conjunctive water use utilizing the canal systems. All three agreements protect the local agriculture economy by allowing acres to continue to be irrigated while capturing excess flows and retiming the discharges and diversions for other benefits such as recharge, the Platte River Recovery Implementation Plan that protects endangered species, and providing increased stream flows in the Platte Basin. All arrangements with the irrigation canals and the CPNRD were voluntary and provided positive benefits for all water users.

Another example is at the Upper Republican NRD (URNRD), at Imperial. In 2011 the URNRD purchased property that included 23 wells, all but five of which will be permanently retired to offset the water that will be pumped to meet the three-state compact between Colorado, Nebraska, and Kansas on Republican River water. Five wells on the northern half of the property will be used to pump water

into Rock Creek, which flows into the Republican River a few miles south of the site. Another benefit of this project will be to recharge water that supplies the Rock Creek fish hatchery operated by the Nebraska Game and Parks Commission.

Annual precipitation in Nebraska varies by nearly 20 inches per year from west to southeast. During times of excessive rainfall flooding can be a concern. To protect lives and property NRDs have constructed or maintain more than 700 flood control structures across Nebraska.

By utilizing comprehensive flood plain management techniques, the NRDs design and build dams, levees, dikes,



*NRDs have constructed or maintain more than 700 flood control structures across Nebraska. Utilizing flood plain management measures, they design and build dams, levees, dikes, drainage ditches and other structures to protect lives and property from flood waters. Shown here is Lake Wanahoo, that opened last year. The 1,777-acre recreation area features picnic shelters, a four-mile walking and biking trail, camping sites and fishing that provide much needed flood control for the area.*

drainage ditches and other structures to protect lives and property from flood waters. Many of these take advantage of opportunities of the multiple benefits the structures have to offer including fish and wildlife habitat, hiking and biking trails, groundwater recharge and surface water quality improvement. In April 2012, Lower Platte North NRD in Wahoo officially opened Lake Wanahoo. The Lake Wanahoo/Sand Creek Project began in the early 1990s as an effort to control severe flood problems on Sand and Wahoo creeks. The 1,777-acre recreation area features picnic shelters, a four-mile walking and biking trail, camping sites and fishing along with much needed flood control for the area.

Key to NRD success are strong partnerships with other organizations; partnerships that provide opportunities for land owners and provide protection and conservation of Nebraska's natural resources. In the past 41 years NRDs have partnered on many levels including local, state and national. Partners have become friends and are strong supporters of natural resources management. Working with agencies such as the USDA Natural Resources Conservation Service (NRCS), Nebraska Department of Environmental Quality (NDEQ), Nebraska Department of Natural Resources (NDNR), and the Natural Resources Commission, as well as citizen/environmental groups and landowners, NRDs combine projects and programs to protect Nebraska natural resources. These projects and programs provide flood control to protect lives and property, manage groundwater, prevent soil erosion, plant conservation trees and create fish and wildlife habitat.

An example of a unique partnership started in 2004 with the Upper Big Blue NRD at York and Cornerstone Bank signed an agreement and entered into a collaborative partnership sharing a small section of irrigated land that the bank manages to be designated as an agricultural test and education project. This project has generated a great deal of publicity and many producers in the NRD are now using this research to improve profitability of their own operations.

Historically, Nebraskans have been independent and forward thinking regarding government structures and NRDs are part of that proud tradition and continue to protect lives, property and the future of Nebraska's natural resources.

"The NRDs have only been around for over 40 years and have accomplished a great deal in that time", said Dean Edson, NARD executive director. "While many projects and actions have been undertaken the districts understand that there remains challenges with water as the need for food, fuel and fiber grows. Nebraska's leaders have created an efficient and effective management system that will sustain the resources for all uses into the future."

## Historical Timeline

A look at events that took place in Nebraska and nationwide leading to creation of Nebraska's Natural Resources Districts:

### 1870s - 1910s

- Land agents knew that stores of water lay below the ground in Central Nebraska and used it to attract settlers.
- Nebraskan J. Sterling Morton creates Arbor Day, the first holiday devoted to natural resources conservation.

### 1920s - 1930s

- Much of Nebraska and the Great Plains are devastated by the twin catastrophes of the Great Depression and the Dust Bowl.
- The U.S. Soil Conservation Service is established in 1935.

