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UNIVERSITY OF NEBRASKA–LINCOLN WATER CENTER

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Water Current

PART OF THE SCHOOL OF NATURAL RESOURCES

MEET THE FACULTY

Tsegaye Tadesse, Ph.D.

Tsegaye Tadesse is an assistant professor in the University of Nebraska–Lincoln's School of Natural Resources and climatologist in the National Drought Mitigation Center (NDMC). Tadesse has been an assistant professor in the NDMC since 2005 and was a research associate there from 2002 to 2005. His research interests and areas of expertise are in drought monitoring, natural resource management, team leadership and development, climate change and variability, human impacts on the environment, remote sensing/GIS, data mining and risk management, among others.

Education:

Ph.D., Agronomy (Agro-meteorology), University of Nebraska–Lincoln, 2002
M.S., Space Studies, International Space University, Strasbourg, France, 1998
B.Sc., Physics, Addis Ababa University, Ethopia, 1982

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INSIDE

Back-to-Back UNL Water Events in October

By Steve Ress, UNL Water Center

Back-to-back water events are coming to Lincoln's downtown Holiday Inn in early October.

The University of Nebraska–Lincoln Water Center and University of Nebraska College of Law co-host a daylong Water Law Conference on Wednesday, Oct. 6. The Water Center then joins with the U.S. Geological Survey's (USGS) Nebraska Water Science Center to present a daylong Greater Platte River Basins Symposium at the same location the following day, Thursday, Oct. 7.

"The Wednesday water law conference focuses on Nebraska water law and will feature a variety of speakers and topics tailored to the practicing bar, but which will also be of benefit to anyone interested in water law," said conference organizer Lorrie Benson, assistant director of the UNL Water Center.

Tentative topics include an overview of property rights to water by UNL law professor Sandi Zellmer; conservation easements by Jesse Richardson of Virginia Tech University; and Clean Water Act enforcement by Patricia Miller of the U.S. Environmental Protection Agency, Region Seven.

Other conference sessions include issues

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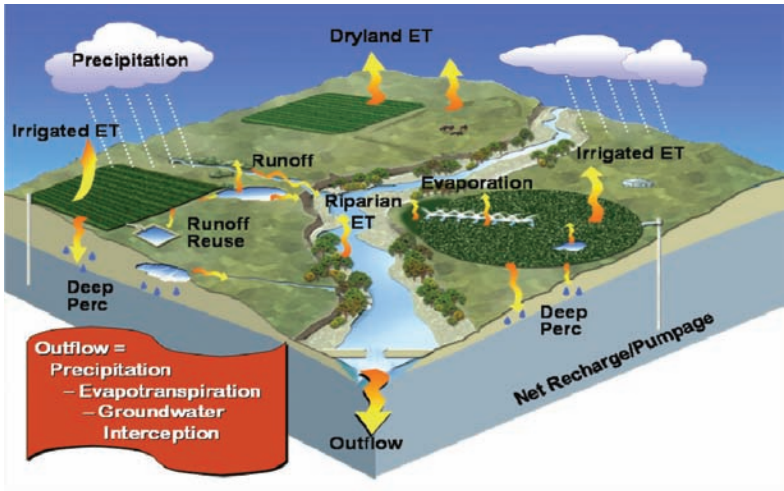
Mapping Evapotranspiration

Jozsef Szilagyi, Associate Professor, Research Hydrologist School of Natural Resources, UNL

By Rachael Herpel, UNL Water Center and NU Rural Initiative

Evapotranspiration, or ET, is loss of water through evaporation from the earth's surface, including open water and plant surfaces, and plant transpiration, or how a plant grows by passing water from its roots up through its stem and leaves to the atmosphere (Source: Derrel Martin, UNL Biological Systems



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From the Interim Director

Bruce Dvorak

Dvorak Temporarily Leaving for Czech Republic; Kuzila to Fill Water Center Director's Post

As some of you may already know, I will be departing on Faculty Development Leave to VŠCHT (Institute of Chemical Technology) in Prague, Czech Republic this fall. This is something of a return trip for me, since I spent the summer of 1990 studying in Prague and am looking forward to another extended visit. I will be on a Fulbright Scholarship, teaching graduate coursework and researching as part of their water treatment technology faculty.

I will also participate in the Stockholm World Water Week while in Europe. I will leave with my family in late August and will return in mid-December. I have been planning this exchange for several years and had formally applied before being approached about the interim director's position here at the Water Center, where I have greatly enjoyed the challenges and opportunities of the past year.

I have met many leaders in the Nebraska water community, University of Nebraska Water faculty and staff, and other stakeholders and have gained a great appreciation for the vast diversity of knowledge and skills that Nebraska has related to water, both within and outside of the University of Nebraska.

I have also found it humbling to realize how much I do not know about water quality and quantity. I only hope that I have been able to help advance the University's overall abilities to help address Nebraska's critical water issues.

I have also enjoyed working with the Water Center staff. They are very dedicated to the mission of the Water Center, and are a very experienced and skilled group with many years of combined professional experiences. I have learned a great deal from them related to water policy, history of water issues in Nebraska, event organization, and outreach.

While I am in Prague this fall, Mark Kuzila has very graciously agreed to provide leadership for the Water Center as acting interim director. He already has too many irons in the fire, but was willing to help for a semester. Many of you know Mark, and know that he brings tremendous experience to the position and will provide strong leadership.

Mark's professional resume is far too accomplished and lengthy to list here, but some highlights of note include that he is a past director of the School of Natural Resources, heads the Conservation and Survey Division and is the State Geologist, which will leave the Water Center in very experienced and capable hands.

I am also engaged in discussions with our senior campus leadership related to potentially returning as the Water Center's interim director for the spring.

The search for a permanent director is currently on-hold, pending decisions at the Chancellor's level concerning how the Water Center and the newly announced Global Water for Food Institute will interact, and what roles and duties each will have. No timeline has been announced related to the search for a permanent director.

The Water Center has a very active coming year (July 2010 to June 2011) of events and interactions with faculty and stakeholders.

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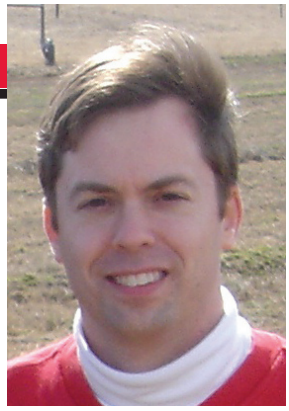
Chris Henry, P.E.



Chris Henry is an Extenson Engineer II in the University of Nebraska–Lincoln Department of Biological Systems Engineering. His programming interests extend into the areas of livestock waste regulations, mortality management, small animal feeding program and land application training, among others.

Education:

University of Nebraska–Lincoln • 2003-present, Ph. D. candidate in Engineering
Kansas State University • 1991-1998
M.S. in Biological and Agricultural Engineering
B.S. in Biological and Agricultural Engineering – Environmental Emphasis
Secondary Major: Natural Resources and Environmental Sciences

Examples of Current Programs:

My primary extension program is called the Livestock Producer Environmental Assistance Project and it strives to develop alternative runoff control systems for small and medium sized livestock operations (Animal Feeding Operations). The primary Extension program focus is on the development of Vegetative Treatment Systems for open lot runoff. The following activities took place in 2008:

— In March 2008 the program offered a "The Art of Vegetative Treatment Design" short course for the Heartland Water Quality Initiative, Technical Service Provider College. The majority of the TSP's indicated that because of the workshop they had a much better understanding of VTS design. Sixty percent asked for additional training. The TSP's in attendance interact with about 2,000 producers, 790,000 head of livestock, and about 2,400 permits annually across the four state region (KS, NE, MO, IA).

