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Spring 2009

## Water Current, Volume 41, No. 2, Spring 2009

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"Water Current, Volume 41, No. 2, Spring 2009" (2009). *Water Current Newsletter*. 235.  
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## MEET THE FACULTY

## Jesse T. Korus

Jesse T. Korus is the groundwater resources coordinator in the University of Nebraska–Lincoln's Conservation and Survey Division, part of UNL's School of Natural Resources. He has been at UNL since December 2008.



## Current Programming:

My work includes aspects of groundwater data collection and management, as well as applied hydrogeologic research. I coordinate the Statewide Groundwater Level Monitoring Program, which involves 27 different agencies and thousands of observation wells throughout the State. I use this information to assess groundwater level changes and assist management agencies in protecting groundwater resources. I use groundwater models to understand long-term changes in ground- and surface-water systems under the influence of

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## Water Current

PART OF THE SCHOOL OF NATURAL RESOURCES

## Fall Symposium: Platte River Basin Science and Resource Management – October 14 and 15 in Kearney

The latest Platte River research and management efforts, including adaptive management, will be showcased at a Platte River symposium in October.

The symposium takes the place of the usual fall research colloquium, normally held on the University of Nebraska–Lincoln's East Campus. The symposium is Oct. 14 and 15, in Kearney.

The Platte River Basin Science and Resource Management Symposium will examine research and management from the physical sciences to the human dimensions aspects of economics, sociology, law and policy. The entire reach of the Platte River, including the North and South Platte Rivers, will be examined.

"Anyone doing research or management work on the Platte River will be invited to submit abstracts to be an oral or poster presenter," said organizer Lorrie Benson, assistant director of the UNL Water Center.

The symposium opens the afternoon of October 14 with tours on the Platte and will include an informal evening reception and dinner. The symposium continues the following

day with a series of fast-paced presentations from researchers and managers.

Posters will be available for viewing both days.

The call for abstracts is open until June 1 and registration will open in late July. Symposium information, including information on submitting abstracts, is online at [watercenter.unl.edu](http://watercenter.unl.edu) as it becomes available.

The event is cosponsored and hosted by the UNL Water Center, U.S. Geological Survey Nebraska Water Science Center, Platte River Recovery Implementation Program and Headwaters Corporation.

Researchers and resources managers from across the Platte basin, including those in Colorado and Wyoming, are being invited to attend the symposium.

Address questions to Benson at (402) 472-7372 or [lbenson2@unl.edu](mailto:lbenson2@unl.edu).



## WRAP Exploring Critical Issues

By Rachael Herpel, UNL Water Center and NU Rural Initiative

The University of Nebraska–Lincoln's Water Resources Advisory Panel (WRAP) met April 27 to share information on their own work and learn about other recent developments at UNL.

Prem Paul, UNL Vice Chancellor

for Research and Economic Development, described two efforts that build upon existing and developing partnerships to address critical needs. The first is to understand the impact of climate change; the second is to grow more food with less water. *continued on page 7*

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 Director

**Dr. Kyle Hoagland**

# UNL to Announce Formation of the Global Water Institute

This is the real deal water fans!

As a member of the planning committee for the Future of Water for Food Conference that was held in Hardin Hall, May 3-5 (along with Shashi Verma and Don Wilhite in the School of Natural Resources, other water-related faculty, industry and federal agency representatives), it was truly satisfying to see all of the conference-related planning efforts over the past eight months come to fruition.

The FWF Conference was hosted by NU President J.B. Milliken and Bill and Melinda Gates Foundation CEO Jeff Raikes, and produced by the UNL Office of Research under the direction of Vice Chancellor Prem Paul. The conference did an outstanding job of promoting dialogue among experts from around the world (including Pakistan, Australia, and Africa), both to assist in identifying key themes regarding the future use of water for agriculture, as well as exploring the role and niche that a new Global Water Institute should fill in addressing this core theme.

Conference attendees clearly articulated the need for the GWI to help both Nebraska and the world efficiently use its limited freshwater resources to ensure a food supply for present and future generations. The following is the abbreviated agenda from the conference:

- “*Fighting Poverty with Water*” (Keynote Address) Jeff Raikes, Chief Executive Officer, Bill and Melinda Gates Foundation
- “*The Significance of Water to Nebraska*” James Goeke, Professor, University of Nebraska–Lincoln School of Natural Resources
- “*The Role of Irrigation in Meeting the Global Water Challenge*” Peter P. Rogers, Gordon McKay Professor of Environmental

Engineering, Harvard University

- “*Use of Water for Agriculture in Pakistan: Experiences and Challenges*” Simi Saraf

Kamal, Chairperson and Chief Executive, Hisaar Foundation, Pakistan

- “*Water Science and Research Issues Associated with the Future of Water for Food*” Richard G. Allen, Professor of Water Resources Engineering, University of Idaho
- “*America’s Water Crisis and What to Do About It*” Robert Glennon, Morris K. Udall Professor of Law and Public Policy, University of Arizona Rogers College of Law
- “*How Do We Grow More Food with Less Water?*” Science and Technology Panel Discussion (panelists: Ramesh Kanwar, Iowa State University; Brian A. Larkins, University of Arizona; Judith C.N. Lungu, University of Zambia; Vincent Vadez, Principal Scientist, International Crops Research Institute for the Semi-Arid Tropics; Ron Yoder, University of Nebraska–Lincoln)
- “*The Costs of Water*” Policy and Human Dimensions Panel Discussion (panelists: Marc Andreini, International Water Management Institute; Sandra Postel, Global Water Policy Project; Dan Tarlock, Otto Szolosi, Charles Sturt University, Australia; Sandra Zellmer, University of Nebraska College of Law)

The remainder of the conference was devoted to working groups charged with

*continued on page 5*



## Mehmet Can Vuran, Ph.D.

Mehmet Can Vuran is an assistant professor in the University of Nebraska–Lincoln's Department of Computer Science and Engineering. He has been a member of the UNL faculty since August 2007. Prior to arriving at UNL, he was a graduate research assistant in the Broadband and Wireless Networking Laboratory in the School of Electrical and Computer Engineering at Georgia Institute of Technology, Atlanta, Ga.

