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Water Current

PART OF THE SCHOOL OF NATURAL RESOURCES

MEET THE FACULTY

Karrie A. Weber, Ph.D.

Karrie Webber is an assistant professor in geomicrobiology and microbial biogeochemistry in the University of Nebraska–Lincoln School of Biological Sciences with a joint appointment in UNL's Department of Geosciences since August 2008

Examples of Current Research/Extension Programs:

Microorganisms are recognized to enzymatically mediate biogeochemical cycles in aquatic and soil/sedimentary environments, thereby shaping our environment. The fate and transport of inorganic and organic natural and contaminant compounds can be directly or indirectly regulated by microbial metabolism(s). My research interests focus on the intricate

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INSIDE

One-Two-Three Punch Clobbers Toxic Algae, Restores Fremont Lake

By Steve Ress

State and University of Nebraska–Lincoln water and wildlife experts may have found a one-two-three punch to knockout toxic algae and restore water quality in Nebraska's numerous sandpit lakes.

Treating Fremont Lake #20 with nontoxic aluminum sulfate. (photo courtesy Tadd Barrow).

"It seems to be working very well so far," said UNL Extension surface water quality specialist Tadd Barrow.

What's working to help rid the too-often toxic algae prone Fremont State Lakes of the

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

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

The jointly sponsored symposium takes the place of the usual fall research colloquium typically held on the University of Nebraska-Lincoln's East Campus. The symposium is Oct. 14 and 15 in Kearney and kicks-off with an optional tour of Cottonwood Ranch and other stops along the river, hosted by Chad Smith of Headwaters Corporation.

The 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,

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From the Director
Dr. Kyle Hoagland

Lessons On Water Scarcity

During my summer vacation (please don't stop here, this is *not* a travelogue!), I visited St. John in the U.S. Virgin Islands for the first time. On this island paradise, I got a real life lesson in water conservation. Apparently most St. John homes have cisterns rather than basements, each holding thousands of gallons of rainwater that accumulate from the rooftops from condos to luxury homes (e.g., Kenny Chesney has a mansion on SJ). This "gray water" (my term, not the locals') is used for laundry, showers, and dishwashing, essentially everything except direct consumption (incl. brushing teeth).

The incentive to conserve is at least partly economic, because at about ten cents a gallon delivered by a water truck, a $450 bill for a supply of standard water that's not even potable is a high price to pay for a 30 minute versus 3 minute shower or cleaning a sink full of dishes with several gallons versus a quart of water.

This is especially true for local folks of more modest means (of course that's all relative too, given that a standard single bedroom condo costs about $1 million). The only thing that amazed me more than how quickly one can adapt to using significantly less water on a daily basis is how quickly one can fall back into the same old water consumption patterns of overuse.

Rain barrels are a parallel notion that seems to be taking hold across the U.S., not only because of the water savings but also because of the water conservation attitude that they convey to children. But are they the equivalent of converting to fluorescent bulbs and "calling it good" on doing our part for our individual energy footprint?

The world's population is currently growing by about 80 million people per year, with a concomitant increase in potable freshwater demand of 64 billion cubic meters annually.

"In the future, we may not be able to sustain unlimited growth and still maintain our current quality of life. Difficult political choices will be necessary regarding future economic and environmental uses of water and the best way to encourage the orderly transition to a new equilibrium" was not written about the Middle East or Sub-Saharan Africa, rather it was written by the Western Governors Association (2006) right here in the U.S., and Nebraska is a member of the WGA. I suspect that, as unpopular as it is (and has been!), we will never conserve water to the extent necessary to sustain a healthy society in this country until it hits us in our personal pocketbook.

Other Matters

Major changes are underway here at the UNL Water Center. First, associate director Mike Jess is retiring from UNL and will leave the Water Center and Conservation Survey Division at the end of August. Mike brought a very welcome new dimension to the Center's staff, the perspective of the taxpaying citizen. "Yes, but what does this mean for the average Nebraskan?" was the "conscience of the Water Center" question that Mike often posed during staff or faculty meetings, which has become more ingrained in our thinking as a result.

Of course Mike's contributions go well beyond this influence, because as anyone who has had the privilege of joining in the

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Robert J. 'Bob' Oglesby, Ph.D.

Bob Oglesby is a professor of climate modeling with a 70 percent appointment within the University of Nebraska-Lincoln Department of Geosciences and 30 percent in UNL's School of Natural Resources. He has been at UNL since January 2006.

Examples of Current Research Programs:

Much of my current research focuses on the causes and predictability of drought, including the relative role of local effects (soil moisture and snow cover) and remote effects, especially patterns in sea surface temperatures (such as due to El Nino/La Nina). I am also very interested in, and concerned about, the impacts of future climate change, especially their impact on water resources. I am also heavily involved in the development of a new regional climate modeling center at UNL, which is intended to take the basic results of climate change science and translate them to the regional and local scale, where the impacts are actually felt.

Examples of Past Research Programs:

Past research includes: 1) understanding how the major continental ice sheets that covered much of North America over the past several hundred thousand years came to be. 2) The effects of deforestation in CentraL America and southern Mexico; how they may have impacted the collapse of the Maya civilization during the 9th century AD, as well as implications for what is currently occurring in this region. 3) Reassessment of paleomagnetism based reconstructions of continental configuration during the Jurassic, as based on climate system considerations and modeling results.

Teaching:

I have developed and teach the following Graduate-level courses: Theory of Climate, Climate Modeling, and Paleoclimates. I have also developed an undergraduate course on The Climate System. These teaching responsibilities are housed within Geosciences, but the courses attract students campus-wide. I am also planning to develop an on-line version of The Climate System.

Selected Publications:

Oglesby, R.J., S. Marshall, D.J. Erickson III, J.O. Roads, and F.R. Robertson (2002) Thresholds in atmosphere-soil moisture interactions: Results from climate model studies. *Journal of Geophysical Research*, 107(D14), 10.1029/2001JD001045.

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Karrie A. Weber *continued from page 1*

interactions between microorganisms and the environment at the molecular scale, the ecosystem scale, and ultimately, the global scale. I have applied and will continue using an interdisciplinary approach in order to link the microbial community to biogeochemical function. As a doctoral student, I accomplished original research studying microbially-mediated anaerobic iron redox cycling as influenced by the presence of nitrate and the subsequent effect on heavy metal mobility. As a postdoctoral scholar my research efforts examining the microbially-catalyzed anaerobic nitrate-dependent metal (iron and uranium) oxidation have continued in pure culture model systems and meso-scale flow through packed column reactors. Current funded projects include the following:

Anaerobic, Nitrate-Dependent Metal Bio-Oxidation—Microbial Dissolution of Uranium Minerals and Uranium Mobility. Soluble uranium (U) is a recognized contaminant in public water supplies in various counties throughout the state of Nebraska. The mechanism driving U mobilization in these environments remains poorly understood. In an effort to understand U mobility in these environments we are examining the role of the indigenous microorganisms to dissolve natural U-rich minerals subsequently contributing bioavailable U in drinking water sources. (PI, Funded by the Department of Interior, United States Geological Survey, National Institute for Water Resources Program in collaboration with Dr. Daniel Snow, School of Natural Resources, UNL.)

Geo-virology: Viruses are the most abundant biological entities on Earth and are prevalent in aquatic systems including groundwater. The surfaces of these biological entities are reactive and have the potential to serve as nucleation points for contaminant adsorption and precipitation of metal/radionuclide-bearing minerals. It is therefore necessary to further understand the potential relationship(s) between viruses, subsurface microbial communities, and contaminant metals/radionuclides. The objective of these research efforts are to further understand the role of viral induced microbial mortality increasing carbon and nutrient availability, as well as contributing to metal biogeochemical cycling and contaminant mobility. (PI, Funded by the University of Nebraska Research Council in collaboration with Dr. Yusong Li, Department of Civil Engineering, UNL.)