— In June the program held its bi-yearly tour, comprised of four demonstration project site stops and in-route presentations. The tour audience (102 participants from KY, KS, NE, MO, SD and IA) tends to be primarily those that advise producers with the rest being producers. Ninety-four percent of the producers (representing 5,470 head of cattle) on the tour indicated that the technologies shown on the tour had application on their farm and sixty-four indicated they intended to make a change as a result of the tour. The advisors on the tour annually advise about 3.9 million head of livestock and all (100 percent) indicated that they would transfer the knowledge they learned on the tour to their clients. As a result of the tour, 70% of participants indicated that they "have a much better understanding of VTS technology." As one participant indicated "Outstanding joint effort, to develop and disseminate, a cost effective, common sense technology to help producers...I am very proud of the University."

— An additional four new demonstration projects (plus finish work on six from 2007) were constructed in 2008, total cost of $201,000 and

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Tsegaye Tadesse, Ph.D. *continued from page 1*

Examples of Current Research:

Drought monitoring research focused on the development of new drought monitoring tools integrating climate, satellite, oceanic observations with biophysical parameters such as land use/land cover in assessing and predicting large-area vegetation stress by using data mining techniques. As a result, we have developed operational monitoring tools such as the Vegetation Response Drought Index (VegDRI), as well as predictive tools such as the Vegetation Outlook (VegOut). Research is undergoing to model & evaluate the prediction tool (i.e., VegOut) to be operational in the near future. Additional research is underway that includes investigation of the use of thermal data and microwave sensors for estimating evapotranspiration and soil moisture to monitor drought in collaboration with scientists who are working at USGS Earth Resources Observation and Science (EROS) and NASA Jet Propulsion Laboratory (JPL). The current projects activities and duties include:

— **Development of the Vegetation Drought Response Index (VegDRI) for the United States** – Investigator. This is a joint NDMC-USGS research project to develop a VegDRI as new vegetation drought monitoring tool for the United States. The project includes applied research, operational development, various publication and outreach activities (e.g., papers, presentations, and surveys).

— **Development of the Vegetation Outlook (VegOut) Tool for Vegetation Condition Prediction** – Investigator. This research project investigates the use of satellite, climate, oceanic, and biophysical data for mapping and predicting the general vegetation conditions for the U.S. Great Plains.

— **Investigation of New NASA Instruments and Products for Enhancing U.S. Drought Monitoring Capabilities** – Co-principal Investigator. This is a joint NASA/NDMC project to assess the accuracy and utility of emerging products (soil moisture and terrestrial water storage estimates) from new satellite sensors (GRACE, QuikScat, and AMSR-E) for national- to continental-scale drought monitoring in North America and inclusion into the U.S. Drought Monitor map's development.

— **The Impact of Weather Extremes on Agricultural Production Methods: Dose Drought Increase the Adoption of Conservation**

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May 10, 2010

Bob Daugherty: Man With a Vision

By Walt Sehnert, McCook Daily Gazette

Recently, the University of Nebraska received one of its largest gifts ever, when Robert B. Daugherty (Valmont) donated $50 million to help the university develop solutions to various world challenges, including poverty, hunger, agriculture production, and water management.

These are lofty goals to be sure. Yet Bob Daugherty is a man who has aimed high in the past, and has a proven record of achieving his goals.

Daugherty's father was a livestock buyer and Bob spent a good bit of his youth around the Omaha Stock Yards, in South Omaha. Though he never lived on a farm he got to know about farmers and their needs, and was drawn to agriculture generally.

After a stint in the Marine Corps, during World War II, Daugherty returned to Nebraska to 1946, looking for a business opportunity. That opportunity came when he met Sam McCleneghan, of Valley. Sam was manufacturing and selling a few items for farmers, some of which he had invented, including a small elevator for moving grain from the ground to grain bins. Bob arranged to buy half interest in Sam's tiny company for $5,000. Business was slow until they managed to snag a contract from Sears Roebuck, to sell their elevators through the Sears Catalog.

All seemed to be going well, and the Valley Manufacturing Co. grew from three to 100 employees. But, in 1952 there was a severe slowdown in the ag industry and business fell off drastically. Daugherty began to look for items that could diversify their business.

An employee told Bob about a new type of irrigation system that was being built in Columbus by Frank Zybach and his partner, Mr. Trowbridge. That system was a water-powered pivot sprinkler that could automatically irrigate up to a quarter section of land. Daugherty was immediately interested. A machine that could make it rain in Nebraska had to be good. After only a few days Daugherty had made a deal to buy Zybach's patent and manufacture the pivots, giving Zybach and Trowbridge royalties on machines sold.

Zybach's pivot irrigated differently, and getting it accepted by skeptical farmers did not come easily. However, the machine had a good bit going for it. It could irrigate land that was too hilly to irrigate by conventional pipe and ditch irrigation. And, once the machine was started it would move around the field automatically – with no labor from the farmer. Note: This is the way it was supposed to work.

My Dad, Walter, in Plainview, was a fellow who was always interested in new ideas for his farm. He was not afraid to try new things – he introduced Landrace hogs, and Brown Swiss cattle to the area. He was one of the first to do no-till farming on his place, which one friend called "a sand pile" – not fit to be farmed. Sometimes his ideas worked, sometimes not. Sometimes he took considerable ridicule from his friends for his "wild ideas."

Anyway, in 1955, after a couple of years of paying (often undependable) high school fellows to move irrigation pipe, Walter was ready for another method of irrigation. He was intrigued by the new pivot system that Daugherty was making at Valley. He visited the plant, talked with Daugherty, and ended up installing one of the first of the pivot systems in the Plainview area. (Daugherty was a very persuasive salesman, and Sam McCleneghan was so knowledgeable and sincere that I'm sure the sale was a foregone conclusion).

The first Valley machines, at $8,000, were quite complicated, and not very reliable. They had steel wheels that tended to leave deep ruts in their path through the field. The machines had a series of towers that had guy wires supporting the main pipe, which also kept the towers lined up.

The machine was moved by hydraulic cylinders on each wheel, the water for power coming from the irrigation water. As long as everything was working as it should there was no problem. But – if the hydraulic cylinders plugged up, if some of the guy wires on the towers lost their tension, if there was a problem at the well, then everything shut down – to keep the machine from tearing itself up.

It was a rare occasion that the Pivot would make a complete round without stopping. Farmers set their alarm clocks, to check their systems once or twice during the night.

In those early days, we got to know the Valley repairmen quite well. There were so few systems that Sam and Woody(?) used to stop when they were in the area, to see how everything was working, whether we had called them or not. Also, Frank Zybach and Mr. Trowbridge would stop on their way to the Atkinson area, where they were buying land on which to put center pivots.

Through these contacts, Charlie, my Dad's tenant, learned the intricacies of the system and became very adept at fixing problems, and preventing them before they occurred. And, despite all the problems, the Pivot Irrigation System did increase yields quite dramatically!

In those early days, Bob Daugherty was a man in a hurry. He wanted things done immediately, and done right. I can only imagine the frustration he must have felt with the problems those early machines presented. But he never lost sight of the big picture. He believed

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Irrigation Management Project Expands

University of Nebraska Extension Educator Randy Pryor said it all started when he learned about the success of the Nebraska Agricultural Water Management Demonstration Network (NAWMDN) in 2007. He and City of Wilber Water Manager Jerry Petracek ordered watermark sensors and an ETgage through a Wilber Wellhead Sourcewater Grant. Using the 4-H motto, they learned by doing with the newer irrigation management technology. That year, Pryor worked with two cooperators near the City of Wilber and placed watermark sensors and a data logger at the Southeast Nebraska Corn Growers Association plot near Crete. He demonstrated the value of watermark sensors and ET gages at the fall Southeast Corn Growers plot tour reaching 85 corngrowers.

By August of 2007, with the help of Extension educators Randy Pryor, Paul Hay, Gary Zoubek and Lower Big Blue Natural Resources District (NRD) manager, Dave Clabaugh, a new cost share proposal was made and adopted by the Lower Big Blue NRD Board of Directors. Using the NRD water quality fund, Extension and the Lower Big Blue NRD teamed up to start a new cost share program for irrigation management. The main goal was to save energy and groundwater in the NRD District.