### Education:

Ph.D., Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Ga. (2007).

M.S., Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Ga. (2004).

B.S., Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey (2002).

### Examples of Current Research/Extension Programs:

*Empirical Study and Simulation of the Underground Channel for Wireless Underground Sensor Networks:* Wireless Underground Sensor Networks (WUSNs), which consist of wireless sensors buried underground, is a field that promises several remarkable merits including concealment, ease of deployment, timeliness of data, and reliability compared to existing wired underground sensing techniques. The realization of WUSNs will lead to several applications in the fields of

environmental monitoring, intelligent irrigation, infrastructure monitoring and border patrol. Despite its potential advantages, the realization of WUSNs faces challenges in terms of realizing efficient and reliable underground wireless links. Underground networks is one of the few fields where the environment has a significant impact on the communication performance. The changes in temperature, weather, soil moisture, soil composition and depth directly impact how these networks operate. In this project, a generic framework for underground wireless communication is being developed, where the effects of soil properties and weather on wireless communication are identified through extensive experimental studies in UNL City Campus. The empirical results of this study are also leveraged to implement a software module that emulates the underground wireless channel for the proliferation of communication protocol design in this area. This project is funded by UNL Research Council.

### Teaching:

CSCE 990 Sensor Networks (Fall 2007)

CSCE 496/896 Embedded Systems (Spring 2008)

CSCE 496/896 Sensor Networks (Fall 2008)

CSCE 496/896 Embedded Systems (Spring 2009)

*continued on page 11*



## Jesse T. Korus *continued from page 1*

pumping. Another aspect of my work includes characterizing geology in three dimensions using a combination of traditional methods, such as test hole drilling and state-of-the-art methods, such as airborne and ground-based geophysics.

### Examples of Past Programming:

I have conducted applied research related to point and non-point source contamination of groundwater, stream-aquifer interconnections, and aquifer vulnerability to contamination. I have provided service to individuals and communities seeking help in evaluating, understanding, and developing their water supplies. I have also conducted geologic studies to investigate complex sedimentary rock layers laid down in ancient stream, delta and estuary environments.

### Examples of Outreach Programs:

I have been host of "Water Jeopardy" at Lincoln's Earth Wellness Festival for the past few years. In this version of the popular T.V. game show, fifth and sixth graders can choose between different categories ranging from streams to wells to aquatic organisms. We use a

computer program with a T.V. monitor and hand-held triggers to give the students a more realistic experience of the game, promoting fun in learning about water.

### Selected Publications:

- Divine, D.P., Joeckel, R.M., Korus, J.T., Hanson, P.R., and Lackey, S.O., 2009, Eastern Nebraska Water Resources Assessment (ENWRA), Introduction to a hydrogeological study: Bulletin 1 (new series), Conservation and Survey Division, School of Natural Resources, University of Nebraska–Lincoln, 31 pp.
- Korus, J.T., Kvale, E.P., Eriksson, K.A., and Joeckel, R.M., 2008, Compound paleovalley fills in the Lower Pennsylvanian New River Formation, West Virginia, USA: *Sedimentary Geology*, v. 208, p. 15-26.

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## Emerging Contaminants in Natural Waterways: Where is the Smoking Gun?

By Alan S. Kolok, Ph.D., Aquatic Toxicologist, Department of Biology, UNO and Department of Environmental, Agricultural and Occupational Health, UNMC

If one had to choose a signature issue for the field of endocrine disruption, a good choice would be the plight of smallmouth bass living in the Potomac River. In 2004, a *Washington Post* article highlighted an ongoing research project by the US Geological Survey that discovered that male smallmouth bass in the Potomac River were laying eggs.

Imagine it, the river that forms part of the border between Maryland and Washington, D.C. as an aqueous testimonial to the reality of endocrine disruption, and right on the doorstep of the national government. If this isn't a poignant call to action aimed at our legislators, I don't know what is.

Since the initial publicity of feminized male fish in the Potomac River, scientists from the U.S. Fish and Wildlife Service and the U.S. Geological Survey have been attempting to link the incidence of intersex to water pollutants. Intersex is the condition in which organisms exhibit biological characteris-

tics of both the male and female sexes, and the presence of eggs in male fish is a classic example. Since it has been well documented in laboratory studies that exposure to water pollutants can cause intersex, the attempt to link a chemical contaminant to it is certainly prudent. However, a recent update published in the *Washington Post* on April 22, 2009 highlights the fact that relationships between organic pollutants and intersex can be very difficult to establish. Despite the fact that the research efforts of two federal agencies have been brought to bear on this issue, the smoking gun that links the presence of an emerging contaminant to intersex has not been found.

One of the first places that the scientists looked for the causative agent of intersex was downstream from wastewater treatment plants. Pharmaceuticals, steroids and cleaning compounds can pass through some wastewater treatment plants intact, therefore sampling downstream from them was a good

place to begin. Fish collected from these sites experienced alarmingly high rates of intersex, but no different from that of fish collected in cleaner waters upstream. These results have led to the speculation that the bass intersex could be due to exposure to a pharmaceutical or an agricultural compound or something else entirely. Furthermore, the scientists have speculated that the problem may be caused by a mixture of pollutants, arising from human sewage, animal hormones from farm manure and pesticide runoff. Not a very convincing conclusion from a multi-year, multiagency environmental study!

What a far cry from the definitive studies of the 1960s and '70s. In those days the issue was one of point source contamination that is, industrial contaminants being discharged through pipelines into local water bodies. The signature issue of the time was industrial contamination in the Great lakes, and it was quite visible as exemplified by the fact that the Cuyahoga River really did catch on fire. The visibility of these issues led, in part, to some key federal legislation including the creation of the US Environmental Protection Agency in 1970 and the enactment of the Clean Water Act in 1972. After the enactment of those pieces of legislation, the clean up of the Great Lakes proceeded, to a large degree, successfully.

Why is it that a clear cause-and-effect relationship is not forthcoming in the studies on the Potomac?