### 1940s - 1950s

- Soil and Water Conservation Districts were formed across Nebraska, by county.
- Devastating floods in the 1950s caused massive property damage and spurred major flood control projects across Nebraska. Managing the resources in the entire river basin became apparent.

### 1960s - 1970s

- In the 1960s and 1970s, groundwater irrigation became economically viable. The state legislature recognized that some local regulatory oversight needed to be put in place.
- State senator Maurice Kremer introduced and the Nebraska Legislature enacted Legislative Bill (LB) 1357 in 1969 to combine Nebraska's 154 special purpose entities into 24 Natural Resources Districts by July, 1972.

### 1980s - 1990s

- NRDs create groundwater management plans to protect Nebraska's groundwater quantity and quality.
- Because of its value to farmers and urban centers, groundwater is commonly recognized as Nebraska's most precious natural resource.

### 2000 and Beyond

- Water, and effective policies to manage and protect it, is a major NRD focus.
- Nebraska's NRDs continue to play the vital role for local control in natural resources policy.

## Experts *continued from page 3*

changes in groundwater policy aimed at improving food production. Now, she said, she and others are focused on making sure those policy changes lead to changes in farmers' behavior.

Benedito Braga, president of the World Water Council, also emphasized a need for improved policies. He noted a "silent revolution" has been underway in increased use of groundwater for irrigation, but it's happened without regulation, threatening long-term water security in some regions.

Braga warned that riots in 37 countries in 2007-08 sparked by food shortages and high prices could "be harbingers of a crisis to come."

Improved crop breeding is essential too, said Sally Mackenzie, the Ralph and Alice Raikes Chair of Plant Sciences at University of Nebraska-Lincoln.

Mackenzie's team is studying the previously untapped field of epigenetic modification of crops to make them more productive and less susceptible to hostile environments. Her work leaves the genes themselves unchanged but focuses on how genes express themselves with an eye toward ultimately manipulating those expressions to improve crops.

Illustrating the significance of epigenetics, she noted that humans and chimps share 98 percent of their genetic information.

"What we've learned from that, other than humility, is that what really differentiates us is not our genes but how we express them," Mackenzie said.

Findings so far, with both nonfood and food crops, are

encouraging in producing plants with improved biomass, vigor, stress resistance and seed production — all without changing their genetic structure, she said.

"We have not been capturing all the breeding potential that we can" without an understanding of epigenetics, Mackenzie said.

Mackenzie is part of the National Plant Science Initiative that will send a report soon to the president and Congress that offers advice on how best to meet the food challenges ahead.

The conference, whose theme is "Too Hot, Too Wet, Too Dry: Building Resilient Agroecosystems," was expected to draw nearly 500 experts from around the world working to overcome the urgent challenge of growing more food with less water. It was sponsored by Monsanto.

Additional information about the 2013 Water for Food Conference is online at: <http://waterforfood.nebraska.edu/wff2013>. The conference concluded Wednesday, May 8.

The Robert B. Daugherty Water for Food Institute (DWFI) is a research, policy analysis and education institute committed to helping the world efficiently use its limited freshwater resources, with a particular focus on ensuring the food supply for current and future generations.

Established in April 2010, DWFI focuses on fundamental and applied research to provide the knowledge base for effective, practical solutions. It is building the tools needed to guide decision-making about management of water quantity and quality and to inform policymaking at all levels.

## From the Interim Director *continued from page 2*

to attend due to my field research commitments. This was our first chance to get together since having to cancel a scheduled late January WRAP meeting due to severe winter weather that hit Lincoln.

Rachael also is currently one of three co-coordinators for this year's collection of IANR research and extension exhibits at the annual Husker Harvest Days farm show near Wood River. UNL has "themed" its research and extension exhibits there for the past six years, beginning with a water theme in 2008, and this year returns to a water efficiency and use theme, which show organizers thought was more than appropriate, given our continuing statewide drought situation and continuing Institute of Agriculture and Natural Resources focus on food, fuel and water.

Coordinating the show exhibits with Rachael are Extension Educators Chuck Burr and Jim Schild. Steve Ress, our Nebraska Water Center communicator, continues as the superintendent for UNL facilities at the show for the sixth straight year.