Pryor said he has observed real and measureable private and public value when farmers adopt new technologies to better manage and schedule irrigations for corn and soybeans. It is not unusual for a producer to save irrigation on the front end and tail end of the growing season or around 2 acre-inches of water with a pivot.

For the past two growing seasons and this year (2008 through 2010), 104 growers in the Lower Big Blue NRD have ordered 730 watermark sensors, 41 ETgages, 51 hand held readers, 26 data loggers and 23 soil probes or about $48,000 worth of irrigation management equipment. Dustin Wilcox from the Lower Big Blue NRD said "at least half of the cooperators purchased additional equipment and expanded their irrigation scheduling arsenal after their first year in the program. The technology in irrigation scheduling continues to evolve, and we plan to continue to adopt that technology and incorporate it into our program."

Jack Mulliken and his son Robert install Watermark soil moisture sensors near Nickerson.

(Left to Right) Dustin Wilcox, Lower Big Blue NRD and Randy Pryor and Paul Hay UNL Extension Educators.

The team of Extension Educators Paul Hay, Randy Pryor and NRD employee Dustin Wilcox trained all first year cooperators in the field and a folder of materials is reviewed on how to interpret the irrigation scheduling data. After that producers are expected to obtain or borrow soil probes for self-installation. "Each year the irrigators get more sophisticated with their questions and improve confidence levels,

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Environmental Science Education: Motive and Opportunity, but Maybe Not the Means?

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

I find myself writing this installment of in this series of *Water Current* articles in a lounge chair in my steamy Omaha backyard at the end of July.

As an academic who has been out of the classroom for almost three months, thoughts regarding education lazily swim through my mind. Considering the current state of science education in the United States, there are certainly things to think about! When compared to 56 other countries ranked in the PISA 2006 science scale, the U.S. ranked slightly lower than Latvia, slightly ahead of the Slovak Republic, and slightly below the overall average.

UNO environmental toxicologist Alan Kolok.

I contend that these numbers do not tell the full story regarding scientific literacy in the U.S. Students today clearly have the opportunity and the motive to become scientifically literate. Perhaps it is up to us to also provide them with the appropriate means. Allow me to explain.

A few weeks ago, I was talking to a few high school students from a small town in central Nebraska. During the conversation, one of them asked if I was familiar with the recent research findings of Dr. Tyrone Hayes in which he found that atrazine exposures during development caused male frogs to develop into fully functional females. Familiar? I guess you could say that, as I had just finishing writing last quarter's *Water Current* article on the same topic!

Two things are truly astounding about this conversation.

First, at the time of the query the research had only been publicized (in the *Proceedings of the National Academy of Sciences*) for a few weeks, and second the question came from a high school sophomore. Published research had traveled from the University of California Berkeley to a central Nebraska high school in just a few short weeks! Any student in the country that has access to a computer can use it to plug into the very most current scientific findings. Talk about opportunity!

As for motive, the motivation to be interested in environmental science appears in daily news headlines. Global warming, the Deepwater Horizon disaster in the Gulf of Mexico, the pervasive presence of pharmaceuticals and other organic compounds in surface water, are all brought into the homes and lives of high school students, as well as the rest of the public, on a daily basis.

Students who talked to me about atrazine and frogs weren't interested in the topic from an academic perspective, but rather were interested because this eco-chemical experiment is currently being conducted in wetlands in their very own backyards.

The one-two punch of unlimited, immediate access to scientific information, and the pervasive nature of environmental issues on both local and national levels, has brought science, particularly environmental science, into the mainstream. High school students today have the motive and opportunity to learn a lot about scientific discourse, but do they also have the means to directly participate in it? Unfortunately, the answer may be no.

If an enterprising high school student wants to conduct a science project that is germane to their backyard experience, they really have one of two choices.

They can either collect simplistic data that will not answer the question they originally posed, or they can begin experiments that will ultimately require technical instrumentation and sophistication well beyond their grasp.

A renaissance in methodology is needed in environmental science, and it is coming.

Laboratories, including my own, are in the process of developing simple, fast, inexpensive technologies for biomonitoring of local air and water quality. These technological advancements will provide the means by which our enterprising young students can partake of the scientific process. Once this occurs, a 'perfect storm' of means, motive and opportunity will take place in environmental science education.

On average, the U.S. high school student population may only rank in the middle of the international pack. However, given the means, motive and opportunity to excel, I contend that the accomplishments of this student population will be truly impressive.

Recent U.S. Geological Survey funding for University of Nebraska Research

Towards Groundwater Recharge Forecasting: Monitoring and Modeling Episodic Recharge Responses to Weather Events

Dr. John Gates, University of Nebraska–Lincoln

Focus: Groundwater, Climatological processes

Start date: 3-1-2010, End date: 2-28-2011

Sustaining water resources through future land use and climatic changes is a critical challenge facing the State of Nebraska and beyond. The need for accurate prediction of how hydrological systems will be affected by forthcoming environmental changes is widely recognized. The proposed project offers a powerful new tool for predicting inputs to groundwater – a vital source of water to cities, agriculture and ecosystems. The goal of the proposed project is to develop a method of predicting groundwater recharge on the timescale of individual rainfall events by combining hydrologic monitoring and modeling with weather radar. Rainfall-recharge linkages on the event scale will be explored using reflectivity-based rainfall intensity data with unsaturated flow modeling and matric potential profile time series data. Intended outcomes include a determination of the meteorological characteristics of storm events that contribute to groundwater recharge in Nebraska, and an assessment of the feasibility of predicting distributed groundwater recharge from radar.

Investigating a New and Potentially Critical Cyanobacterial Toxin in Midwestern Reservoirs

Dr. Kyle Hoagland, University of Nebraska–Lincoln

Focus: Cyanobacteria, toxins, BMAA

Start date: 3-1-2010, End date: 2-28-2011

Cyanobacteria (also termed blue-green algae) often form blooms or rapid population increases in lakes and reservoirs, with associated releases of toxins. To date, seven major toxins or families of toxins have been identified as being directly associated with cyanobacteria. Recently, another blue-green algal toxin can be added to the list, namely BMAA (beta-N-methylamino-alanine), a simple amino acid that recently has proved to be a powerful neurotoxin that can have profound effects on humans. BMAA is the focus of the proposed study in large part because of its potentially devastating effects on human health across the agricultural Midwest. In addition, its presence in many freshwater ecosystems has not been confirmed. The specific objectives of the proposed study are to: (1) determine the overall occurrence of BMAA in eutrophic reservoirs throughout Nebraska; (2) ascertain the likelihood of biomagnifications of BMAA in fish (because they are the most likely transfer agent to be consumed by humans), and; (3) develop the methodologies needed to rapidly assay BMAA from water bodies elsewhere in Nebraska, as well as worldwide. Finding elevated concentrations in fish tissues would clearly be the most significant result of this study, prompting a series of studies, including extensive bioassays on fish and mammalian models (e.g., mice), as well as epidemiological research.

Mitigate and Treat Antibiotic Residues and Antibiotic Resistance Genes in Soil and Water

Dr. Xu Li, University of Nebraska–Lincoln
(Co-PI: Dr. Dan Snow, University of Nebraska–Lincoln)

Focus: Wastewater, treatment, agriculture

Start date: 3-1-2010, End date: 2-28-2011

Antibiotic residues and antibiotic resistant bacteria from untreated animal wastes can lead to the proliferation of antibiotic resistance in the environment. Preliminary studies detected antibiotic (AB) residues and antibiotic resistance (ABR) genes in the soil and water environments that were under the influence of

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Tips to Prepare for EPA CAFO Inspections

If you own a Concentrated Animal Feeding Operation (CAFO), you may have heard about U.S. Environmental Protection Agency (EPA) Region 7 inspection and enforcement activities. These are part of increased national emphasis aimed at ending harmful discharges of pollutants from CAFOs into rivers and streams.

Having EPA inspect your facility can sometimes be a daunting experience. Inspections are very comprehensive and typically cover all aspects of a facility's operation. EPA inspectors routinely perform walk-throughs of production and land application areas, review records and collect samples.