A New Pathway in Nitrogen Cycling: Nitrogen (N) is a key nutrient to microbes, plants and animals, and considerable research has been directed

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Study: Low Flows on Niobrara Could Result in Economic Losses

Reducing the flow of water on the Niobrara River could result in a loss of $471,000 to $695,000 a year over the next decade.

That's one of the findings in an almost-finished report compiled by Steve Shultz, an economics professor at the University of Nebraska at Omaha.

Shultz studied the economic and social values of recreational floating on a 76-mile federally protected stretch of the Niobrara downstream from Valentine in north-central Nebraska.

His goal was to generate "objective and accurate" data for the Nebraska Game and Parks Commission, which is working on an instream flow application for the Niobrara to protect minimum flows for fish, wildlife and recreation.

Shultz, who was hired by Game and Parks to conduct the study, looked only at recreational floating and not such economic benefits as agriculture, fishing and environmental conservation. Most of his findings were based on mail-in and windshield surveys done in 2007 and 2008, respectively.

Many farmers and ranchers in the Niobrara valley oppose instream flow rights for the river. They claim it would waste water by preventing its future use for irrigation and industrial development. They also argue it's unnecessary because all rights to the Niobrara's water have been assigned.

The Game and Parks Commission directed its staff to pursue an instream flow right for the Niobrara River in May 2006. Gene Zuerlein, assistant fisheries division administrator, said the state has 12,371 miles of fishable streams but so far has protected 285 miles, or 2 percent.

Here are some highlights from Shultz's study, which was funded by the Nebraska Environmental Trust.

* In 2008, floaters spent an average of $234 each per day getting to and floating on the Niobrara in tubes, kayaks or canoes. The total economic impact for the year was $10.9 million.

* If floating increased at the historic annual growth rate in visitation of 2.3 percent per year over the next decade (2009-18), the economic impact would average $10.5 million per year in 2008 dollars.

* And if it increased by 8.5 percent — as it has in the past three years — the economic impact over the next decade would be $14.6 million per year.

* At least 32 percent of Nebraskans are familiar with the river, 15 percent have floated it, 23 percent have participated in recreational activities there and 40 percent know of friends or family who have.

* Last year, about 45,500 people floated the scenic stretch of the river downstream from Valentine, according to the National Park Service.

* 23 percent of them said low flows on the scenic river were a primary concern or threat, while 11 percent were concerned with litter and potential water quality issues.

* 7 percent of floaters felt low flows might limit or reduce future visits, while 35 percent said they consider flow levels while planning trips; 66 percent check flows in advance.

Shultz said the survey also looked at comparable rivers in Nebraska that would offer some of the same recreational opportunities. It found none.

"There is no substitute for the Niobrara as it currently is," he told the two dozen people who showed up to hear the report at UNL on Monday afternoon.

Shultz said the Niobrara on a typical summer Saturday represents a cross-section of the state.

"If you want to see a mixture of Nebraskans in any one place, this is it," he said.

He told the audience he personally believes the 8.5 percent annual growth in floaters is realistic because right now there is a healthy mix of repeat and first-time visitors, which is unusual for rivers in other states. Most of the visitors are from Lincoln and Omaha.

Bruce Kennedy of Malcolm, speaking for the Nebraska Wildlife Federation, thanked Game and Parks for conducting the study.

"We hope they go ahead and make an application to protect the flows in the Niobrara," Kennedy said during a question-and-answer session.

Shultz said his findings won't solve the debate, but they are useful. He said the study is designed so additional data in coming years can be plugged in and result in more useful and up-to-date information.

The draft study should be posted Tuesday at http://unorealestate.org/. Shultz said comments are welcome.

(Editor's Note: The above story is by Algis J. Laukaitis, *Lincoln Journal Star*, June 22, 2009).

Featured Partner: Audubon Nebraska

By Duane Mohlman

Kids playing in the tall grasses of a beautiful prairie. Kids finding frogs in a beautiful stream. Kids growing up a place with clean air, clean water, and an abundance of wild things. These are all part of the vision toward which thousands of volunteers and supporters of Audubon Nebraska are working toward. Many of the choices we are making as a society are not pointing us in that direction, and we hope to change that. Efforts toward this vision include those at Nebraska's two education centers located in threatened areas of our state: the *Iain Nicolson Audubon Center at Rowe Sanctuary* near Kearney, focusing on Platte River conservation, and *Spring Creek Prairie Audubon Center* near Lincoln, focusing on tallgrass prairie conservation. There are also four Audubon chapters across the state supporting conservation efforts on a wide variety of natural resource issues.

Iain Nicolson Audubon Center at Rowe Sanctuary (*http://www.rowesanctuary.org*) is located approximately 20 miles east of Kearney, Nebraska. The Rowe Sanctuary's primary mission is to conserve Platte River ecosystems for cranes and other wildlife through conservation and education. The sanctuary's original purchase of 782 acres in 1974, funded by Lillian Annette Rowe of Trenton, New Jersey, comprised 3.5 miles of river channel, wet meadows, and some agricultural fields. Through land acquisitions, the sanctuary has since grown to nearly 1,900 acres. Since 1974, it has been one of the premier spots in central Nebraska to enjoy the spectacular March/April migration of over 500,000 sandhill cranes, as well as millions of ducks, geese, and other waterbirds. Director Bill Taddicken says, "The spring migration is one of top migration spectacles in the world and it is right here in Nebraska. The *Iain Nicolson Audubon Center*, opened in early 2003, offers year-round educational programs for local schools and the public.

Spring Creek Prairie Audubon Center (*http://www.springcreekprairie.org*) is an 808-acre tallgrass prairie nature sanctuary located approximately 15 miles southwest of Lincoln, Nebraska. Director Marian Langan states, "Tallgrass prairie is the most threatened ecosystem in North America. The generosity of hundreds of individuals and groups has made this wonderful legacy possible as a place for us to celebrate our natural and cultural history. Their efforts help toward making sure that future generations get to enjoy it as well." Visitors enjoy walking trails winding through the native tallgrass prairie, ponds and wetlands, wildflowers and grasses, scenic views, and a wide assortment of birds and wildlife. Bird-watchers can observe grassland birds such as greater prairie-chickens, bobolinks, upland sandpipers and dickcissels. The Center offers year-round educational programs for schoolchildren and families who have hands-on experiences with Nebraska's natural and human history. The site is also listed on the National Register of Historic Places due to the presence of mid-19th century wagon ruts from the Nebraska City-Fort Kearny Cutoff to the Oregon Trail. The State Audubon Office is also located here.

Evening on Spring Creek Prairie, near Lincoln (Photo courtesy of Audubon Nebraska).

Audubon Chapters: Four Audubon Chapters are active in the state. Chapter contact and membership information can be found under the "Chapters" menu choice on the Audubon Nebraska Web Site. The four Nebraska chapters, including year formed, area served and web site, are:

The *Audubon Society of Omaha* (1971), serves Omaha, surrounding communities and Western Iowa (*http://audubon-omaha.org/*).

The *Wachiska Chapter* (1973) serves 17 counties in southeast Nebraska, including the cities of Lincoln, Beatrice and Nebraska City (*http://www.wachiskaaudubon.org/*).

The *Big Bend Chapter* (1975) serves south-central Nebraska, including the cities of Kearney, Grand Island, Hastings and surrounding communities.

The *Wildcat Chapter* (1978) serves 11 counties in the Nebraska panhandle, including the cities of Scottsbluff, Sidney and Chadron (*http://www.wyoneb.net/-delara/wildcataudubon.htm*).

Rivers and Wildlife Celebration (RWC): The RWC is an annual celebration hosted by Audubon Nebraska, Rowe Sanctuary, and the Nebraska Partnership for All-Bird Conservation. RWC is the longest running annual wildlife festival in the U.S. Each March, registrants interact with wildlife enthusiasts from around the world during the annual migration of sandhill cranes and waterfowl. This annual celebration is for anyone interested in experiencing one of the planet's great wildlife spectacles. If you are interesting in learning more about the natural world in a friendly and informal atmosphere, you may wish to mark the next RWC on your calendar: March 20-22, 2009, at Kearney, Nebraska. For details about the upcoming RWC, consult the Audubon Nebraska web site (*http://www.nebraska.audubon.org*).