As Fall semester returns, we will hold our fall science and policy symposium on Oct. 15 at Lincoln's Cornhusker Hotel. The symposium will focus on the latest research, practice, programming and policy in Nebraska and the Great Plains. An invitation to present at this symposium is on our website at [watercenter.unl.edu/Symposium2013](http://watercenter.unl.edu/Symposium2013) and is open until June 17. Both oral and poster presenters are being solicited.

The following day, Oct. 16, the water law conference will be held at the same location focused on water law for practicing attorneys and water professionals. Continuing legal credits (CLEs) will be applied for in Nebraska, Colorado and Iowa.

The conference committee is currently planning the day's agenda and new information on the conference will be available online as they become available.

We hope to see you at one or both of these annual events.

## October Symposium *continued from page 1*

Water planning, especially, is currently a topic of increasing interest as sometimes competing uses vie with one another for their share of a limited and often overused resource, Benson said.

“Plenary presentations, as well as several of the afternoon breakout sessions, are designed to provide information to assist in planning efforts,” she said.

Though subject to change, since it’s still early in the symposium planning process, the day is set to open with a brief history of Nebraska water planning by retired UNL lecturer and consulting water resources engineer Mike Jess, followed by a presentation on the larger view on water planning by David Yates, National Center for Atmospheric Research and Stockholm Environment Institute.

Yates has significant expertise and experience in the water planning process, including impacts from climate change.

Following Yates, Shannon McNeeley of North Central Climate Science Center, a consortium located at Colorado State University, Fort Collins, Colo., will discuss water-related climate change adaptations. McNeeley co-wrote the adaptation chapter for the recently released National Climate Assessment Report issued by the U.S. Global Change Program and is an expert in how people respond and make decisions related to impacts from climate change.

Mike Hayes, director of UNL’s National Drought Mitigation Center, will talk about how drought planning should be incorporated into the water planning process; and Alan Tomkins, director of the NU Public Policy Center, will discuss research in which he and colleagues asked about trust in and knowledge about Nebraska’s natural resources districts, Nebraska Department of Natural Resources and other water-relevant organizations in the state.

Other scheduled speakers include Karl Brooks, director of the Region VII office of the U.S. Environmental Protection Agency, Kansas City, Mo., addressing water quality as part of comprehensive

water planning.

A call for both afternoon breakout session presenters and poster presenters remains open through June 17. Any water-related topic of interest in Nebraska and the Great Plains is welcome. Details of the call for presenters can be found online at <http://watercenter.unl.edu>.

The itinerary for Wednesday, Oct. 16’s water law conference is building, Benson said.

NU College of Law professor Anthony Schutz will open the day with Water Law 101, a primer of important statutes and cases and their context to help listeners understand how and why they developed. Other scheduled speakers include Don Blankenau of Blankenau Wilmoth Jarecke LLP, Lincoln, who will deliver an update on legal issues in the contentious Republican River basin; and David Barga of Rembolt Ludtke LLP, Lincoln, who is set to speak on implications from a recent ruling in the Columbus sewer backup case.

Nick Buda of Jacobsen, Orr, Lindstrom and Holbrook, P.C., L.L.O., Kearney, will present a fast-paced review of new laws, regulations and cases from Nebraska and around the U.S.

Several other presentations will be added to the program, including one by Steve Smith of Smith, Snyder and Pettitt, Scottsbluff, and 60 minutes of ethics. As in past years, continuing legal education credits (CLEs) will be applied for in Nebraska, Colorado and Iowa.

Though Wednesday’s conference focuses on information of interest to practicing attorneys, it is open to all.

Registration rates will remain at last year’s levels of \$155 for one day and \$270 for those electing to attend both events, Benson said. Registration is set to open early in the summer.

More information about both events, including detailed agendas and online registration, will be at [watercenter.unl.edu](http://watercenter.unl.edu) as they become available. Questions should be directed to the NWC at 402-472-3305.