To assist producers in preparing for inspections, EPA offers the following 10 tips to help ensure operations are in compliance.

1. Are you discharging? Answering this question is one of the primary purposes of an EPA CAFO inspection. Owners and operators of CAFOs should evaluate their facilities to determine if any runoff is getting into nearby rivers and streams. If you are discharging, contact the state regulatory agency to determine waste controls and permit requirements.

2. Are you controlling runoff from feed storage areas? CAFOs are required to control runoff from all production areas, including feed storage areas.

3. Are you controlling runoff from manure/bedding stockpiles? These stockpiles are considered part of a facility's production area even if they are located outside the facility's footprint. Care should be taken to prevent runoff from discharging into nearby rivers and streams.

4. Is your facility medium sized? If your operation conveys runoff from the production area through a man-made ditch, flushing system or other similar man-made device, then you need to obtain a permit or stop the discharge.

5. It is important to read your National Pollutant Discharge Elimination System (NPDES) permit and implement its requirements.

6. Are you counting animals correctly? Both EPA and state regulatory agencies require that species in open lots be counted together with similar species in confinement for the purposes of determining your size status as a CAFO. Also, if your operation confines enough animals of one species to be considered a large CAFO, then all animals at the operation must be counted and runoff from these areas must be contained.

7. Maintain complete and accurate animal inventory records. One of the first things an inspector does is determine your CAFO status by looking at the number of animals that have been confined at your facility. This determination can take time if the right records are not readily available.

8. If you have an NPDES permit, you cannot expand operations beyond the capacity listed in your current permit without authorization from the state regulatory agency.

9. Maintain lagoon berms free of trees, shrubs and erosion features and follow pump-down level requirements for lagoons to maintain adequate storage levels.

A concentrated animal feeding operation, or CAFO (IANR photo by Brett Hampton).

10. Maintain records for land application of manure solids and liquids and follow a nutrient management plan/manure management plan in the application of any manure. These records are vital to demonstrating that you are implementing appropriate land application practices.

Learn more about NPDES and how it regulates CAFOs at http://cfpub.epa.gov/npdes/home.cfm?program_id=7.

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livestock operations, suggesting that these contaminants can be potential threats to drinking water sources. However, little is known about what environmental factors determine the fate and transport of these contaminants in soil or water, which impeded the development of practical solutions to mitigate the contaminants in the environment and treat them in drinking water. Therefore, in the proposed project, the following objectives will be achieved: 1) measure various AB residues and ABR genes in various agricultural wastewater environments and determine the environmental factors that govern the fate and transport of these contaminants; 2) quantify the effects of ultraviolet (UV) radiation and oxygen levels on the fate of AB residues and ABR genes in animal waste lagoons; and 3) investigate the fate of AB residues and ABR genes during disinfection using chlorine, and quantify the potential of the disinfected water in proliferating antibiotic resistance. A successful completion of the research objectives will contribute to the development of the new management practices to minimize the impacts of AB residues and ABR bacteria on water sources during animal waste handling and lead to the design of drinking water treatment processes to eliminate the potential impacts of these contaminants to human health.

Wireless Underground Sensor Networks for Irrigation Management

Dr. Mehmet Can Vuran, University of Nebraska–Lincoln

Focus: Irrigation, methods, agriculture

Start date: 3-1-2010, End date: 2-29-2011

The improvements in embedded system design and low-power wireless communication techniques have made wireless sensor networks an attractive tool for many application areas. In this proposal, the development of wireless underground sensor networks (WUSNs), which carry information through soil, in investigated for autonomous irrigation management. More specifically, the integration of underground networking techniques with center pivot systems is considered, where WUSNs promise significant reduction in water usage for irrigation. This impact is important considering the fact that irrigation constitutes nearly 70% of all water usage in the world. The objectives of this project are to (1) design and implement a cross-layer communication module for environment-aware underground networking in agricultural fields, (2) Implement an irrigation management test bed, where WUSNs will be integrated with a center pivot system to realize autonomous irrigation management through real-time soil moisture information, and (3) Develop hands-on educational tools and provide experiences in WUSNs. Accordingly, the project is anticipated to result in a complete empirical characterization of the underground communication and an environment-aware communication protocol. Second, the proposed research will result in a comprehensive decision support tool and the associated networking components for real-time soil information delivery and automated irrigation management with a center pivot system. The tools provided by the project can be integrated into any agricultural equipment that requires information from the soil in the future.

Despite the potential merits of WUSNs such as concealment, real-time data delivery, and coverage density; preliminary field experiments and analysis show that the communication performance in underground settings is significantly affected by the variations in soil conditions. Moreover, underground sensor nodes has been integrated with an aboveground device attached to a center-pivot system to provide a proof-of-concept for the project. The insights from these analyses will be exploited to develop cross-layer communication platforms that adopt the environment and implement an autonomous irrigation management system using center-pivot systems. To this end, the PI has partnered with biological scientists to develop an agricultural underground sensor network test bed to evaluate the protocols developed as a result of this research and demonstrate the effectiveness of the environment-aware cross-layer design techniques.

The proposed work is expected to have a significant impact on research in wireless underground sensor networks and education tools for teaching findings to students and farmers as well as an economical impact on agriculture. The realization of WUSN techniques has the potential to transform local agriculture industry, which is one of the main driving forces of economy in Nebraska. This will facilitate broader application of sensor networks in agricultural solutions. The proposed activities will further student education, both within the University of Nebraska–Lincoln and outside including junior high and high school education. One graduate student working toward Ph.D. will be supported using the student support from the project, and the results from the proposed work will be aggressively published in premier conferences and journals. Moreover, the test bed and the simulation platforms will be used in class projects as educational tools to provide insight and deep understanding of the underground networking.

Annual Water & Natural Resources Tour:

"Sharing Limited Water Supplies in the Platte River Basin of Nebraska, Colorado and Wyoming"

July 12-15

UNL professor Stephen Young talks with tour co-director Mike Jess at the Tri-State Diversion Dam.

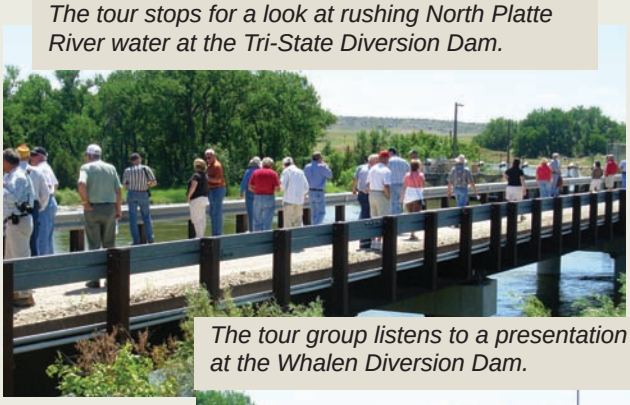
Pathfinder Irrigation District general manager Dennis Strauch talks to the water tour at the Whalen diversion dam, which diverts North Platte River water into the Ft. Laramie and Interstate irrigation canals.

Steve Brill, Goshen County Weed and Pest Control District, Torrington, Wy. talks about an ambitious and successful invasive species removal project in western Nebraska and eastern Wyoming in association with UNL Extension.

Dennis Strauch of the Pathfinder Irrigation District, Mitchell.

Nebraska native Tom Cech, general manager of the Central Colorado Water Conservancy District in Greeley, Colo., talks about recent water well shutdowns in eastern Colorado when the tour stopped in Fort Morgan enroute to Fort Collins.

The tour stops for a look at rushing North Platte River water at the Tri-State Diversion Dam.



The tour group listens to a presentation at the Whalen Diversion Dam.

Corey Steinke of Central Nebraska Public Power and Irrigation District talks with State Senator Tom Carlson of Holdrege during a lunch break at Glendo Reservoir in Wyoming.