Simply put, the reason is that the issues regarding water quality that we are struggling with today are much more difficult to solve. For one thing, as I have discussed in a previous *Water Current* article (Summer 2008 issue), emerging contaminants are having effects at levels that were analytically unquantifiable just a few years ago.

*continued on page 7*



Alan Kolok of UNO and UNMC (IANR photo by Brett Hampton).

## Featured Partner:

# NACEE: Nebraska Alliance for Conservation and Environmental Education

By Duane Mohlman

Nebraska Alliance for Conservation and Environment Education (NACEE) is a statewide non-profit organization seeking to foster an environmentally literate Nebraska citizenry and serves as a leader in conservation and environment education.

Formed in 2001 from a merger of the Nebraska Environmental Education Association and the Nebraska Organization for Environmental Education, NACEE aims to promote and strengthen environmental education in Nebraska.

A NACEE strength is its diverse mix of member talents, interests and knowledge. Membership is comprised of a wide variety of organizations and individuals including classroom teachers, environmental educators, government agency representative, nature centers and environmental organizations. NACEE currently has about 90 members and is governed by a nine-member board, all of which hold environmentally-related professional positions.

Annual individual membership is \$15 (students \$10). Three levels of organizational memberships are also available.

If you are interested in environmental education, NACEE provides a number of

excellent resources. It publishes a quarterly newsletter called *Environmental Education Connections*. EEC is a joint newsletter of NACEE, Project WILD, Project WET, Project Learning Tree, and the Leopold Education Project in Nebraska. It is mailed without charge to anyone who has participated in one of these projects, as well as NACEE members.

The 16-page, magazine-style newsletter, is loaded with news items, updates, educational resources, upcoming events and funding opportunities. To encourage discussion among members, and to quickly spread the word about important news, a NACEE listserv, hosted by the University of Nebraska-Lincoln, is also available. Visit NACEE online at <http://www.nacee.org>, for additional resources and membership information.

NACEE hosts an annual two-day conference, with the coming conference being May 29-30 in Kearney. This year's theme is *Location, Location, Location: Exploring Nature in Your Neighborhood*. It will explore service learning and Nebraska's natural history, and will feature new environmental education resources, programs and events, concurrent sessions, field trips and round-table discussions. An optional four-hour

pre-conference workshop, *Environmental Education Guidelines Training*, will be the afternoon of May 28. A downloadable conference brochure is available at [http://www.nacee.org/pdfs/09\\_conference\\_schedule.pdf](http://www.nacee.org/pdfs/09_conference_schedule.pdf).

"The annual NACEE conference is a great opportunity for Nebraska teachers, resource professionals, and environmental educators to network and learn more about new and existing programs for environment education in our state.

"This year's conference is filled with great concurrent sessions and field trips to help Nebraskans enhance conservation and environmental education efforts" said Lindsay Rogers, NACEE Board Member.

For more about NACEE, go online to <http://www.nacee.org/>, e-mail [nacee@lpnrd.org](mailto:nacee@lpnrd.org), or write to NACEE, PO Box 85344, Lincoln, NE 68501.

*(Editor's Note: This is the first of a new Water Current series featuring Nebraska environmental non-governmental groups, organizations and/or partners of the UNL Water Center. By featuring these groups we hope to promote their good work).*

## From the Director

*continued from page 2*

completing a "white paper" which will summarize the conference outcomes, with recommendations regarding the mission and focus of the GWI.

Hopefully, the GWI will be primarily, or at least in part, funded by an endowment from the Daugherty Foundation and the Bill and

Melinda Gates Foundation (the Daugherty Foundation and the University of Nebraska Foundation provided financial support to stage the conference). The University's commitment to the GWI has come from the highest levels of NU administration, with *both* Milliken and UNL Chancellor Harvey Perl-

man attending the entire conference!

I can attest to the fact that this is one of the best received and finest conferences ever offered by UNL. The new *Global Water Institute* will certainly put the University of Nebraska on the *world* water map!

## Protect State's Legacy of Living Rivers

By Sandra Zellmer,  
UNL College of Law

A bill pending before the Legislature could strangle the lifeblood from Nebraska's rivers and streams. By prohibiting instream appropriations in fully appropriated watersheds, LB438 would leave our most treasured waterways vulnerable to depletion.

Existing law aspires to protect the waters of Nebraska's streams for fish, wildlife, recreation and the well being of present and future generations. The integrated water management provisions of LB962, enacted in 2004, impose a stay on the issuance of surface water permits when a basin is declared fully appropriated (that is, where existing uses of water equal the available supply). However, exceptions are authorized for transfers to new uses, such as dedications to instream flow protection, and for "good cause," which includes nonconsumptive uses such as preserving flows. These provisions were adopted to ensure the state's economic viability as well as human and environmental health.

Adequate flows are the essence of a stream. Streams aren't simply water delivery

structures. Healthy streams maintain land values, meet the needs of fish and wildlife, and support recreation of all types, such as fishing, hunting and boating. We rely upon them to perform many ecosystem services including livestock watering, groundwater recharge and dilution of sewage and other pollutants.

Indeed, Nebraska's future economic vitality would be threatened if our streams' needs were ignored. This may be why 81 percent of Nebraskans support protecting instream flows for fish and wildlife, while 69 percent support protection for canoeing, swimming and other recreational uses, according to a 2008 survey by UNL's Bureau of Sociological Research. Too many western states set upon a path of development that left their streambeds virtually empty.

Without protection, streams became little more than concrete ditches. Residents demanded that the law protect the streams they loved. Today, the majority of western states, such as Nebraska, have adopted some form of instream flow legislation. There is

no reason to worry about instream appropriations running rampant and "locking up" the state's resources. Since the passage of its instream flow law in 1984, only 285 miles (two percent) of Nebraska's 12,371 miles of streams have received protection.

This is because of the strict limitations placed on instream appropriations. First, instream flows may only be appropriated to maintain existing recreational uses or existing fish and wildlife species. And, like several other states, Nebraska allows only the Game and Parks Commission and the Natural Resource Districts to hold instream flow rights. Nebraska imposes a public interest review on instream applications and requires them to be weighed against specified economic and social values.