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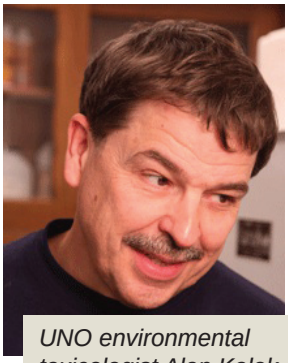
Sediment, Microbes and Environmental Fate of Emerging Contaminants

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

For many, the experience of walking a sandy beach with waves lapping our feet is part and parcel to the summertime experience. In Nebraska, a less romantic, but not uncommon interaction with sediment would be that of an intrepid individual trying to extradite themselves from hip deep, boot-sucking creek mud.

What do these vastly different forms of sediment have to do with emerging contaminants? A lot more then you might think.

Our interest in emerging contaminants naturally focuses on the compounds freely available in water. After all, these are the compounds that are most readily bio-available to aquatic organisms.



UNO environmental toxicologist Alan Kolok.

Nevertheless, the underlying sediment is also important. In a previous article (*Water Current*, Winter 2009), I discussed the fact that emerging contaminants are not necessarily stable in the aquatic environment, but may be converted into different forms or metabolites.

These metabolites can retain their biological activity, however they will all have slightly different chemical structures and may be very difficult to identify.

Microorganisms are primarily responsible for the metabolism of these compounds, and many of these microbes live on the surface of sediment particles. As such, it is not uncommon for one compound to enter the upper sediment layers at the bottom of a stream, and for a different compound to be released from those same sediments back into the water column.

The effect of sediment microorganisms on emerging contaminants would be manageable if the microbial communities associated with different sediments behaved in the same way.

Unfortunately, this is not the case. Sediment is any particulate matter that can be moved by flowing water, and the more rapid the water flow, the larger the particles of sediment that can be moved. In fast flowing streams and rivers, the smallest particles, silts and clays, are carried downstream leaving behind the larger sands, cobble and boulders.

Wherever the water slows, the silts and clays are deposited and over time can develop into a thick layer of organically rich muck. The small sediment particles have more surface area on a per volume basis, which means that there are more places for microorganisms to live in a spoonful of silt or clay then there are in a spoonful of sand (to visualize this, consider the surface area of a tennis ball in a small Mason jar relative to the same jar filed with marbles. While each marble is much smaller than the tennis ball, the overall surface area of all of those marbles is much greater.)

Greater sediment surface area equates to a greater number of bacteria, which in turn leads to greater rates of metabolism. Consequently, the rate at which the microbial community in creek muck metabolizes many compounds is much faster than what would occur in an equal volume of beach sand.

Other factors also play a role in determining microbial communities in sediment. As water slows and fine inorganic particles of silt and clay settle on the river bottom, detritus (nonliving particulate organic matter) often settles alongside.

Bacteria and fungi aggressively colonize detritus particles, as it is a bountiful food source for the microbial community. The composition of the microbial community living on this cornucopia is fundamentally different then that living in the more austere environments associated with detritus-free sediments. These different communities metabolize emerging contaminants in very different ways, and the metabolites released from organically rich and organically poor sediments are likely to be fundamentally different.

The importance of sediment in the environmental fate of emerging contaminants is being confirmed in the laboratory. Recent studies have tested for hormonally active emerging contaminants in Nebraska river water and sediment. Sediments of varying particle size and organic content were collected, along with the water in which the sediments were immersed.

At some sampling sites, hormonally active compounds were found in the river water, whereas at other locations, the active compounds were found in the sediment. At some sites the sediment bacteria appear to be absorbing a relatively benign compound from the water, then metabolizing it into a biological active compound that was re-released back into the water column!

Sediment is more than something to merely walk on at the beach. Sediments contain a vast community of microorganisms that ambitiously transform organic materials, such as emerging contaminants, from one form into another. A true understanding of the fate and biological effect of emerging contaminants in the environment will have to pay attention to these unseen, but highly dynamic, communities of microorganisms.

WRAP Update

By Rachael Herpel, UNL Water Center and NU Rural Initiative

The University of Nebraska–Lincoln's Water Resources Advisory Panel (WRAP) has ranked their water research priorities and met in August to review the rankings. WRAP Water Quality Work Group met August 5 and the Water Quantity Work Group meets August 26. WRAP will convene as a whole in the fall.

To inform the WRAP members, the NU Water-Related Research Database (http://watercenter.unl.edu/researchdb/researchdb.asp) was used to develop reports describing faculty's current and completed research applicable to each topic. This database has been expanded to include the work of 124 faculty and staff - 92 individuals are listed as the primary contact; an additional 32 are listed in support of a project or program.

Prior to WRAP's work group meetings, faculty working in the prioritized areas will be asked to determine whether their current work is accurately represented on the research database, the degree to which their previous work in a topic area should be added to the research database (to increase awareness of this work and lay the foundation for future research), whether they have any research project proposals pending in this topic area, and their specific interest in and availability for additional research in this topic area.

Vance Anderson Receives Kremer Award

Vance Anderson of Hastings received The Groundwater Foundation's 2009 Maurice Kremer Groundwater Achievement Award. The 99-year-old Nebraskan was honored at a private event in late July.

The Kremer Award was established in 1985 to recognize Nebraskans who have made a substantive contribution to the conservation and protection of Nebraska's groundwater.

"He has always been a kindred spirit, enthralled and always curious about the wondrous nature of Nebraska's water resources," said Jim Goeke, research hydrogeologist with the University of Nebraska–Lincoln Conservation and Survey Division and selection committee member.

Vance's grandfather, Mads, began farming near the confluence of the North and South Loup rivers in 1895, according to an article about the family in the book, *Flat Water: A History of Nebraska and Its Water*, published by UNL. So his family has always been intertwined with Nebraska's water resources as they struggled to ingeniously irrigate their fields.

At the young age of 15, Vance helped an uncle irrigate in Oregon and then a year later was sent to the family farm to help the tenant with this new "irrigation" and the use of their newly installed centrifugal pump. Their elaborate system pumped 2,200 gallons per minute from the North Loup River. Vance pitched a tent by the river to look after the pumps during the irrigation season. In 1944, the North Loup flooded and shifted its course, prompting Vance to prospect for a groundwater source. He finally located a 174-foot well that pumped 1,000 gallons per minute and is still a unique well today.

Vance headed up pump sales for WLR from 1940 until he retired in 1979. He is a past secretary of the Nebraska Water Resources Association and a former chairman of the public advisory board to the Nebraska Department of Water Resources. He is an honorary life member of the Nebraska Well Drillers Association (NWDA) and served 25 years on the NWDA board of directors. He is also a past board member of the State Irrigation Association, was the first chairman of the Nebraska Water Conference Committee and was a board member for the Central Nebraska Public Power and Irrigation District.