## Bentonite *continued from page 6*

with a gravel-packed annulus. Research results are illustrated by pumping the wells after adding dye to represent contamination. As a well is pumped, recharge water is pulled toward the well from all directions. Contaminants can move with the water, toward the well. While water and contaminants move around the bentonite-packed annulus, they are pulled into the gravel-packed annulus and move down the annulus, past the confining layer, into the deep, confined aquifer. The deep, confined aquifer is then contaminated and all other wells drawing water from the confined aquifer are at risk. As the bentonite-packed well in the aquifer continues to be pumped, contaminants in the confined aquifer move toward the well and through the well screen. The water in the bentonite-packed well is then contaminated. This scenario accurately represents findings of the eight-year study.

While models may not duplicate the actual subsurface perfectly, they can be useful tools to illustrate key concepts. The new model

and slide show developed by UNL and DHHS clearly illustrate how a bentonite-packed well annulus prevents contaminants from entering and moving into water-bearing zones. Bentonite-packed wells do not present a contaminant pathway risk to aquifers and all wells supplied by water in those aquifers. The model graphically illustrates how a gravel-packed well does allow contaminants to enter the confined aquifer through the annulus, putting all wells in the aquifer at risk.

DHHS is proposing new well construction standards for all wells as a result of this new information. The model and slide show can help Nebraska residents understand the research, and the reason for the proposed legislation.

For more information on the model, or to schedule its use, contact Bruce Dvorak at [bdvorak1@unl.edu](mailto:bdvorak1@unl.edu) or (402) 472-3431.

## NEWS BRIEFS

### GW Foundation Launches Trivia App

The Lincoln-based Groundwater Foundation has launched “Water1der”, a mobile groundwater awareness trivia game app which is available free of charge from the Apple app store. The game is designed to educate everyone about our most precious resource – water.

The game challenges players in their knowledge of groundwater basics, pollution prevention, conservation, irrigation, the water cycle, aquifers, recycling, watersheds, water use and wells. Players “spin” a wheel to choose a category and play their way through a variety of questions and activities and then see their final score.

For more on the app, go online to [www.water1der.com](http://www.water1der.com).

“With our society turning so mobile, we thought this was a great opportunity to get groundwater awareness into the hands of everyone,” said Groundwater Foundation President Jane Griffin. “Even though it is in a game format, it’s a great educational tool for everyone and fits with the Foundation’s mission to educate and inspire to ensure clean, sustainable groundwater for future generations.”

The Water1der app is part of the Growing Groundwater Awareness in Nebraska program, funded through a grant from the Nebraska Environmental Trust.

### USGS WaterNow

For the first time, anyone can find out the current conditions on thousands of rivers and streams across the country, right from their phone, using USGS’ latest system called WaterNow.

WaterNow makes the water conditions monitored by more than 16,000 stream gauges and other sites across the country available via text or email.

Like its predecessor and companion program, WaterAlert, WaterNow seeks to make USGS gauge information for streamflow, groundwater levels, springs, water quality, and lake levels more readily available to the general public. These data have been available for over 10 years at USGS Water Data for the Nation, which requires a web browser to access.

Knowing what current water conditions are is important for a variety of purposes, from disaster planning and response to recreation. For example, water levels in streams can be checked during floods to guide evacuations or on a bright weekend morning to plan a day of paddling.

Land and resource managers can benefit from WaterNow too. Not only can water levels be checked, but also water temperatures can be checked to determine when it is necessary to release water from a reservoir to protect downstream trout fisheries.

WaterNow expands on the service provided by the USGS WaterAlert service. WaterAlert provides a notification only when conditions exceed a threshold set by a user, whereas WaterNow provides data anytime on demand. This data is collected typically at 15 to 60-minute intervals, stored onsite, and then transmitted to USGS offices every hour.

So how do you sign up? It’s easy! All you have to do is find the gauge you are interested in using (instructions are on the WaterNow page) then send a message to [WaterNow@usgs.gov](mailto:WaterNow@usgs.gov) with the site number of the gauge you would like to get updates from.

You will receive a reply within a few minutes that includes the most recent values of stream depth and flow, if available for that site. This data is by far the most frequently requested; therefore, they have been pre-set as defaults. Data values are also available for other kinds of data-collection sites such as wells, springs, and lakes.

For complete instructions and guides on what types of data might be useful to you or which stream gauges might be of interest to you, visit the USGS WaterNow site!