Brian Barels of Nebraska Public Power District, talks to the tour at Lake Maloney, near North Platte, about NPPD's commitment to the Platte River Recovery Implementation Program.

Co-sponsors:

Central Nebraska Public Power & Irrigation District
Kearney Area Agricultural Producers Alliance
Kearney Area Chamber of Commerce
Nebraska Public Power District
Platte River Recovery Implementation Program
UNL Water Center

Tour participants congregate at the overlook for Seminoe Dam, high in the mountains of the U.S. Bureau of Reclamation's North Platte Project.

Water laps at the top of historic Pathfinder Dam, completed in 1909. The dam is the heart of the U.S. Bureau of Reclamation's North Platte Project in Wyoming.

After years of unprecedented drought, reservoirs in the U.S. Bureau of Reclamation's North Platte Project in Wyoming are at or nearing capacity. Shown here in Seminoe Dam and Reservoir.

Usually not much more than a strong trickle, the North Platte River flows strong in the reservoir country of Wyoming.

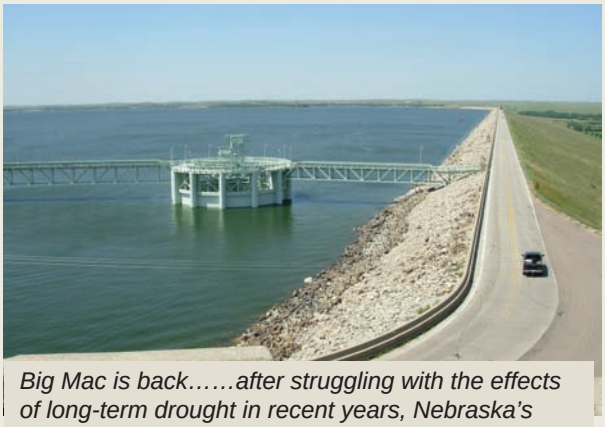
An informal stop for lunch in a nice picnic setting at Glendo Reservoir in Wyoming.

A very full and fast-flowing North Platte River, as it appeared in mid-July at the Tri-State Diversion Dan.

Tour co-director Jennie Nollette talks with Ken Peitzmeier of Norfolk at Pathfinder Dam.

Iconic Chimney Rock near Bridgeport.

Tour participants listen to a Nebraska Public Power District presentation on repairs that were made to the lake's dam. The lake is located south of North Platte.



Big Mac is back……after struggling with the effects of long-term drought in recent years, Nebraska's Lake McConaughy, near Ogallala, has rebounded to near full capacity this summer.

Tour Planning & Coordination Committee
Jeff Buettner – Central Nebraska Public Power & Irrigation District
Jennie Nollette – Kearney Area Chamber of Commerce
Steve Ress – UNL Water Center
Michael Jess – Consultant

(Photos by Lorrie Benson, Rachael Herpel and Steve Ress)

EPA Proposes New Permit Requirements for Pesticide Discharges

The U.S. Environmental Protection Agency (EPA) is proposing a new permit requirement that would decrease the amount of pesticides discharged to our nation's waters and protect human health and the environment. This action is in response to an April 9, 2009 court decision that found that pesticide discharges to U.S. waters were pollutants, thus requiring a permit.

The proposed permit, released for public comment and developed in collaboration with states, would require all operators to reduce pesticide discharges by using the lowest effective amount of pesticide, prevent leaks and spills, calibrate equipment and monitor for and report adverse incidents. Additional controls, such as integrated pest management practices, are built into the permit for operators who exceed an annual treatment area threshold.

"EPA believes this draft permit strikes a balance between using pesticides to control pests and protecting human health and water quality," said Peter S. Silva, assistant administrator for EPA's Office of Water.

EPA estimates that the pesticide general permit will affect approximately 35,000 pesticide applicators nationally that perform approximately half a million pesticide applications annually. The agency's draft permit covers the following pesticide uses: (1) mosquito and other flying insect pest control; (2) aquatic weed and algae control; (3) aquatic nuisance animal control; and (4) forest canopy pest control. It does not cover terrestrial applications to control pests on agricultural crops or forest floors. EPA is soliciting public comment on whether additional use patterns should be covered by this general permit.

The agency plans to finalize the permit in December 2010. It will take effect April 9, 2011. Once finalized, the pesticide general permit will be used in states, territories, tribal lands, and federal facilities where EPA is the authorized permitting authority. In the remaining 44 states, states will issue the pesticide general permits. EPA has been working closely with these states to concurrently develop their permits.

EPA will hold three public meetings, a public hearing and a webcast on the draft general permit to present the proposed requirements of the permit, the basis for those requirements and to answer questions. EPA will accept written comments on the draft permit for 45 days after publication in the Federal Register.

More information on the draft permit: http://www.epa.gov/npdes.

Send Us Your Flood Photos

If you have photos of this summer's flooding that occurred in many parts of Nebraska, the UNL Water Center would like to have them.

Email your high resolution jpgs to sress1@unl.edu. Please include a brief description of when and where the photo was taken, what it depicts and who took the photograph. Any photos we receive will be considered for publication in the next issue of the *Water Current* newsletter, which will be in mailboxes just after Thanksgiving. Prints can be mailed to Steve Ress, UNL Water Center, University of Nebraska–Lincoln, P.O. Box 830979, Lincoln, NE 68583-0979. Prints will be returned, if requested.

Chris Henry, P.E. *continued from page 3*

in-kind producer contributions of $69,000 ($456,000 since project inception). Important innovations occurred in several of these project, including the development of a deadhead riser, picket filter fences for buffer projects, upsizing of the sprinkler VTS (two times larger from first demonstration), pre-fabricated trash rack, and a skimmer outlet. All of these represent the first application (or further adaption) of a new concept to a runoff control system for livestock known in the US. NE NRCS have already specified two of these innovations in projects planned for 2009 as a result of this year's demonstrations.

This Extension program was the topic (for 2008) for three Nebraska Farmer articles, an article in the Nebraska Cattlemen Magazine, the Beatrice Daily Sun, the Cattle Business Weekly, an Ag Almanac, and a Market Journal Segment. The estimated cost savings of the adoption of this technology to the cattle industry is $152 million.

Selected Publications:

Henry C. G. and W. F. Koenig. 2005. **A Guide to Professional Licensure for Agricultural, Food, and Biological Systems Engineers.** PEI of ASAE, 2950 Niles Road, St. Joseph, MI 49085 USA. ISBN 1-892769-49-2. 76 pp.

Henry, C.G., P. J. Watts, P. J. Nicholas. 2008. **The Development of Industry-Specific Odor Impact Criteria for Feedlots using Models.** Journal of the Air and Waste Management Association. Special issue, September 2008, v58:1177-1186.

Henry, C. G., P.C. D'Abreton, R. J. Ormerod, G. G. Galvin, S. J. Hoff, L. D. Jacobsen, and D. D. Schulte. 2007. **Downwind Odor Predictions from four Swine Finishing Barns using Calpuff.** Presented at the Tenth International Symposium on Air Quality and Waste Management for Agriculture. September 16-19, 2007 Omni Interlock Resort, Broomfield, Colorado. ASABE, St. Joseph Michigan.

Henry, C. G., P. J. Watts, and P. J. Nicholas. 2007. **A Feedlot Pond Odor Emission Model.** Presented at the Tenth International Symposium on Air Quality and Waste Management for Agriculture. September 16-19, 2007 Omni Interlock Resort, Broomfield, Colorado. ASABE, St. Joseph Michigan.

Gross, J and C. G. Henry. 2007. **A "Sprinkler" Vegetative Treatment System.** Presented at the Tenth International Symposium on Air Quality and Waste Management for Agriculture. September 16-19, 2007 Omni Interlock Resort, Broomfield, Colorado. ASABE, St. Joseph Michigan.

Galvin, G G., R. J. Ormerod, C. G. Henry, P. C. D'Abreton, and G. Stark. 2007. **Odor Dispersion Modeling Assessments for Meat Chicken Farms in Australia.** Presented at the Tenth International Symposium on Air Quality and Waste Management for Agriculture. September 16-19, 2007 Omni Interlock Resort, Broomfield, Colorado. ASABE, St. Joseph Michigan.