Once granted, instream appropriations are reviewed every 15 years to ensure that they remain in the public interest. Finally, instream appropriations cannot interfere with senior appropriations. Because they are relatively recent, they can only safeguard a stream against diversions by more junior users.

## Zellmer Authors Book Chapter

Professor Sandra Zellmer, University of Nebraska-Lincoln College of Law, has published a book chapter entitled *United States: The Emergence of Environmental Considerations* in *The Evolution of the Law and Politics of Water* (Springer 2009).

The book is an overview of historic and global trends in water law and policy, identifies key research questions for decision makers and assesses current global water governance, its evolving characteristics, and the national and international legal theories at play.

Zellmer's chapter traces the emergence of environmental considerations in U.S. water law, beginning with colonial America and proceeding through the Gilded Age of industrialization, the Progressive Era of wise use, the New Deal and the rise of the federal administrative state, and the modern environmental era.

A thumbnail of the book can be found online at [http://www.springer.com/law/environmental/book/978-1-4020-9866-6?detailsPage=common|tell\\_a\\_friend](http://www.springer.com/law/environmental/book/978-1-4020-9866-6?detailsPage=common|tell_a_friend).

*The Evolution of the Law and Politics of Water* is the first volume to take a global perspective on the evolution of water law and policy. It describes global patterns and sets forth the particulars of eight national legal systems drawn from every continent and five regional or supranational systems, as well as the body of customary international law as a whole.

The book is particularly useful for academics in law, policy, political science, environment, water and hydrology; government agencies, commercial water concerns and non-governmental organizations.





Also, instream appropriations apply only to the stream segment covered in the application. Once the water passes through that segment, it can be put to use by downstream appropriators. Rather than restricting instream appropriations even further, it would be wise to expand flow protections in order to maintain the critical ecosystem services and economic benefits that our streams provide.

In most of Nebraska's basins, including the Niobrara and the Platte, contentious fights over whether a stream is, in fact, fully appropriated have generated a knee-jerk hostility toward in-stream

uses. It is difficult to cope with the idea that our demands have met our supply. But eliminating the ability to maintain some water in the stream cannot create more water. It simply ignores the most important demand that we make of our streams — that they be streams.

Zellmer is a Professor at the University of Nebraska College of Law. The views expressed here are personal and do not reflect a position of the university.

(Editor's Note: This editorial appeared in the Feb. 5 issue of the *Lincoln Journal-Star*).

## Emerging Contaminants in Natural Waterways: Where is the Smoking Gun? continued from page 4

The issue is no longer only one of toxicity, but now also includes the hijacking of cell signaling pathways. As discussed in previous issues of the *Water Current*, this signal mimicry can occur at astonishingly low exposure concentrations, and can lead to bizarre changes in development, such as the development of ovarian follicles within the testes of male fish.

In addition, the sources of the contaminants may be much less visible than those being released from an industrial discharge pipe. The sources could very well be from the waste products of the animals that we consume, or from the chemicals that we apply to our croplands and to our lawns. If so, there is no discharge structure, but rather an insidious trickle of effluent from a very large number of sources. Furthermore, these compounds may not remain in one

form in the environment, but rather may morph into an array of different metabolites each one with its one relative environmental potency. How do the scientists working on the Potomac River identify and characterize the effects of all of these compounds? It is a daunting task, indeed.

The lack of a smoking gun in the Potomac River study should not be viewed as disempowering, but rather as a testimonial to the difficulty of the problem that we are being faced with.

These problems are solvable although it may take substantial scientific innovation and a reinvigorated dose of political will to do so. The Potomac River is not on fire, as was the Cuyahoga, however male bass laying eggs may be prove to be one of the signature water quality issues of our time.

## WRAP Exploring Critical Issues continued from page 1

The growing consensus is that climate change is occurring; and regardless of whether it is caused by humans, humans will have to adapt to whatever conditions a changing climate may bring. In 2008 UNL and the U.S. Geological Survey joined forces to host a climate change workshop and discuss how to partner to better understand, adapt to and mitigate the impacts of climate change in the Platte River Basin and in the High Plains.

Paul shared copies of the workshop proceedings, *Sustainability in a Time of Climate Change: Developing an Intensive Research Framework for the Platte River Basin and the High Plains*. These proceedings are also available online at [http://research.unl.edu/docs/climatechangereport\\_final.pdf](http://research.unl.edu/docs/climatechangereport_final.pdf). They describe how the High Plains region is an excellent natural laboratory to study the effects of climate change.

Growing more food with less water was the focus of a May 4 "The Future of Water for Food" conference. Paul explained how this conference would bring positive attention to UNL water research and lay the groundwork for a global water institute. A conference report will inform university administrators and partners as they secure support and organize the institute.

WRAP members reviewed their website at [water.unl.edu/wrap](http://water.unl.edu/wrap). A members only section features information about projects currently underway, proposals ranked but projects not underway, proposals for consideration, and archives.

WRAP members also reviewed the outcomes of a water quality summit held April 21. The summit was organized by the Water Center so members of WRAP's water quality work group could meet with faculty to discuss research priorities.

Fifteen researchers from departments that included Biology, Natural Resources, Civil Engineering, Biological Systems Engineering, Architecture and Geosciences, discussed WRAP's draft research priorities. Faculty suggested WRAP focus on cross-cutting topics that organize diverse faculty to produce new knowledge of local, state, and national importance.

WRAP members concluded the meeting by agreeing to rank the revised research priorities and water quality research topics developed at the water quality summit. Members then asked to see the more detailed proposals written in response to their first priority list and how research completed or underway corresponds with WRAP's draft research priorities.



## Sixth Annual University of Nebraska–Lincoln Water Law, Policy and Science Conference: *“Blue Gold: When Water Meets Money”* April 29, 30 Embassy Suites Hotel, Lincoln

Presented by University of Nebraska–Lincoln Office of Research, Water Resources Research Initiative, Institute of Agriculture and Natural Resources, Water Center, School of Natural Resources and College of Journalism and Mass Communications.



University of Nebraska President J.B. Milliken opened the sixth annual UNL conference.