*Graduate students and members of the American Meteorological Society from Omaha and Lincoln share pizza on February 6 prior to an informal evening lecture and discussion by Dr. George Huffman, a NASA meteorologist. Dr. Huffman presented the spring water lecture earlier that day.*

## Water Research *continued from Back Cover*

At one time, the Aral Sea was one of the world’s largest freshwater lakes, though reduced inflows and diversion for irrigation have reduced it to 10 percent of its original area. Construction of a massive canal system in the 1950’s and 1960’s along with use of enormous quantities of now-banned chlorinated pesticides has resulted in serious water quantity and quality issues throughout the Syr Darya basin.

Although crops raised in the basin now use more modern pesticides, irrigation practices and infrastructure have not changed and residues of currently used pesticides as well as legacy pesticides such as DDT in soils, are likely carried through return flows to the river

and ultimately to the northern remnant of the Aral Sea.

Very little is known about occurrence, fate, and environmental impact of these chemicals. Future research by scientists and students at Al-Farabi KazNU hope to answer some of these questions through use of advanced analytical chemistry, including some methods developed at our NU Water Sciences Laboratory.

I am excited about the potential for collaboration and sharing knowledge in analytical chemistry with scientists and students at Al-Farabi KazNU and look forward to expanding this work in the years ahead.

# Examining *E. coli*

## What It Is:

- *Escherichia coli*, or *E. coli*, is a type of bacterium, which includes hundreds of strains. It is a type of fecal coliform bacteria, found naturally in the intestines of humans and animals. It is named after its discoverer, Theodor Escherich, a 19th-century German physician.
- *E. coli* will grow in a wide variety of intestinal conditions.
- A typical rod-shaped *E. coli* cell measures about 2 microns by 0.5 microns.

## Occurrence:

- Presence is a strong indicator of recent contamination by human sewage or animal feces. Water can test positive for coliform bacteria without *E. coli* being present.
- Found in agricultural runoff, surface water or groundwater.
- Most *E. coli* strains are harmless, but a few cause serious disease. Harmful strains include O157:H7, O121 and O104:H21.
- Humans can ingest *E. coli* by eating insufficiently cooked ground beef, hamburger or salami; eating unwashed, contaminated fresh vegetables; drinking unpasteurized milk or juice; or swimming in or drinking sewage-contaminated water.

## Health Effects:

- *E. coli* infection produces everything from no symptoms to bloody diarrhea, abdominal cramps, nausea and vomiting. Most people recover without treatment within 10 days. Some *E. coli* strains also can cause urinary tract infections and neonatal meningitis.
- In young children, the elderly and the immunocompromised, *E. coli* O157:H7 can cause a life-threatening condition: hemolytic ure-

mic syndrome, which destroys red blood cells and causes kidney failure.

## In The News:

- Illness-causing *E. coli* in ground beef and spinach sold in supermarkets or restaurants has been in the news recently. One major O157:H7 outbreak was due to contaminated groundwater: In 1999 at the Washington County Fair in upstate New York, a well at the fair used for drinking and food preparation was contaminated by manure from a nearby animal barn. The result was two deaths, 65 people hospitalized and more than 1,000 sickened.

## Regulation:

- The U.S. Environmental Protection Agency (EPA) requires regular testing by public water systems for coliform bacteria under the Total Coliform Rule. The maximum contaminant level (MCL) goal for total coliforms is zero. If more than 5 percent of a system's samples taken each month detect coliforms, this must be reported to the public, the system must continue testing, and it may need to take immediate corrective action. Detection of *E. coli* in this process creates a "direct health risk." Testing frequency is determined by system size. Rule does not apply to private wells (EPA recommends regular testing).

## Water Treatment:

- Highly effective at *E. coli* removal: ultrafiltration, nanofiltration, reverse osmosis, distillation, ultraviolet, chlorination, ozone, boiling.

(Editor's Note: from EPA, U.S. Centers for Disease Control and Prevention, WebMD®.)

# UNL Extension Irrigation and Soils Courses Online

University of Nebraska–Lincoln Extension provides two online short courses on irrigation and soils at [marketplace.unl.edu](http://marketplace.unl.edu).

The courses combine the convenience and flexibility of online learning with the opportunity to obtain continuing education unit (CEU) credits.