Henry, C. G., D. D. Schulte, R.K. Koelsch, R. R. Stowell, N. Ebrahim, A.M. Parkhurst, and D.P. Billesbach. 2006. **Comparing Field Odor Assessment Methods with an Atmospheric Dispersion Model for Calibrating Setback Estimation Tools for Livestock Facilities.** Workshop on Agricultural Air Quality: State of the Science. Potomac, Maryland. June 5-8, 2006.

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Tsegaye Tadesse, Ph.D. *continued from page 3*

Tillage Practices? – Investigator. This is a joint NDMC and Department of Agricultural Economics research project to develop an economic model in estimating the impact of weather extremes (e.g., drought and flood) on the adoption rates of alternative tillage methods isolating the changes in economic factors such as commodity prices and related policies.

Examples of Past Research:

Meteorologist and team leader at the National Meteorological Services of Ethiopia. Past research includes identifying the relationships between climate variability and Oceanic conditions (i.e., El Nino and La Nina conditions and drought).

Outreach:

Presented climate and remote sensing-based drought monitoring research and applications at several national and international professional meetings and workshops. Conducted numerous workshops nationally to introduce agricultural producers and other decision makers to new drought monitoring tools being developed at the NDMC and educate them on the use of information from these tools for agricultural applications.

Teaching:

No permanent teaching responsibility, but has taught applied climate science courses as guest lecturer (e.g., climate and society, climate in crisis, introduction to agriculture and natural resources systems, etc.)

continued on page 15

Bob Daugherty: Man With a Vision continued from page 4

that his product could increase yields, to feed more people, and help the farmer's bottom line – and he was determined to become a major player in the ag industry.

Gradually, the Valley Pivots became better, more reliable, and more expensive. Rubber-tired wheels replaced the steel ones. Electric motors replaced the water-driven hydraulics; trusses along the main pipe replaced the towers and all those guy wires. Low sprinklers replaced the overhead sprayer heads, reducing evaporation on a windy day.

Pivots became very reliable. It is now a rarity when a machine doesn't complete a round.

Every year, the pivot machines improved, and acceptance among the farmers grew. Yet agriculture continued to be a cyclical business and Daugherty continued to add products to diversify his business. One big addition was the making of steel and aluminum pipe, initially to be used in Valley Systems, but later to be sold in the making of light poles and other infrastructure development, leading to the company's world prominence in two markets – irrigation equipment and pipe products.

Over the years there have been many other products added, through mergers and acquisitions. Under the leadership of Mogens Bay (a native of Denmark), CEO of Valmont since 1997, the company has made impressive growth, especially in the overseas market. Today Valmont (the name since 1969) is listed on the prestigious list of Forbes Top 400 Big Companies. It operates 18 plants in eight countries, in North and South America, Europe, and Asia (including a "state-of-the-art" Pivot Irrigation System plant in McCook).

It markets products in more than 90 countries around the world. It is said that more than 10 million acres of Ag land receive water from Valmont irrigation systems.

Valmont manufactures one half of all the pivot irrigation systems in the world. (The four largest manufacturers of pivot systems are all located in Nebraska.)

Daugherty's gift of $50 million is probably a drop in the bucket toward solving the problems of poverty, hunger, ag production and water management. Still, Daugherty started his company with a tiny $5,000 investment in 1946. Last year, Valmont did more than $1.8 billion in sales.

When we consider that 65 percent of the world's dwindling supply of fresh water is used by agriculture, and estimates show that food production must double in the next 35 years, we can only pray that Bob Daugherty's latest investment is as successful as his first one was. I wouldn't bet against him.

Irrigation Management Project Expands continued from page 5

because they have additional experience with the technology," said Pryor.

In the fall of 2007, Extension Educators sent surveys to 89 producers actively involved in NAWMDN in the Upper Big Blue NRD and Lower Little Blue NRD Districts. Producers were asked to estimate their water savings for corn and soybeans. Estimated water savings for corn ranged from 0" to 7.5" with an average of 2.6" while soybean water savings ranged from 0" to 4.8" with an average of 2.1". Using 2007 diesel prices, the water savings of 2.6" and 2.1" that was achieved with the Network are associated with a savings of $24.00/acre and $19.40/acre, respectively. Nearly 100% of survey respondents indicated that involvement in the Network influenced the amount of irrigation water they applied.

A new project has emerged in 2010 with UNL Extension Educators Keith Glewen, Aaron Nygren, Michael Rethwisch, Dave Varner, and Gary Zoubek. The partnership and financial support is from the Lower Platte North Natural Resources District (LPNNRD) to expand the NAWMDN into the District. The project will target growers and irrigation consultants annually, 2010 through 2012.

The goals are to reduce irrigation total amounts by two acre-inches each year without reducing crop yields and reducing growers' energy use by 15 percent annually. Dave Varner said, "We currently have 45 growers/consultants engaged in this process as our first year class and I'm excited about the opportunity to help producers improve their irrigation management. The first year experience has been encouraging both for the producers and the educators involved."

Working in teams with multiple agencies and with area growers can be a positive combination. In addition to the demonstration projects, the information is delivered to participants through field days, seminars, workshops, publications and media reports. More detailed information on the Network goals and objectives and progress can be found at: http://water.unl.edu/cropswater.nawmdn.

It has been estimated for every acre-inch of water not pumped, this benefits Nebraska producers by an energy savings of approximately 3.3 gallons of diesel fuel energy and 72 pounds of reduced carbon dioxide emissions. A reduction of 2 acre inches of water pumped on all Nebraska irrigated acres would produce 400 billion gallons of reduced water pumped, 60 million gallons of diesel fuel equivalent savings, and an equivalent of 540,000 tons of reduced carbon dioxide emissions each year.

Meet the Faculty *continued from page 3*

Tsegaye Tadesse, Ph.D. *continued from page 13*

Selected Publications:

Wardlow, B.D., M.J. Hayes, M.D. Svoboda, T. Tadesse, and K.H. Smith, 2009. Sharpening the Focus on Drought – New Monitoring and Assessment Tools at the National Drought Mitigation Center. Earthzine.

Harms, S., **T. Tadesse**, and B. Wardlow, 2009. Algorithm and Feature Selection for VegOut: A Vegetation Condition Prediction Tool. In: J. Gama et al. (Eds.), *Discovery Science: Lecture Notes in Computer Science*, Springer Berlin/Heidelberg, Germany, pp. 107-120.

Tadesse, T., B. Wardlow, and M. Hayes, 2008. The application of data mining for drought monitoring and prediction. In: H. Rahman (Ed.), *Data Mining Applications for Empowering Knowledge Societies*, Idea Group Publishers, New York, NY, pp. 280-291.

Tadesse, T., M. Haile, G. Senay, C. Knutson, and B.D. Wardlow, 2008. Building integrated drought monitoring and food security systems in sub-Saharan Africa. *U.N. Natural Resources Forum*, 32, 303-316.

Brown, J.F., B.D. Wardlow, **T. Tadesse**, M.J. Hayes, and B.C. Reed, 2008. The vegetation drought response index (VegDR): a new integrated approach for monitoring drought stress in vegetation. *GIScience and Remote Sensing*, 45(1):16-46.

Tadesse, T., J.F. Brown, and M.J. Hayes. 2005. A new approach for predicting drought-related vegetation stress: Integrating satellite, climate, and biophysical data over the U.S. central plains. *ISPRS Journal of Photogrammetry and Remote Sensing*, 59(4):244-253.

Tadesse, T., D.A. Wilhite, M.J. Hayes, S.K. Harms, and S. Goddard. 2005. Discovering associations between climatic and oceanic parameters to monitor drought in Nebraska using data-mining techniques. *Journal of Climate*, 18(10):1541-1550.