Tricia Liedle and Pat Jarecke man the registration desk at the Embassy Suites.



The conference drew an attendance of nearly 200.



In the conference's law track, David Barfield, director of the Kansas Division of Water Resources talked about the view of interstate compact issues on the Republican River basin from a Kansas point of view.



Listening to a session in the conference's second day law track.



National Drought Mitigation Center director Mike Hayes spoke on what climate change may mean.



Ari Michelsen of Texas A&M University delivered the conference keynote on the "Economics of Water."

Anne McKinnon, former editor-in-chief of the Casper Star-Tribune titled her conference talk "Under Construction: Compensating for Ecosystem Services on the Ditch-Bank."



Garth Taylor, University of Idaho, spoke on hydrologic externalities and water markets.



Christopher Goemans, Colorado State University, spoke on ways to put value on water.

Lash Chaffin moderated a panel discussion that included Suzanna Glover-Ettrich, Nebraska Department of Health and Human Services; Jean Angell, Nebraska Department of Natural Resources; Jeff Schroeder, Attorney General's Office Department of Roads; Annette Kovar, Nebraska Department of Environmental Quality; Richard Totten, U.S. Army Corps of Engineers; and David Cozad, U.S. Environmental Protection Agency.



Ann Bleed of CDR Associates spoke on evaluating the hydrologic cost of water transfers.





## Rain Gardens and Urban Stormwater Management Education in Nebraska

By Steven N. Rodie, Ph.D., Landscape Horticulture Specialist, UNL Department of Agronomy and Horticulture  
Thomas G. Franti, Ph.D., PE, Surface Water Management Engineer, UNL Department of Biological Systems Engineering

**R**ain gardens are currently in the stormwater management spotlight.

Landscape lovers, stormwater managers and native plant enthusiasts are in mutual support of this relatively new stormwater management practice that both controls urban pollution and adds an aesthetic feature to lawns and landscapes.

Rain gardens have a proven track record across the country as an effective stormwater management tool that can benefit urban water quality and reduce runoff.

Their popularity is growing in Nebraska, and many people want to know more about rain garden aesthetics and function.

A rain garden is designed as a small depression in the landscape with mounded soil (soil berm) around three sides that captures rainwater and allows it to infiltrate into the soil.

The garden is typically planted with flowering shrubs, forbs and grasses. The rainwater can be directed from any hard or vegetated surface where runoff tends to collect, such as a rooftop, driveway, patio, or turf area. The garden is sized based upon the amount of surface where runoff is collected (for example, the area of a roof) and the type of soil in the garden. Gardens are designed to hold the water from 90 percent of all rainfalls that occur in a

given location. In Western Nebraska, 90 percent of rain events produce a half-inch or less of precipitation; in Eastern Nebraska, this amount is approximately 0.85 inches or less.

For these amounts of rain, the rain garden holds the entire storm run-off and allows the water to drain into the soil in 24 to 48 hours. For the 10 percent of storms that exceed rain garden capacity, the water overflows to a predetermined location.

On average, rain gardens sized to capture roof runoff from one roof downspout on a typical residential lot with adequate soil infiltration range from 100 to 300 square feet.

General rules-of-thumb for successful rain garden design and implementation include:

- Ponded water should drain away in less than 48 hours (for plant health as well as elimination of mosquito potential)
- The average depth should be 4-8 inches, with a level bottom
- Build only if soil infiltration tests indicate a minimum infiltration rate of one-

quarter inch per hour; if not then soil drainage improvement methods will be needed or an alternative site will be required

- Locate rain gardens at least 10 feet from house foundations, 25 feet from wellheads or septic systems, and down slope from homes or other buildings
- Plant only deep-rooted native and adapted plants that tolerate swings of wet and dry soils, provide season-



al interest and habitat value, and stay relatively short so as not to flop over and appear weedy

- Include an overflow point in the soil berm so that when the garden fills from a heavy rainfall, excess water is properly released without causing soil erosion
- Use organic mulch to minimize weed growth and moisture loss during dry periods; wood mulch with a shredded, not blocky texture, will tend to lock together and will not float when water fills the garden
- Establish plants with supplemental water to help young plantings during dry periods, and provide regular maintenance to renew mulch and inventory plant health

UNL Extension has recently formed an urban stormwater management group. The group, co-led by Kelly Feehan, Extension Educator and Steven Rodie, Landscape Horticulture Specialist, is leading efforts to expand Nebraska stormwater educational materials and programs on rain gardens and other best management practices.

Audiences include homeowners, green industry designers and managers, communities across Nebraska as required by federal and state regulations (under Phase II of the National Pollutant Discharge Elimination System (NPDES) permit program), and land managers and developers.



*This rain garden figures prominently in the landscape of a Kansas City, Mo. Church (photo courtesy Steve Rodie).*

Additionally, curriculum is being developed for students, ranging from 4-H lessons for middle school programs, to studio projects for landscape architecture students at UNL.

To-date, the work group has held two rain garden design workshops and two extension in-service site tours; produced eight publications on rain gardens and other best management practices; developed three major sections on the UNL Water Website (Lawns, Landscapes and Gardens; Lawn and Landscape Irrigation; and Property Design and Management); produced a five-minute segment on residential best management practices for a Nebraska Educational

Television documentary on stormwater issues in Omaha; constructed a working rain garden model of a residential site to illustrate rain garden concepts at public events; and scheduled numerous presentations across the state and region on rain gardens and urban stormwater best management practices.

More specific information on rain garden design, construction and plant selection, together with additional materials on topics such as home and yard water pollutants, soil management, and best management practices for large-scale land development, can be found online at [water.unl.edu/landscapes](http://water.unl.edu/landscapes).