Past Kremer Award recipients:

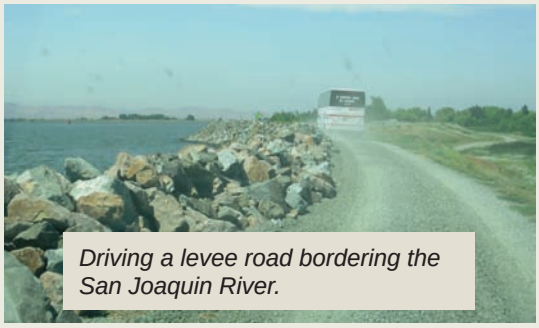
1986: Vincent Dreeszen (UNL)
1987: Maurice Kremer
1988: Eugene Reed (UNL)
1989: Val Kuska
1990: Warren Fairchild
1991: Ralph Marlette
1992: Ted Filipi
1993: Robert B. Crosby
1994: Virginia Smith
1995: Fred Salmon and Family
1996: Frank A. Smith
1997: Robert B. Daugherty
1998: Les Sheffield (UNL)
1999: Richard Harnsberger
2000: Wayne Madsen
2001: Jim Goeke (UNL)
2002: Eugene Haarberg
2003: Chris Beutler
2004: Darrell Watts
2005: Roger Patterson
2006: Ed Schrock
2007: Jim Cook
2008: Ann Bleed

2009 UNL Water & Natural Resources Tour of the Bay-Delta Region of Northern California June 15-18, 2009

Cosponsored by:
Central Nebraska Public Power & Irrigation District, The Flatwater Group, Inc., Gateway Farm Expo, Kearney Area Chamber of Commerce, Nebraska Public Power District, Nebraska Water Conference Council and UNL's School of Natural Resources, Conservation & Survey Division and Water Center

The 2009 water and natural resources tour group at the U.S. Army Corps of Engineers Bay-Delta Model in Sausalito, Calif.

UNL's summer water and natural resources tour visited the Sacramento-San Joaquin River estuary, known as the Bay Delta, northwest of San Francisco, Calif. In June. The tour examined threatened and endangered species issues and state water law and water use issues from perspectives of what Nebraskans might learn from California's situation (map courtesy of UNL Conservation and Survey Division).



Driving a levee road bordering the San Joaquin River.

Tasting locally produced wines, produced from grapes grown in the Bay-Delta, on the Craig and Nancy Kirchhoff ranch near Courtland, Calif.

Mike Jess, John Ford and Jeff Buettner on top of Oroville Dam, the tallest earthen dam in the United States.

Lori Potter of the *Kearney Hub* accompanied the tour, filing many articles about the trip.

Michael Perry, manager of the Lodi, Calif. Wine and visitor's center explains the growing and vinting of grapes in California's central valley.

Learning about state efforts to relocate threatened and endangered fish species at a state-operated fish screening operation.

Near Oroville Dam, John Ford of the California Dept. of Water Resources, talks about an operation to tag and harvest eggs from Salmon that migrate along the Sacramento River.

Craig Kirchhoff explains the workings of a mechanical grape picker on his ranch in the Bay-Delta.

(Photos by Rachael Hespel and Steve Ress)

Jerralee Barry explains the operation of a three-generation family fruit farming operation as the tour moves south from Oroville to Sacramento, Calif.

Tour participants take a break during a stop in San Francisco on the last afternoon of the tour.

Michael Miller (from left) of the California Dept. of Water Resources talks with Charles Schlabs of Hereford, Tex. and Richard Ogden of Oxford.

A Sacramento River diversion dam for the Glenn-Colusa Irrigation District, north of the Bay Delta.

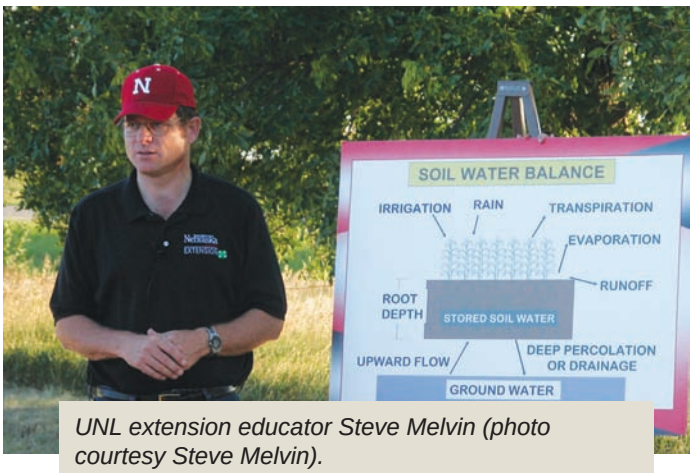
UNL Extension Continues Helping Farmers Learn Irrigation Strategies to use Less Water

By Steve Melvin, UNL Extension Educator

Irrigation water management has always been important to southwest Nebraska. It was evident to the farmer in the area from the earliest days that the land was very productive with adequate water. Thus, over the years, a large portion of the area has had irrigation systems developed. Today, due to numerous factors, water shortages and allocations have become a reality that threatens the stability and security of the area.

Finding ways to conserve irrigation water and teaching Nebraska farmers how to use them has been an important endeavor at the University of Nebraska-Lincoln's West Central Research and Extension Center at North Platte for a long time. The Republican River Basin Irrigation Management Project was started in 1996 with funding support from the U.S. Bureau of Reclamation (BOR) to help farmers understand and adopt water saving methods. BOR continues this funding partnership today.

Record high pumping costs, declining water supplies, and recently enacted water allocations in this part of the state have magnified the importance of farmers adopting strategies to maximize benefits from available irrigation water. To help them succeed, UNL Extension faculty and staff have conducted 35 field tours over the past four years to teach irrigation options specifically adapted for Nebraska crops, soils, and irrigation issues.



UNL extension educator Steve Melvin (photo courtesy Steve Melvin).

UNL Extension Educator Steve Melvin coordinates this project, which has involved more than 25 Extension personnel. The primary program goal is to demonstrate research-based irrigation management strategies in farmer fields and provide hands-on practical teaching environment for farmers and consultants to learn how to implement these practices. A key objective is to make irrigation scheduling and management as easy as keeping fuel in the tank using the fuel gauge. Other water saving techniques like no-till farming and irrigation applied vs. nitrogen rate interactions were part of the program, as well.

Plots have primarily been located in farmer fields in Nebraska's Republican River basin. Some of the sites were equipped with line-source sprinkler systems to demonstrate irrigation strategies for corn that use less water. All sites had soil moisture monitoring equipment and evapotranspiration (ET) gauges installed for use at field tours and to allow producers and crop consultants to work with the equipment.

UNL extension educator Steven Melvin (far left) at a well attended irrigation water management session (photo courtesy Steve Melvin).

Fifteen of the sites that were equipped with three line-source sprinkler laterals were to demonstrate and compare the traditional fully watered strategy and two strategies that conserve water. Research has shown that no significant yield reduction occurred when irrigation is delayed and corn is moderately stressed during the vegetative stage. However, significant yield reductions were found when stress occurred during the pollination and grain filling stages.

A line-source irrigation system is a set of sprinklers that are placed in the field and left in the same location for the season. The sprinkler spacing within the line is 10 feet and spacing between lines is 100 feet. The sprinkler used had a wetted diameter of 80 feet, creating a 20-foot strip between lines that does not receive any irrigation to represent dryland conditions.

This configuration creates a watering pattern of the planned application depth next to the sprinkler line and a gradual decrease in the depth of application until about 40 feet from the line where no water is applied. The advantage of the layout is that it gives the planned depth of irrigation plus a gradient from the planned depth to dryland and more

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Robert J. 'Bob' Oglesby, Ph.D.

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Karrie A. Weber, Ph.D.

at understanding the controls on N retention and loss in terrestrial ecosystems. Despite this effort, much uncertainty remains, especially with regard to gaseous N losses. This is particularly troubling in the context of human modification of the N cycle, which is dramatically increasing N pollution, runoff, and N_2O emissions. The oxidation of ammonium (NH_4^+) coupled to ferric iron (Fe(III)) reduction has been hypothesized to occur in aquatic systems, wetlands, and wastewater treatment reactors. This new pathway, called Feammox, could lead to the production of inert dinitrogen gas (N_2) as well as reactive nitrite (NO_2^-), which could be subsequently be reduced to N_2O, N_2, organic N (ON), or NH_4^+ under anaerobic conditions. Given the potential gaseous loss of nitrogen from terrestrial environments as inert N_2 or the greenhouse gas, N_2O, this pathway may play a significant role in the nitrogen cycle. The proposed research will place this newly discovered N transformation pathway in the context of the larger N cycle. (Co-PI, Funded by the National Science Foundation, Ecosystem Sciences Program in collaboration with Dr. Whendee Silver, Department of Environmental Science, Policy, and Management, University of California, Berkeley.)