Tadesse, T., D.A. Wilhite, S.K. Harms, M.J. Hayes, and S. Goddard. 2004. Drought Monitoring Using Data Mining Techniques: A Case Study for Nebraska. U.S.A. *Natural Hazards* 33(1):137-159.

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ttadesse2@unl.edu

From the Interim Director *continued from page 2*

Highlights of the plan for the rest of 2010-11 include:

i. Sponsoring the Greater Platte River Research Symposium and Water Law Conference on October 6 and 7.

ii. Connecting Faculty Expertise to external stakeholders through many meetings and events, often organized by external stakeholders. Please contact Rachael Herpel in our office if you have ideas or needs.

iii. Junior faculty mentoring sessions and activities – to engage junior faculty with Nebraska water issues and stakeholders.

iv. Continuing to facilitating the Water Resources Advisory Panel (WRAP).

v. Facilitating a faculty retreat related to human dimensions in water resources in September.

vi. Sponsoring the Water Resources Seminar Series during the spring of 2011, with talks by external experts already planned on storm water management and the intersection of energy and water use. If you have suggestions for topics or speakers, please contact Lorrie Benson by early September.

vii. Providing support for academic programs, in particular a new graduate course website will should be unveiled in September.

viii. Incorporation of videos into water center and water.unl.edu web pages.

ix. Continuing to provide assistance to the Global Water for Food Institute.

As the majority of you are no doubt aware, the new Global Water for Food Institute has been funded by the generosity of the Robert B. Daughtery Foundation. The Institute has the overall mission of producing more food with the same, or less, water.

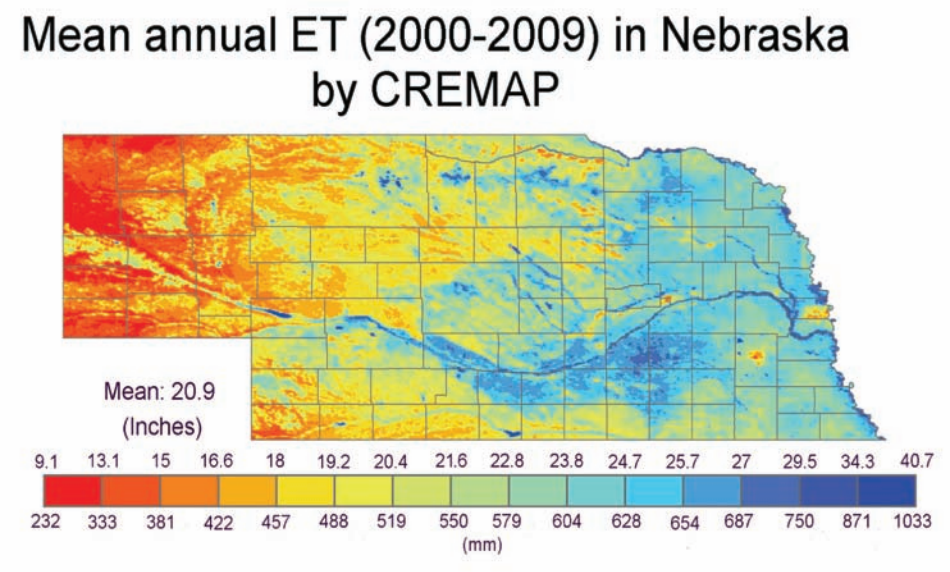
The formation of the Institute is underway, with a faculty advisory committee having been formed in July and meetings with groups of faculty in July and August to discuss possible organization models and research directions for the Institute. The search for the institues's executive director will start soon; with an external search firm being retained for this purpose. It is hoped that the new executive director can be announced by the next Water for Food Conference in early May 2011.

Currently, the only new faculty positions that will be created as part of the institute will be the executive eirector, and two associate directors (one for research and one for policy). It is anticipated that many current UNL faculty will be affiliated with this institute and perform its work. It is also anticipated that the institute will provide funds for post-doctorial associates, graduate students, and undergraduate student workers and visiting scholars.

Mapping Evapotranspiration continued from page 1

Engineering. *Watershed Water Balance: The Role of ET and Consumptive Use*.)

ET rates depend upon a number of factors including temperatures and wind speed. To estimate ET rates at a 1 kilometer scale, a linear equation is used to transform surface temperatures into ET rates on a monthly basis. This calibration-free ET mapping technique (CREMAP) works best for a flat to rolling landscape such as Nebraska's. Nebraska is one of the few areas in the world to have maps that show ET rates statewide at such high resolution.



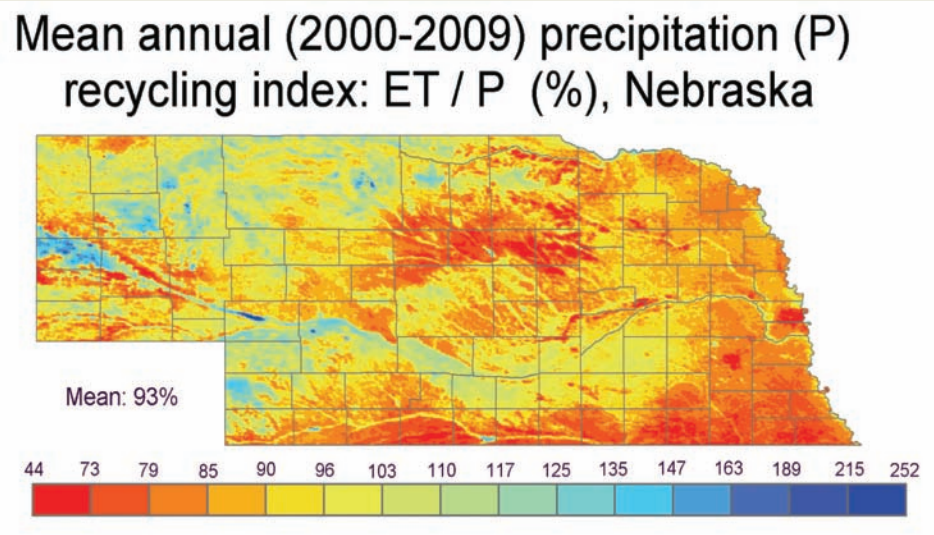
The map above shows the mean (middle) annual ET rate over the last decade. Areas at the high end of the ET spectrum (blue) are reservoirs and rivers with mean ET rates of up to 40 inches per year over the last decade. Areas with the lowest ET rates are in the relatively dry west, where range, pasture, and grasslands dominate the landscape. In the relatively wet east, ET rates are lowest in urban areas - Lincoln and Omaha are clearly visible. Urban areas have comparatively more paved or solid surfaces, such as roads and rooftops, and therefore less vegetation, resulting in more runoff, higher temperatures and less ET. Areas near rivers and streams generally have more abundant vegetation and higher ET rates.

The map below shows ET as a percentage of mean annual precipitation. In Nebraska precipitation varies considerably from west to east, ranging from less than 16 inches in the panhandle to over 34 inches in the far southeast. Areas over 100% (light green to blue) show where ET is greater than precipitation, or where precipitation is being supplemented by water from other sources. The bluest areas are:

- reservoirs, where evaporation from open water occurs,
- irrigated areas, where groundwater and surface water irrigation is used to supplement crop needs,
- areas in the Sandhills where a significant amount of groundwater returns to the atmosphere through evaporation from lakes and directly from the soil.

Areas under 100% (yellow to red) show where precipitation is greater than ET. These are the areas that generate the highest net rate of runoff and/or groundwater recharge, the latter contributing the most to the well-being of the precious groundwater reserves under Nebraska's soil.

ET maps are also available from 2000-2009 by year and month. In the future this method can be used to show trends in ET due to changes in climate, land use, and irrigation.



Back-to-Back UNL Water Events in October *continued from page 1*

and impacts of transactions that involve water, boundary disputes, updates on recent Nebraska water law cases, Endangered Species Act law and application, practicing before state agencies, and designing integrated management plans to simplify water transfers.

Continuing legal education (CLE) credits for attending the conference have been applied for.