## Meet the Faculty *continued from page 3*

### Mehmet Can Vuran, Ph.D.

#### Selected Publications:

- M. C. Vuran and I. F. Akyildiz, "Error Control in Wireless Sensor Networks: A Cross-layer Analysis," to appear in **IEEE/ACM Transactions on Networking**, 2009.
- I. F. Akyildiz, M. C. Vuran, and Z. Sun, "Channel Modeling and Analysis Solutions for Wireless Communication in Soil, Mines, and Tunnels," to appear in **Physical Communication Journal (Elsevier)**, 2009.
- M. C. Vuran and I. F. Akyildiz, "Packet Size Optimization for Wireless Terrestrial, Underwater, and Underground Sensor Networks," in **Proc. IEEE INFOCOM'08**, Phoenix, AZ, April 2008.
- L. Li, M. C. Vuran, and I. F. Akyildiz, "Characteristics of Underground Channel for Wireless Underground Sensor Networks," in **Proc. Med-Hoc-Net '07**, Corfu, Greece, June 2007.
- M. C. Vuran and I. F. Akyildiz, "A-MAC: Adaptive Medium Access Control for Next Generation Wireless Terminals," **IEEE/ACM**

**Transactions on Networking**, vol. 15, no. 3, pp. 574-587, June 2007.

- I. F. Akyildiz, W. Y. Lee, M. C. Vuran, and S. Mohanty, "NeXt Generation / Dynamic Spectrum Access / Cognitive Radio Wireless Networks: A Survey," **Computer Networks Journal (Elsevier)**, vol. 50, pp. 2127-2159, September 2006.
- M. C. Vuran and I. F. Akyildiz, "Spatial Correlation-based Collaborative Medium Access Control in Wireless Sensor Networks," **IEEE/ACM Transactions on Networking**, vol. 14, no. 2, pp. 316 -329, April 2006.
- M. C. Vuran, O. B. Akan, and I. F. Akyildiz, "Spatio-Temporal Correlation: Theory and Applications for Wireless Sensor Networks," **Computer Networks Journal (Elsevier)**, vol. 45, no. 3, pp. 245-261, June 2004.

#### Web/e-mail addresses:

<http://cse.unl.edu/~mcvuran>  
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## What's New at the Lab: New Samplers for Surface Water Monitoring *continued from page 16*

water, and is comprised of a solid sorbent sandwiched between two filter membranes. Multiple POCIS can be deployed in a single cage for replicate measurements of the constituents of interest. These samplers are anchored at different locations on a stream, left to trap contaminants, retrieved and analyzed in the laboratory. Its ease of use and apparent resistance to fouling make it particularly attractive for determining time-weighted average concentrations of organic compounds in water. POCIS samplers have been used by researchers in Nebraska

for both qualitative and semi-quantitative estimate of pharmaceutical, pesticide and hormone occurrence in surface waters.

POCIS are passive samplers, meaning that no additional flow measurements are required to obtain estimates of time-weighted average concentrations. Average concentrations can be estimated based upon an uptake rate for a given compound.

Although these uptake rates are ideally constant over a range of environmental conditions, recent studies suggest uptake rates are highly dependant on temperature, salinity,

other dissolved organics, and membrane fouling. Currently, we are working to understand how these factors influence the contaminant concentrations predicted by POCIS.

Another promising technology for improved sampling organic contaminants is the development of a more selective sorbent, perhaps using customized polymers or antibodies. Research is now underway at UNL to determine the best sampling approach for increasing our understanding the occurrence, fate and effects of these compounds in our water supplies.



## UNL Presenters at USDA CREE National Water Conference

Several University of Nebraska–Lincoln faculty, staff, and graduate students attended the U.S. Department of Agriculture Cooperative Research, Education, and Extension National Water Conference in February.

The conference highlighted innovative water research and education from across the nation. It brought together water professionals engaged in research, extension, and education to share knowledge and ideas and to identify and update emerging issues.

Lessons learned will be applied to benefit Nebraska as a whole as we work to protect and maintain the state's most valuable resource — water.

A number of UNL representatives were selected to present information through presentations or posters. Nebraska contributions included the following presentations (with first listed author):

- *Narrow Grass Hedge Effects on Nutrient Transport* (John Gilley).
- *Livestock and Poultry Environmental Learning Center - Connecting with Clientele Using the Web* (Rick Koelsch).
- *Nutrient Concentrations of Runoff During the Year Following Manure Application* (John Gilley).
- *Evaluation of the Effectiveness of Selected Farm Practices in Reducing Groundwater Nitrate* (Mary Exner-Spalding).
- *Reducing Phosphorus Pollution of Surface Waters in Crop-Ethanol-Livestock Ecosystems of the Midwest* (Charles Wortmann).
- *Introduction to Podcasting* (Jill Heemstra).

- *Modeling Groundwater Nitrate Transport Beneath a Ground Water Quality Management Area in the Central Platte* (Hugo Perera-Estrada).

Posters (and first listed author) included:

- *Expanding, Focusing and Evaluating Nebraska's Stormwater Management Education Program* (Kelly Feehan).
- *Spatial Variations in Nutrient and Microbial Transport from Feedlot Surfaces* (John Gilley).
- *Narrow Grass Hedge Effects on Nutrient Transport Following Manure Application* (John Gilley).
- *Nitrogen and Phosphorus Concentrations of Runoff as Affected by Plowing* (John Gilley).
- *Application of Landscape Vulnerability Models to Assess Off-Site Pesticide Movement in a Nebraska-Kansas Watershed* (Patrick Shea).
- *University of Nebraska Comprehensive Water Web Site* (Sharon Skipton).
- *Corn-Applied Fungicides in Nebraska Streams* (Jason Vogel).
- *Nebraska Agricultural Water Management Demonstration Network Update and Interactive Website* (Gary Zoubek).
- *Heartland Nutrient and Pesticide Management Regional Extension Publications* (Charles Wortmann).
- *Personality Characteristics and Conservation Tillage: Understanding Farmers to Improve Surface Water Quality in Tuttle Creek Lake, Kan.* (Courtney Quinn).

## DeSal Association Launches New Journal

The International Desalination Association (IDA) today announced plans to launch the *IDA Journal on Desalination and Water Reuse*, a new publication that will include peer-reviewed articles on the technical and scientific aspects of desalination.

The inaugural issue of the Journal will debut at the 2009 World Congress, which takes place November 7-12 in Dubai. It will be co-published for IDA by the American Water Works Association (AWWA), which has a well-established Publishing and Media Group.