Teaching Responsibilities:

Fundamentals of Microbiology
Geomicrobiology

Selected Publications:

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http://microbialbiogeochemistry.googlepages.com/

New USGS Report on Aquifers

The U.S. Geological Survey has released a new report, *Factors affecting water quality in selected carbonate aquifers in the United States, 1993-2005.*

USGS scientists sampled for 151 chemical constituents or physical properties in about 1,000 wells and springs across 20 states, mainly in the eastern and central United States.

The majority of wells sampled in the study are used as drinking water sources, either for domestic or public supply. Other sampled wells not used for drinking water included livestock wells, irrigation wells, and monitoring wells.

Carbonate aquifers are the largest sources of drinking water for public supply of any bedrock aquifer, providing about 20 percent of the groundwater supplied as drinking water nationally.

In general, findings show that carbonate aquifers provide water of acceptable quality for human use and consumption in the majority of wells sampled across the U.S.

With few exceptions, chemicals detected in groundwater from carbonate aquifers were low, generally below human-health benchmarks. Radon and nitrate were among the few contaminants with elevated concentrations in samples from wells tapping these important aquifers.

Results showed that many of the carbonate aquifers have natural features, such as confining clay layers, that protect the aquifer, and thus the concentrations of contaminants can vary greatly. Carbonate aquifers with features such as sinkholes, caves, and porous rocks are particularly vulnerable to contamination, particularly aquifers located in intensively farmed areas, and contaminant levels in a few of these areas are among the highest in the Nation.

Other Highlights

Nitrate—mostly derived from man-made sources such as from fertilizer applications, animal manure application, and septic tanks—was the most commonly detected contaminant at concentrations greater than the federal drinking water standard for public-water supplies (10 parts per million). Concentrations exceeded the federal drinking water standard in 5 percent of the wells sampled. The vast majority of the samples that exceeded the standard for nitrate were in the Piedmont and the Valley and Ridge aquifers, which exceeded the standard in 63 and 14 percent of the wells, respectively. The high levels were due to a combination of the ease of contaminant transport and agricultural land use in those two areas.

USGS findings show that the types and concentrations of selected contaminants in groundwater in carbonate aquifers are closely related to land use, such as fertilizers, pesticides, and volatile organic compounds

continued next page

UNL Analyzes Data from Test Holes and Helicopter for NRDs

By Kelly Helm Smith, UNL School of Natural Resources

This is not your grandmother's water dousing. University of Nebraska–Lincoln geologists are analyzing data collected by high-tech helicopter-mounted equipment to pinpoint locations where water is likely to be found.

Resource districts and others will be able to use the analyses for exploration, development and protection of groundwater supplies, said Jesse Korus, groundwater resources coordinator for the Conservation Survey Division of UNL's School of Natural Resources.

The helicopter was overhead the week of April 20, with a large, missile-shaped object hanging beneath it. The helicopter electromagnetic surveys are collecting data about Nebraska's aquifers, Korus said. Interpreting this data requires direct sampling of materials from test holes and a team of geologists.

Equipment towed about 100 feet below the helicopter in a long tube maps geologic structures beneath the earth. The helicopter company, Fugro Airborne Surveys, of Ontario, Canada, works with pilots who are specially trained for low-level flying.

The surveys "can tell you what types of soils and materials exist under the surface," Korus said. "The red is materials like sand and gravel, from which groundwater can be pumped in large quantities, if it's saturated with water. The blue are materials in which groundwater doesn't flow readily, like clay or silt."

Korus used visualization software to produce a three-dimensional image that combines survey data with test-hole data for an area near Firth. This image is a preliminary version of a much more comprehensive analysis that will include maps, cross sections and images.

The most recent helicopter flights gathered data over study sites near Hickman, Sprague and Hallam in Lancaster County and Wahoo, Weston, Ithaca and Swedeburg in Saunders County. These studies build upon earlier HEM surveys conducted in 2007 near Firth, Ashland and Oakland.

Collaborators include the U.S. Geological Survey, the Lower Platte North and Lower Platte South Natural Resources Districts, the School of Natural Resources and the Nebraska Environmental Trust.

New USGS Report on Aquifers *continued from previous page*

(or VOCs). For example, concentrations of nitrate were significantly higher in groundwater underlying agricultural land than in groundwater underlying undeveloped or urban land.

Herbicides were detected more frequently in agricultural wells, whereas insecticides and VOCs such as chloroform were more frequently detected in urban wells. Only 2 of the 47 pesticides analyzed exceeded human-health benchmarks in 20 sites and 4 of the 59 VOCs in 5 sites analyzed exceeded federal drinking-water standards.

Findings also show that factors other than land use can affect groundwater quality. For example, natural geochemistry is a factor influencing radon occurrence. Radon concentrations exceeded the proposed drinking water standard of 300 picocuries per liter in 58 percent of the samples where radon was analyzed. Natural factors controlling aquifer confinement, groundwater residence times, and the presence of organic carbon can help to minimize the transport of contaminants to an aquifer or enhance degradation of contaminants to innocuous forms prior to entering wells.

The report can be found online at http://water.usgs.gov/nawqa/pubs/carbonate/.

Fall Platte River Basin Science and Resource Management Symposium *continued from page 1*

including the North and South Platte Rivers, will be examined.

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

On October 15 the symposium will host a full day of fast-paced sessions by a broad cross-section of Platte River researchers, managers and interested parties. Researchers and resource managers from across the basin, including in Colorado and Wyoming, were invited to present.

Presentation and poster topics include integrated water management in the basin, invasive species management, wildlife and threatened and endangered species concerns, surface water and groundwater conflicts and socioeconomic issues, among others. Posters will be available for viewing both days.

The day's presentations open with panel discussions on the Platte River Recovery Implementation Program and the Platte River Program Independent Scientific Advisory Committee.

Registration opens in mid-August and symposium information, including a tentative agenda, is online at watercenter.unl.edu.

The event is cosponsored and hosted by U.S. Geological Survey Nebraska Water Science Center, Platte River Recovery Implementation Program, Headwaters Corporation and UNL's Water Center, School of Natural Resources, Water Resources Research Initiative, Office of Research and Institute of Agriculture and Natural Resources.

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

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One-Two-Three Punch Clobbers Toxic Algae, Restores Fremont Lake continued from page 1

oily green scum that can close them at the height of the summer recreation season is a combination of ridding a lake of its rough fish population, treating it with an agent that takes the algae's primary food source out of the water and then restocking it with sport fish.

That's the combination that UNL water management specialists, water quality experts from the Nebraska Department of Environmental Quality (NDEQ) and fisheries experts at the Nebraska Game and Parks Commission used to get Fremont Lake #20 off the list of perennially closed lakes when they killed-off its population of carp and other rough fish and treated the lake with aluminum sulfate two years ago.

"The result was the lake wasn't closed at any time during the 2008 recreation season and we think that trend will continue this year," Barrow said. Though numerous Nebraska lakes have been closed due to blue-green algae infestations over the last few years, Fremont Lake #20 was a virtual poster child for the problem until the state and UNL experts developed their plan to clean it up long-term.

"From June 2004 to September 2007, the beach at the lake was closed for 36 weeks, making it one of the most impacted public lakes in the state for blue-green algae toxins," said Paul Brakhage, water quality expert at NDEQ.

Because of these frequent closings of this one lake in the chain of Fremont State Lakes, the entire state recreation area lost thousands of public visits each summer.

Uncontrolled algae growth can clog these sandpit lakes with bluish-green scum, contribute to fish kills and make them unsafe, foul smelling and unusable for swimming, boating, fishing and water skiing.