UNL Extension educator Chuck Burr said the virtual learning environment is especially suited for those whose schedules or location may prevent them from attending traditional extension training opportunities. The modules are intended for crop consultants, agency personnel, crop producers and others interested in improving their soil science or soil fertility management and irrigation management skills.

UNL Extension educator Keith Glewen added, "The courses are designed to assist online learners in acquiring new knowledge. This in turn can result in management decisions which have a positive impact on financial and environmental outcomes."

The soils course aims to expand the participant's knowledge of soil science, including the origins, physical properties and chemical properties of soil. Understanding this information benefits those making management decisions related to soil fertility and crop produc-

tion. This in turn can improve the efficiency of fertilizer applications, reduce nutrient loss and improve crop yields.

The irrigation management course will help increase awareness and understanding of irrigation management concepts. Agricultural water users can optimize water use efficiency and protect the quality of water resources by applying basic information about irrigation systems, crop water use and management practices.

Reducing irrigation application amounts and increasing uniformity of application leads to reduced deep percolation and runoff. The result can be reduced irrigation costs, increased efficiency, increased yields and reduced surface and groundwater contamination.

Formal admission to UNL is not required to enroll in the short courses. Register online at [marketplace.unl.edu/extension/registration](http://marketplace.unl.edu/extension/registration). The registration fee for each course is \$50. CEU credit is available for an additional \$10 per credit with a maximum of 13 credits per course.

Contact Burr at [chuck.burr@unl.edu](mailto:chuck.burr@unl.edu) for details on the irrigation short course and Glewen at [kglewen1@unl.edu](mailto:kglewen1@unl.edu) for information on the soils short course.

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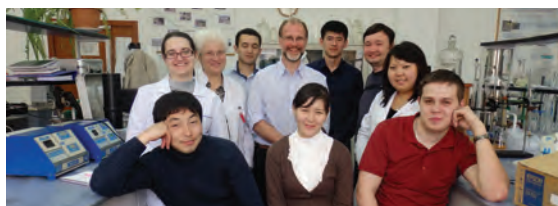
## Water Research in Kazakhstan

By Daniel Snow, Ph.D., Director of Laboratory Services, NU Water Sciences Laboratory

The economy in central Asia's Kazakhstan is currently doing well these days, mainly from development of abundant petroleum and mineral deposits. The world's largest landlocked country, formerly part of the Soviet Union, is investing some of this revenue toward building capacity in science and engineering research.

Water research is high on that list of priorities, given uneven distribution of water resources, a history of contamination from nuclear testing and agriculture, and complications from transboundary water use.

Earlier this semester I was fortunate to travel to Al-Farabi Kazakh National University (Al-Farabi KazNU) in Almaty, Kazakhstan to lecture on environmental mass spectrometry and learn about opportunities for collaborative water resources research. Professor and Vice Rector Mukhambetkali Burkitbekov supported this visit through the Ministry of Education and Science visiting scholars program. Burkitbekov has led multiple international research projects investi-



*University of Nebraska research associate professor Daniel Snow, director of laboratory services at the NU Water Sciences Laboratory (center) with Dr. Bolat Uralbekov (back right), his staff and students in the Marie Skłodowska-Curie Radiation Ecology Laboratory at Al-Farabi Kazakh National University, Almaty, Kazakhstan.*

gating environmental impacts of radioactivity, including NATO "Science for Peace" -sponsored projects investigating the legacy of Soviet weapons testing near the Semipalitinsk nuclear test site.

Environmental radioactivity and impacts to water quality is also a concern from uranium mining, as Kazakhstan is one of the world's three leading producers of uranium ore. A research paper published last year on uranium isotopes in the Shu River, flowing between the borders of

Kazakhstan and Kyrgyzstan, led me to contact Dr. Uralbekov about our research on uranium here in Nebraska.

Uralbekov, a former student of Burkitbekov's and now a KazNU faculty member, is interested in collaborating on the occurrence and use of uranium isotopes in groundwater and surface water, as well as building capacity in environmental analytical chemistry. They now have a project investigating the impact of uranium mining in the Syr Darya river basin, one of the two major rivers draining into the Aral Sea.

*continued on page 14*