"The launch of the IDA Journal reflects

IDA's role as the world's leading resource for information about desalination and water reuse. It provides an additional vehicle for fulfilling our mission of promoting the appropriate use of desalination and desalination technologies worldwide by disseminating relevant, timely and accurate information," said Patricia A. Burke, Secretary General of the IDA.

According to Ms. Burke, research has identified a clear need for a scholarly, peer-reviewed publication devoted to desalination and water reuse. "Our goal is to present the industry with technical literature of the

highest caliber. We will employ a formal peer review to ensure that the Journal presents readers with literature that has undergone and passed rigorous scrutiny by the world's top industry professionals and scientists."

Monica Joda Baruth, Director of AWWA's Publishing and Media Group, noted that "AWWA is very pleased to be associated with IDA, the world's leading authority in desalination, in this endeavor. Our market research indicates the urgent need for further research, science, and practical application articles on desalination and water reuse. Clearly, there is

# USGS Study: Water Quality A Potential Concern in Private Wells

More than 20 percent of private domestic wells sampled nationwide contain at least one contaminant at levels of potential health concern, according to a study by the U.S. Geological Survey (USGS).

About 43 million people, 15 percent of the nation's population, use private wells, which are not regulated by the Federal Safe Drinking Water Act.

USGS scientists sampled about 2,100 private wells in 48 states and found that the contaminants most frequently measured at concentrations of potential health concern were inorganic contaminants, including radon and arsenic. These contaminants are mostly derived from the natural geologic materials that make up the aquifers from which well water is drawn.

Nitrate was the most common inorganic contaminant derived from man-made sources—such as from fertilizer and septic tanks—that was found at concentrations greater than the federal drinking-water standard for public-water supplies (10 parts per million). Nitrate was greater than the standard in about 4 percent of sampled wells.

The study shows that the occurrence of selected contaminants varies across the country, often following distinct geographic patterns related to geology, geochemical conditions and land use.

For example, elevated concentrations of nitrate were largely associated with intensively

farmed land, such as in parts of the midwest corn belt and California's central valley. Radon was found at relatively high concentrations in crystalline-rock aquifers in the Northeast, in the central and southern Appalachians, and in central Colorado.

Plugging a water well with bentonite  
(photo by Dave Shelton)



Other contaminants found in private wells included man-made organics, including herbicides, insecticides, solvents, disinfection by-product, and gasoline chemicals. Few organic contaminants (seven out of 168) exceeded health benchmarks, and were found above health benchmarks in less than one percent of sampled wells.

Contaminants found in private wells

usually co-occurred with other contaminants as mixtures rather than alone, which can be a concern because the total combined toxicity of contaminant mixtures can be greater than that of any single contaminant. Mixtures of contaminants at relatively low concentrations were found in the majority of wells, but mixtures with multiple contaminants above health benchmarks were uncommon (about four percent).

Bacteria, including total coliform bacteria and *Escherichia coli*, were found in as many as one third of a subset of 400 wells. These bacteria are typically not harmful but can be an indicator of fecal contamination. About half of the 2,100 sampled wells had at least one property or contaminant outside recommended ranges for cosmetic or aesthetic purposes, such as total dissolved solids, pH, iron and manganese.

Private well owners, who generally are responsible for testing the quality of their well water and treating it, if necessary, can contact local and state health agencies for guidance and information about well maintenance and siting, water quality and testing options, and in-home water treatment devices. Access the *Quality of Water from Domestic Wells in the United States* Web site for related links to sources of information and recommendations for private well owners.

(Editor's Note: To access this article in its entirety, go to <http://www.usgs.gov/newsroom/article.asp?ID=2173>).

## DeSal Association Launches New Journal *continued from previous page*

unprecedented global interest in desalination and water reuse.”

The IDA Journal will be available to IDA members as well as to individual and institutional subscribers. It will be published quarterly and made available in both print and electronic formats.

“With desalination becoming an increasingly important part of the solution to the world's water problems, it is critical to provide

members of the industry with information about the latest advances and applications, and the science behind the technologies,” said Ms. Burke.

For information about the IDA Journal, please contact Leslie Merrill at [lmerrill@idadesal.org](mailto:lmerrill@idadesal.org).

### Hydrology Resists Hiring Slump

Despite a deepening U.S. recession, the demand for hydrologists is expected to grow by 24 percent from 2006 to 2016, much faster than the average for all occupations, according to the Bureau of Labor Statistics.

The reason is that water quality and quantity have become more pressing issues as climate changes increase, said Professor Dork Sahagian, director of Lehigh University's Environmental Initiative in Bethlehem, Penn.

The federal government employs about 28 percent of hydrologists; another 21 percent work for state agencies; and others find jobs in the fields of architecture, engineering, water management, and scientific and technical consulting.

In Nebraska, the University of Nebraska-Lincoln is admirably positioned and equipped to provide undergraduate and graduate education programs leading to careers in hydrology and related fields.

For information on the full-range of courses and fields of study in water science and related fields at UNL, contact School of Natural Resources undergraduate coordinator Aris Holz at [aholz2@unl.edu](mailto:aholz2@unl.edu) or go online to <http://water.unl.edu>.

Careers in environmental consulting, water law and policy analyst, water chemist, groundwater and surface water hydrologist, water resources manager, aquatic ecologist, environmental lobbyist, research technician are some of the many exciting career paths waiting qualified applicants.

(Information partially sourced from the *New York Times* by Eilene Zimmerman)

### Assessing Drinking Water Needs

A recent drinking water needs survey will help the U.S. Environmental Protection Agency (EPA) determine distribution formula for Drinking Water State Revolving Fund (DWSRF) grants for fiscal years 2010 through 2013.

The document assesses anticipated costs for repairs and replacement of transmission and distribution pipes, storage and treatment equipment, and projects that are necessary to deliver safe supplies of drinking water.

Drinking Water Infrastructure Needs Survey and Assessment is completed every four years. It reflects data collected in 2007 from states. According to the survey results, the nation's water utilities will need to invest an estimated \$334.8 billion over the next 20 years to deal with aging infrastructure.