It has long been known that nontoxic aluminum sulfate bonds with phosphorus, which is the primary food, source for toxic algae in sandpit lakes, and takes it to the bottom of the lake. Alum, as it is known, forms a flock-like barrier on the bottom of a lake that binds with the phosphorus and keeps it out of the water column. UNL researchers have successfully treated other Fremont State Lakes with the solution in the 1990's. What hadn't been tried before was treating one of the lakes after the algae toxins were already known to be in it, as was the case when they treated lake #20 in 2007.

"Water chemistry, the shape and size of the lake and sources of nutrients for the algae to feed on are all factors in how successful treating with alum might be. Typically a treatment can last five to 10 years or longer," Barrow said.

To help ensure the treatment would take-hold and last, and to begin the process of restoring the lake as a fishery, it was treated with Rotenone, a gill-targeting pesticide that killed the lake's population of mostly carp and white perch which contribute to the phosphorus algae eats.

Two months later, NGPC restocked the lake with bluegill, largemouth bass and channel catfish.

Several months later the lake was treated with an algaecide, which did not harm the fish, to reduce the amount of algae in the water and make the alum treatment more effective, Brakhage said.

Following treatment, lake water quality results have shown phosphorus is down 85 percent and a result of that is that chlorophyll-a, algae's biomass, has been reduced 92 percent, resulting in no algal toxins being detected in the lake last year.

"The difference in the clarity of the water is amazing, as well," Barrow said. "Last spring (2008) you could see the bottom of the lake in 18 feet of water."

Water quality and fisheries monitoring of the lake will continue for the next several years, but Barrow is confident that the combination of clean-up and treatment options used at Fremont Lake #20 will be successful long term and that they could prove applicable for other chronically algae infested sandpit lakes.

"We think the initial success at lake #20 will do a lot to get past the stigma that Fremont State Lakes has had over the last few years for being closed due to toxic algae problems. We think this treatment method is applicable elsewhere as well," He said.

Though alum is more expensive to apply than the traditional algae treatment, cooper sulfate, it is nontoxic and lasts far longer. Copper sulfate kills fish and other aquatic organisms along with the algae and does nothing to reduce a lake's nutrients and cooper treatment often has to be repeated several times annually.

The Nebraska Environmental Trust and Nebraska Game and Parks Commission provided funding for treatment of Fremont Lake #20. Funding for water quality monitoring was provided by UNL and Clean Water Act Sections 106 and 319 Funds by NDEQ and the U.S. Environmental Protection Agency.

Featured Partner: Audubon Nebraska *continued from page 5*

Important Bird Areas (IBA): Another program of Audubon Nebraska, the IBA Project, is an international effort to identify sites that are important for maintaining bird populations and to focus conservation efforts on protecting those sites. Within Nebraska, populations of many birds have significantly declined, primarily due to habitat loss. The IBA project is a means to focus attention on the best habitats of Nebraska in an attempt to slow and/or reverse these trends. Twenty-four sites have been designated in Nebraska at this time.

IBA sites provide important habitat for one or more bird species. IBAs include sites that birds use during breeding season, migration, or as wintering grounds. Sites can be a few acres or thousands of acres, but typically are discrete sites that stand out from the surrounding landscape. IBAs can be sites that encompass public or private land, and protected or unprotected status.

The Audubon Nebraska web site has a map and listing of current Nebraska IBAs, as well as instructions of how you can help to potentially designate an area as a new IBA. For each Nebraska IBA on the web site, a site description, ornithological summary and links to further information are included.

How can you get involved? The success of Audubon Nebraska relies on volunteer help and donations. If you are interested in supporting the efforts of Audubon Nebraska, there are a number of ways you can assist:

Monetary donations: Make a tax-deductible contribution, see website for details.

Planned giving: You can include Audubon Nebraska or any site or chapter in your will, contact Audubon for details.

Equipment and educational materials: Both centers have wish lists.

Volunteer your time: Includes land management and education programs.

For more information, or to contact Audubon Nebraska, please consult the web site at *http://www.nebraska.audubon.org*. The Audubon Nebraska State Office can be contacted at: Audubon Nebraska, 11700 SW 100th Street, Box 117, Denton, Nebraska 68339, Voice (402) 797-2301; Fax 797-2304 (fax); Email *nebraska@audubon.org*.

(Editor's Note: This is the second 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. The author would like to thank Directors Marian Langan and Bill Taddicken for their assistance in preparing this article).

Panola Mountain Research Watershed; Sept. 16 Lecture at Hardin Hall

Norman (Jake) Peters, Atlanta, Ga. Is tentatively scheduled to present a lecture on the Panola Mountain Research Watershed in the first floor auditorium of Hardin Hall, University of Nebraska-Lincoln East Campus on Wednesday, Sept. 16, 12:30-2 p.m.

"Evolution of hydrological and biogeochemical process understanding at a Water, Energy, and Biogeochemical Budgets Program site: Panola Mountain Research Watershed, Georgia" will detail the PMRW, a relatively undisturbed forested watershed near Atlanta, Ga.

Research there began 25 years ago, evaluating methods for measuring dry atmospheric deposition and to determine watershed processes controlling acid neutralization, which provided some process understanding and quantification.

Since 1991 when PMRW became a Water, Energy, and Biogeochemical Budgets Program site, the research has expanded scope of basic hydrological and biogeochemical processes to include the effects of climatic variables, and human influences on watershed processes.

Process conceptualization of PMRW has evolved from: (1) rainfall on and runoff from bedrock outcrop areas moving rapidly through the watershed to episodic subsurface flow on and leakage through bedrock outcrops and major leakage through bedrock underlying soil-mantled hillslopes; (2) uniform flow through soils to preferential flow producing high sulfate concentrations in ground and stream water; (3) vertical recharge and discharge of riparian zone aquifers to threshold (non linear) linking stream-riparian zone interactions with hillslope connectivity linking groundwater levels, soil moisture content, precipitation and stormflows; (4) simple mixing model assessments of hydrologic pathway contributions to stream solute fluxes to multi-end member mixing analysis, which provide quantification of end member contributions; and (5) uniform distributions of soil moisture content to temporal and spatial varying hillslope soil moisture content affected by trees through evapotranspiration.

In addition, research also has evolved our understanding of factors affecting atmospheric deposition and canopy interactions, calcium depletion, carbon sequestration and respiration, mercury cycling, weathering, and groundwater residence times and included modeling.

The evolution in process understanding also involved changes in approach/scale for hypothesis testing and serendipity.

The lecture is being sponsored by the U.S. Geological Survey Nebraska Water Science Center.

NEWS BRIEFS

Kearney Hub Coverage of Northern California Water Tour

A series of articles, by journalist Lori Potter of the *Kearney Hub*, on the June water and natural resources tour to Northern California and the California Bay-Delta estuary can be found online at http://www.kearneyhub.com/

Titles and topics of the articles are:

Kirchhoffs' move from Nebraska's Republican Valley to California's Bay Delta meant swapping cornfields for vineyards

Lessons for Neb. flow in Calif.

Bay Delta's future: More habitat, less farmland

Thorough process ensures Californians have chance to comment on projects

Should Calif. delta system fail, it could cost entire U.S.

Many factors complicate Calif. water marketing

Veteran Nebraska farmers disbelieving when seeing crops, irrigation uses

Former Neb. water director Patterson now helps lead huge SoCal water district

In complex Calif. water rights, groundwater still 'sacred cow'

Gigantic 'garden' depends on Calif. water projects

Cost of an earthquake in Bay Delta could easily eclipse Katrina plus decimate grocers' produce sections across the United States

NGWA web site

The National Ground Water Association (NGWA) recently redesigned and updated its educational web site for well owners called Wellowner.org (www.wellowner.org). It is a great resource for information on well construction, well maintenance, water testing and treatment, and groundwater protection.

NWQMC Conference

The National Water Quality Monitoring Council (NWQMC) will host its Seventh National Monitoring Conference, "Monitoring From the Summit to the Sea" in Denver, Colo., April 25-29, 2010.

The conference will focus on the many facets of water quality and quantity monitoring for improved understanding, protection, and restoration of our natural resources and communities. The conference is a centerpiece forum for communication that generally attracts 500-800 water practitioners from all backgrounds-including governmental organizations, volunteers, academia, watershed and environmental groups, and the private sector-to exchange information, develop skills, and foster collaboration and coordination.

Come present and learn about new new findings on the quality of the Nation's streams and groundwater, estuaries, and lakes, as well as recent innovations and cutting-edge tools in water-quality monitoring, assessment, and reporting.

An online abstract submission system is available and conference information can be found online at http://acwi.gov/monitoring/conference/2010/index.html.

Wetlands of Nebraska DVD

The Nebraska Game and Parks Commission has free copies of "Wetlands of Nebraska" DVD which highlights the different kinds of wetlands located in Nebraska and their importance.

To receive a free copy contact Ted LaGrange at Ted.Lagrange@nebraska.gov or (402) 471-0641. Also available for free download is *Guide to Nebraska's Wetlands and Their Conservation Needs*. This 31-page guide helps readers understand the different types, locations, and conservation needs of Nebraska's wetlands. To download the guide, visit: www.ngpc.state.ne.us/wildlife/programs/wetlands/wetlandsguide.pdf.

Census of Agriculture Data Now Available at Watershed Level

For the first time, results from the Census of Agriculture have been published at the watershed level by the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS).

"Our data users in the agricultural and environmental communities have expressed the need for watershed data and NASS is proud to meet their needs," said Carol House, NASS deputy administrator for programs and products. "The new watershed publication presents agricultural data that conforms to geographic boundaries, rather than state and county boundaries."

In the new publication, NASS reports selected data from the 2007 Census of Agriculture according to watershed boundaries set by the U.S. Geological Survey. The information is available for all 20 major water sources in the United States, as well as for each of the 376 water basins.

Information from the 2002 Census of Agriculture is published alongside the 2007 Census results to demonstrate changes in land use, production practices and livestock distribution over the past five years.

The Census of Agriculture is a complete count of the nation's farms and ranches and the people who operate them. It provides the only source of uniform, comprehensive agricultural data for every state, county, and now water basin in the nation.

For more information about the Census of Agriculture and to access the watershed publication, visit www.agcensus/usda/gpv <http://www.agcensus.usda.gov/> or call (800) 727-9540.

High Plains Aquifer Health

Water produced by the High Plains aquifer, which provides water to eight states, is generally acceptable for human consumption, irrigation, and livestock watering, according to a U.S. Geological Survey (USGS) study highlighted at the summer meeting of the Western States Water Council in Park City, Utah.

The study warns, however, that heavy use of water for irrigation and public supply and leakage down inactive irrigation wells is resulting in long-term gradual increases in concentrations of contaminants such as nitrate and dissolved solids from the water table to deeper parts of the aquifer where drinking-water wells are screened.

The report, "*Water Quality in the High Plains Aquifer, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, 1999–2004,*" U.S. Geological Survey Circular 2009-1337, is online at http://pubs.usgs.gov/circ/1336/.

The High Plains aquifer, also known as the Ogallala aquifer, is the nation's most heavily used groundwater resource. The majority is used for irrigation, but nearly two million people also depend on the aquifer as a source of drinking water.

USGS scientists analyzed water for more than 180 chemical compounds and physical properties in about 300 private domestic wells, 70 public-supply wells, 50 irrigation wells, and 160 shallow monitoring wells sampled between 1999 and 2004. The study also assessed the transport of water and contaminants from land surface to the water table and deeper zones used for supply, to predict changes in concentrations over time.

For more information on the High Plains aquifer study, contact Jason Gurdak (jjgurdak@usgs.gov) or Pete McMahon (pmcmahan@usgs.gov).

Dvorak Receives ASCE Greeley Award

Bruce Dvorak, associate chair of the UNL Department of Civil Engineering has been awarded the American Society of Civil Engineers' (ASCE) Samuel Arnold Greeley Award.

ASCE presents the award in recognition of outstanding papers dealing with the design, construction, operation or financing of water supply pollution control, storm drainage or refuse disposal projects.

Dvorak, along with Matthew Morley and Patrick Denning, received the award for a paper entitled "Relative Impact on GAC Usage Rates of Operating Strategies for Treatment of Contaminated Groundwater" that appeared in *Practice Periodical of Hazardous, Toxic and Radioactive Waste Management*, April 2008.

ASCE cited the paper for its originality as a major factor in its selection for the Greeley award.

The award was presented at an Environmental Water Resources Institute conference in Kansas City, Mo. in May.

From the Director *continued from page 2*

annual summer water tour knows, Mike's encyclopedic knowledge of water history in Nebraska and his mental GIS-precision map of every canal, stream, and drainage ditch in Nebraska (and many other western states) have made him invaluable on those tours. His sense of humor and positive demeanor, which also added to the tours, will be missed in the School of Natural Resources as well. So, drop Mike a note or the next time you see him, thank him for all that he's done for Nebraska's water resources over the past 20 years, including his stellar work at UNL.

One other major change will occur at the Water Center on September 1. I have decided to step aside as director after more than nine years. Suffice it to say that the decision was relatively easy, given that almost three years ago I was diagnosed with Parkinson's disease.

It may sound odd, but I feel very fortunate to lack most of the more debilitating symptoms, such as tremors, rather in my case the PD is manifest mainly by virtually illegible, tiny handwriting (something that university professors are supposed to have, right?) or micrographia and low speech volume or microphonia (not to be confused with iPod headphones). The bottom line here is that the Water Center needs a strong spokesperson, literally, now more than ever, a role that I can't provide.

So, it's time for a change. The better news is that the Water Center is in very capable hands, with Lorrie Benson, Steve Ress, Rachael Herpel, Duane Mohlman, Pat Jarecke and Tricia Liedle all manning the ship. The other good bit of news is that UNL administration values the Water Center to the extent that they have given the go-ahead to conduct a national search for a new director.

I won't be fading away, rather my future contributions will be mainly in the form of large grant proposals to initiate and/or sustain water research, education and extension activities at UNL, and white papers that will hopefully provide guidance to UNL administration on all wet matters. So, as a "senior water analyst" I hope to contribute to making Nebraska's water resources sustainable, and who could have a better job than that?!

UNL Extension Continues Focuses on Helping Farmers Learn Irrigation Strategies to use Less Water continued from page 10

importantly, makes a good field day site because the three irrigation strategies are all within a few hundred feet of each other. Tillage and cropping methods were the normal practices for that farmer and were primarily conventionally tilled furrow irrigated fields. The timing and the amount of water applied were the only management variables.

Teaching methods consisted of working one-on-one with producers and their crop consultants, whose fields we were on. A workshop style was used during the field tours to teach water conserving irrigation strategies and irrigation scheduling techniques.

Over the past four years, approximately 875 people attended 35 field tours. About 75 percent of those attending have been farmers.

Participating farmers have reported managing an average of 1,060 acres of irrigated cropland per farm. The average reported value of the knowledge gained by the producers completing the survey was $18,487 per operation.

If this average were extended to all producers attending, the value of the education gained would be more than $12.2 million over the four years and should become an annual savings. The reported potential water savings of 2.1 acre-inches by farmers would be a 15-20 percent savings from the typical irrigation water usage. About one-fourth of those attending tours also reported substantial knowledge gains that will help save water and increase returns per acre.

Occupations ranged from crop consultants, agri-business representatives, government agency personnel and others. The acre influence/manage ranged from none to over 100,000 acres. This variation makes it difficult to determine the impact of their involvement, but it is very significant as well.

The program continues this year with five sites. All sessions are open to the public:

Ainsworth area. Monday, Aug. 3, 6:30 p.m. 5 ½ miles west of Ainsworth on U.S. Hwy 20 and 2 ½ miles north on a county road. Field entrance is ½ mile west on the north side of the road.