Since DWSRF began in 1997, states have provided more than \$15 billion in funding to utilities for infrastructure projects.

To access the survey and assessment online, go to <http://www.epa.gov/safewater/needsurvey>.

### WILD Workshops

The Nebraska Game and Parks Commission will sponsor a Project WILD workshop in North Platte, July 23, 9 a.m. to 3 p.m. There is no charge for the workshop. For details, contact Michelle Koch at (402) 471-5363 or email [michelle.koch@nebraska.gov](mailto:michelle.koch@nebraska.gov).

Other upcoming Project WILD workshops include:

**June 12-13**, Hands-On Herpetology, Lake Ogallala – Eagle Viewing Center, Ogallala. For details, contact Jeanine Lackey at (402) 471-5581 or email [jeanine.lackey@nebraska.gov](mailto:jeanine.lackey@nebraska.gov). Cost: \$20 (refundable).

Project WILD workshops:

**June 29**, ESU 8, Neligh. Contact Jamie Bachmann at (402) 370-3374.

**June 30**, Community Center/Bowman Lake, Loup City. Contact Koch at (402) 471-5363 or email [michelle.koch@nebraska.gov](mailto:michelle.koch@nebraska.gov)

**July 23**, North Platte Community College, North Platte. Contact Koch as above.

**Oct. 9**, Camp Fontanelle, Nickerson. Contact Koch as above.

### EPA Watershed Web Site

The U.S. Environmental Protection Agency (EPA) recently launched Watershed Central, a web site designed to help organizations find key information for implementing watershed management projects.

According to EPA, Watershed Central helps users find environmental data, watershed models, local organizations, guidance documents, and other information. The site contains links to watershed technical resources, funding sources, mapping applications, and information specific to individual watersheds.

The site includes a wiki for collaboration and information sharing. EPA encourages all watershed practitioners to use this wiki to share tools, scientific findings, expertise, and local approaches to watershed management.

Learn more by visiting Watershed Central at [www.epa.gov/watershedcentral/](http://www.epa.gov/watershedcentral/).

### Water Quality Goals

The California Water Boards' A Compilation of Water Quality Goals contains an extensive compendium of numerical water quality limits from the literature for over 850 chemical constituents and water quality parameters. An on-line search tool has been added to help you find water quality limits for the constituent or parameter of interest.

You may search by chemical or parameter name, portion of a name, abbreviation, or Chemical Abstracts Service (CAS) Registry Number. The site can be found at [http://www.waterboards.ca.gov/water\\_issues/programs/water\\_quality\\_goals/](http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/).

Instructions for using the search tool are online at [http://www.waterboards.ca.gov/water\\_issues/programs/water\\_quality\\_goals/how\\_to\\_use\\_wqgoals.shtml](http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/how_to_use_wqgoals.shtml).

# Help Us Publish a Better *Water Current*

**H**elp us publish a better *Water Current*.

Take a few moments to complete this questionnaire and return it to us. If you do, we will enter you in a drawing for one of three Water Center fishing lures and one of three Water Center umbrellas. To be eligible for these drawings, return your completed survey to Steve Ress, UNL Water Center, P.O. Box 830979, University of Nebraska, Lincoln, NE 68583-0979 or FAX it to (402) 472-3574 by Friday, June 27. UNL subscribers may return surveys via campus mail to 913 HarH, EC, 0979.

Mail or FAX the entire page (so we have your name and address for the drawings). Survey responses and names of responders are confidential used only by the *Water Current's* editorial staff.

1. Rank, in order of importance, the usefulness of the following general areas of the *Water Current* (1 - most important to 7 - least important):

- ☐ News Briefs
- ☐ Meet the Faculty
- ☐ Reporting on upcoming events, seminars, conferences, tours, etc.
- ☐ Director's Notes
- ☐ Reporting on water and environmental research, survey and outreach activities
- ☐ Guest editorials/columns
- ☐ Information on what's happening with the Water Sciences Laboratory, Water Resources Research Initiative, etc.

2. What would you like to see in upcoming issues of the *Water Current*?

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3. What are your primary water and environmental interests?

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4. The *Water Current* provides timely and important information that I find useful.

- ☐ Strongly agree    ☐ Mostly agree  
☐ Mostly disagree    ☐ Strongly disagree

5. The *Water Current* provides more information than I need.

- ☐ Strongly agree    ☐ Mostly agree  
☐ Mostly disagree    ☐ Strongly disagree

6. Do you read each *Water Current* you receive?

☐ Yes    ☐ No

7. Do you circulate your *Water Current* to anyone else?

☐ Yes (if so, how many others \_\_\_\_\_)  
☐ No

8. Should the *Water Current* be distributed

☐ More often    ☐ less often  
☐ remain a quarterly

9. Do you ever access the PDF copy of the *Water Current* that is on the Water Center's web site at <http://watercenter.unl.edu>?

☐ Yes    ☐ No

10. What can we do to improve the appearance and/or readability the *Water Current*?

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11. Additional comments (include address corrections or other updates to your mailing information):

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## What's New at the Lab: New Samplers for Surface Water Monitoring

By Daniel D. Snow, Ph.D., UNL Water Sciences Laboratory and  
Shannon Bartelt-Hunt, Ph.D., UNL Department of Civil Engineering

Collection of representative samples from a flowing stream presents a number of interesting challenges, especially when monitoring for low concentrations of pesticides, pharmaceuticals or steroid hormones.

While traditional grab and composite sampling can tell us about the occurrence of contaminants in surface waters, these techniques only capture information at the time of collection. Individual and composite samples cannot easily characterize concentration changes during changing flow, sources, and the influence of precipitation. Continuous on-line sampling, where hundreds of samples are collected and analyzed, may

be prohibitively expensive.

A new type of sampler developed by the U.S. Geological Survey for use in monitoring trace organic chemicals is the Polar Organic Chemical Integrative Sampler (POCIS). This device is designed to trap polar (water soluble) organic compounds from



*A water colloquium display of some of the UNL Water Sciences Laboratory's capabilities (photo by Steve Ress).*

*continued on page 11*