Alma area. Thursday, Aug. 6, 6 p.m. 6 3/4 miles north of Alma on U.S. Hwy 183 or ¼ mile south of intersection of U.S. Hwy 183 and Nebr. Hwy. 42A (Huntly Road). The field is on the west side of highway. The program will start on the east side of the road at the Vince Colgan farm.

Curtis area. Monday, Aug. 17, 6 p.m. Located from the intersection of Nebr. Hwy 23 and Center St. (flashing light in Curtis), six blocks north to dead end, turn east (right) ½ block, then north (left) and follow the road 0.3 mile. Turn east into field road.

Benkelman area. Tuesday, Aug. 18, 5 p.m. (MDT). Located 6 miles west of intersection of Nebr. Hwy 61 and Road 712 (six miles north of Benkelman). Turn north on Avenue 332. The plot is ¾ mile north on Avenue 332 on the east side of the road.

Gothenburg area. Thursday, Aug. 20, 6 p.m. Located 1 ½ miles east of intersection of Nebr. Hwy 47 and Road 767/27th St. (north of Gothenburg). Plot is on the north side of road.

Nebraska's Increase in Irrigated Acreage Puts State First in the Nation continued from back page

acres between 1997 and 2007 as aquifer levels have declined due to overuse.

Not only does Nebraska's volume of irrigated acreage account for about one of every six acres of irrigated land in the United States, the quality of the state's irrigated agriculture is impressive as well, Johnson said.

Three of every four irrigated acres is under center-pivot irrigation. In 2005, an estimated 52,000 center-pivot systems operated in Nebraska, and that number has only increased, he said.

Nebraska's irrigated acreage is spread across all 93 counties, but considerable variation is seen. Areas of the state not over the Ogallala Aquifer, such as extreme southeast Nebraska, and areas with more marginal cropland like the western Sandhills region, have limited acres under irrigation. In other counties, the majority of cropland is irrigated.

Custer and Lincoln counties experienced the largest increases in the 10-year time period — 61 percent and 56 percent, respectively.

"Although Nebraska is the leading state in irrigation, the state has essentially reached its maximum development limits," Johnson wrote. "Major portions of Nebraska are already designated as either fully appropriated or over-appropriated."

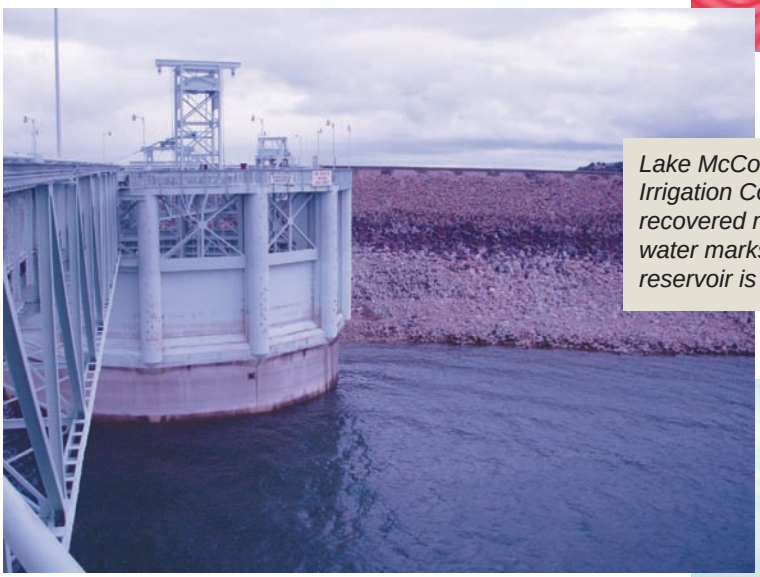
The Nebraska Legislature this year passed a law putting significant restrictions on further groundwater development for irrigation purposes.

"In short, there is no more development frontier," Johnson wrote. "From now on, Nebraskans, from the individual water user up through our policy arena, will need to wisely manage our water resources for a sustainable future."

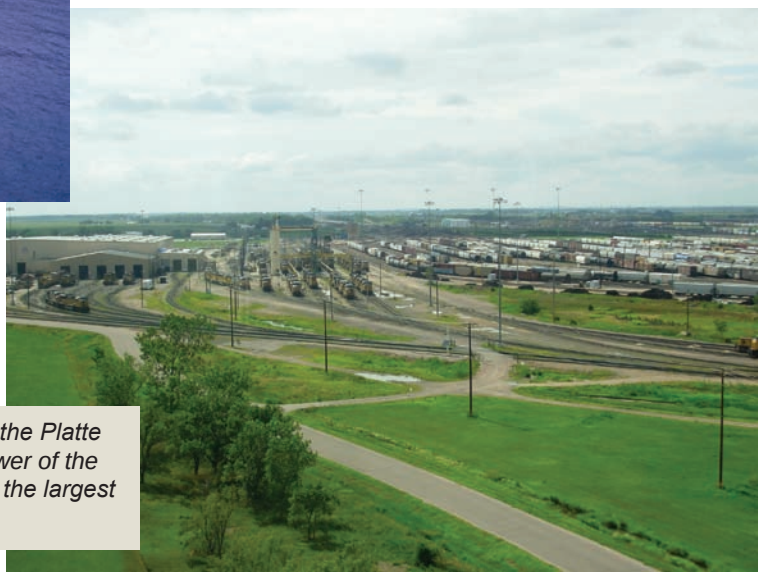
Four States Irrigation Council Tour of Platte and Republican Basins

Larry Janicek of the U.S. Army Corps of Engineers explains the operation of Harlan County Dam during the Four States Irrigation Council tour of the Platte and Republican River basins in July (photo: Steve Ress).

Those attending July's Four State Irrigation Council tour of the Platte and Republican River basins got a tour inside Harlan County Dam, near Alma (photo: Steve Ress).



Lake McConaughy and Kingsley Dam were stops on the Four States Irrigation Council tour in mid-July. Lake McConaughy levels have recovered markedly from historic lows of a few years ago, but as high-water marks on the dam indicate, still have a ways to go before the reservoir is once again at capacity (photo: Steve Ress).



The final stop on the Four States Irrigation Council July tour of the Platte and Republican River basins was the Golden Spike viewing tower of the Union Pacific Railroad's North Platte classification yard, one of the largest railroad yards in the world (photo: Steve Ress).

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Nebraska's Increase in Irrigated Acreage Puts State First in the Nation

By Lori McGinnis, IANR News Service

While the number of irrigated acres is dropping in many parts of the country, it continues to rise in Nebraska, which now ranks first in the nation.

Some areas of the state are over-irrigated, however, and significant limitations on future irrigation are looming, said Bruce Johnson, University of Nebraska-Lincoln agricultural economist.

By the end of 2007, Nebraska had 8.5 million acres under irrigation, Johnson wrote in the June 10 issue of "Cornhusker Economics." Nebraska added 560,000 acres from 1997 to 2002 and another 930,000 acres between 2002 and 2007.

The most recent U.S. 2007 Census of Agriculture, released in February, shows Nebraska now has more irrigated farmland acres than any other state, accounting for about one of every six acres of U.S. irrigated farmland.

The increase puts certain areas of the state at risk for being over-appropriated, Johnson said. Some 30,000 irrigated acres may have to be changed to dryland acres as a result.

"We have a very precious water resource in this state ... and we're developed pretty much to the max," he said in an interview.

While it is not surprising that Nebraska has been in an irrigation expansion mode for several years, what is surprising is that other major irrigation areas of the country have reduced irrigated acreage, Johnson said.

California, which historically has been first in irrigated acres, dropped 900,000 acres between 1997 and 2007, with the bulk of that decline between 2002 and 2007. Johnson attributed the drop to multiyear drought conditions and an ever-growing demand for water by the state's metropolitan areas. California's irrigation acres stood at 8.2 million in 2007, down from 8.71 million in 2002.

Among other major irrigation states, only Arkansas has experienced consistent growth over time, Johnson said. Texas, which shares part of the vast Ogallala Aquifer with Nebraska, reduced irrigation on about 750,000

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