The following day, Thursday, Oct. 7, the Water Center and USGS Nebraska Water Science Center host a Greater Platte River Basins Symposium as a separate event at the same location.

The symposium focuses on water-related research and innovative programming in the Niobrara, Platte and Republican River Basins. Robert Hirsch, a national expert in water science and policy and USGS hydrogeologist, opens the symposium with "Perspectives on Hydrology and Water Management in a Changing World."

The remainder of the morning examines management of water resources beyond the state's current integrated management planning requirements. A diverse panel of experts considers differing angles to future water management, including sustainability and resilience, legal frameworks, human dimensions, whether we have the science needed, possible scenarios for the future, and reality checks.

Attendees can choose from 20 presentations by researchers on topics ranging from basic hydrology to economics to wetlands to fish and wildlife issues. A formal poster session offers several dozen posters on a wide range of water-related topics.

Though the two events are separate, Benson said there are many in the water profession that will find both useful and informative and a discounted registration fee is being offered to those electing to attend both.

Online registration and more information on topics and speakers are at watercenter.unl.edu or contact Benson at lbenson2@unl.edu or (402) 472-7372.

We're Updating!!

We are updating our mailing list. If you have a change of address, title and/or name, or would like to have your name added to or removed from the *Water Current* mailing list, please let us know. Also, if you know of anyone who might be interested in receiving our publications, please give us their names and we will be glad to add them to our mailing list.

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NEWS BRIEFS

EPA Drinking Water Rule

The U.S. Environmental Protection Agency (EPA) is proposing to revise a national drinking water regulation for greater public health protection against waterborne pathogens in public water systems.

Waterborne pathogens can cause acute abdominal discomfort or in more extreme cases, kidney failure, hepatitis or chronic concerns.

EPA is proposing to revise the 1989 Total Coliform Rule to incorporate improvements recommended by a federal advisory committee that included representatives from a broad range of stakeholder groups, including public health and public interest groups, environmental groups, state drinking water agencies and drinking water utilities.

The revised rule will better protect people from potential exposure to dangerous microbes because it requires water systems to take action when monitoring results indicate that contamination or a pathway to contamination may be present.

Water utilities are required to regularly monitor for microbial contamination in the distribution system. Although microbes detected in monitoring are not necessarily pathogens themselves, detection can indicate there is a pathway that would allow pathogens to enter the system, such as a water main break or an opening in a storage tank. Under the proposed rule, when monitoring results are positive, systems must find and fix any pathways leading to microbial risk.

EPA is seeking public comment on this proposed rule for 60 days following publication in the Federal Register. More information about the proposed rule go online to http://www.epa.gov/safewater/disinfection/tcr/index.html.

NACEE Conference

The Nebraska Alliance for Conservation and Environment Education's (NACEE) 2010 annual conference, "Coming into Focus: Conservation and Environment Education in Nebraska," will be Sept. 9-11 at Camp Carol Joy Holling, Ashland.

Schedule and registration materials can be downloaded at http://www.nacee.org/pdfs/2010_NACEEconf_reg.pdf. http://www.nacee.org/.

Conference scholarships are available for Nebraska teachers (pre-service, formal educators, and non-formal educators). Applications can be downloaded at www.nacee.org.

Quality of Water from U.S. Public-Supply Wells, 1993–2007

About 105 million people—more than one-third the nation's population—receive their drinking water from one of the 140,000 public water systems across the U.S. that rely on groundwater pumped from wells. U.S. Geological Survey (USGS) scientists assessed water quality in source (untreated) water from 932 public-supply wells (referred to as public wells), and in finished (treated) and source water from 94 of these wells.

The study focused primarily on "source" water before treatment or blending and describes the occurrence of naturally occurring and man-made contaminants in source water from public wells and their potential significance to human health.

Go to http://water.usgs.gov/nawqa/studies/public_wells/ to access the USGS circular and supporting materials.

For more information on the public-well assessment, contact Patricia Toccalino, USGS hydrologist and lead scientist of the assessment , at ptocca@usgs.gov or phone (916) 278-3090.

EPA Data on Industrial and Toxics Releases

The U.S. Environmental Protection Agency (EPA) has published the latest data on industrial releases and transfers of toxic chemicals in the United States between Jan. 1 and Dec. 31, 2009. EPA is making the Toxics Release Inventory (TRI) data available e through its Web site and in the popular tools, TRI Explorer and Envirofacts. The database contains environmental release and transfer data on nearly 650 chemicals and chemical categories reported to EPA by more than 21,000 industrial and other facilities.

The preliminary dataset allows communities to find out about releases and transfers of chemicals at the local level. Examples of industries that report to TRI include manufacturing, metal mining, electric utilities, and commercial hazardous waste treatment facilities among others.

The preliminary dataset includes more than 80 percent of the data expected to be reported for 2009. EPAQ will update the dataset in August and September so citizens will have complete access to the information. More information is online at http://www.epa.gov/tri.

Invasive Saltcedar, Russian Olive Consume Similar Amounts of Water as Cottonwoods and Willows continued from page 20

The report was collaboration among the USGS, the U.S. Bureau of Reclamation (BOR), U.S. Forest Service, and other federal agencies and universities to assess and summarize a large number of previously published studies.

One notable finding is that native trees such as cottonwoods and willows along western rivers typically consume as much water as non-native saltcedar and Russian olive. Generally, the report noted, removal of saltcedar from floodplain areas along rivers leads to replacement by other vegetation that consumes roughly equal amounts of water.

Therefore, removal of saltcedar from these areas is unlikely to produce measurable water savings once replacement revegetation becomes established, report authors wrote.

"None of the published studies to date, which include projects removing very large areas of saltcedar, have demonstrated production of significant additional water for human use," said Curt Brown, Director of Research for BOR. However, the authors note that saltcedar and Russian olive can also grow on river terraces that are too high and dry for cottonwoods and willows.

Some scientists have suggested that, on these sites, revegetation with native dry-site species could save some water for human use. But, the effectiveness of such an approach has not been demonstrated.

Similarly, although it has long been assumed that these non-native trees harm streamside habitat and wildlife productivity, research evaluated in the report indicates this isn't always true. Many reptiles, amphibians, and birds use habitat dominated by saltcedar and Russian olive. Even the endangered southwestern willow flycatcher frequently breeds in saltcedar stands.

However, according to the report, saltcedar-dominated landscapes do not provide suitable habitat for more specialized birds, such as woodpeckers and birds that live in cavities. Dense tracts of pure saltcedar are typically unfavorable for most wildlife, and the report notes that many birds still prefer native cottonwood or willow habitat.

Other negative impacts of dense stands of these introduced species can include impeded access to riverside recreational areas, increased wildfire hazard, and clogging of irrigation ditches.

Saltcedar and Russian olives are now the third and fourth most common streamside plants in 17 western states. The species have been the focus of significant removal efforts along some western rivers, such as the Rio Grande and Pecos River.

Plant removal techniques range from use of herbicides and bulldozers to biological controls such as insects. Once the invasive plants are killed or removed, effective restoration depends on replacing them with plant species that meet the specific goals of the planned restoration, the report said.

"The vegetation that replaces saltcedar following its removal, with or without restoration actions, will influence the quality of wildlife habitat, amount of water use and other ecological conditions," said Pat Shafroth, a USGS scientist and lead editor of the report.

Site restoration, however, can be challenging and costly, depending on the size of the area and the methods used. Restoring key river processes, such as natural patterns of high and low flows, can help re-establish native vegetation and other important ecosystem features over larger areas than is possible with site-specific restoration, he added.

The authors highlight areas where further study could advance understanding of invasive plant control and restoration, including effects on wildlife habitat and water use.

"Research and monitoring could be particularly important in the context of biological control of saltcedar," Shafroth said. "The beetle that has been released for biological control has been defoliating saltcedar and spreading rapidly in some watersheds. We really need to understand the effects of biocontrol on these ecosystems, to better inform river and riparian restoration."

The report provides a summary of the latest science and is expected to be helpful to organizations that undertake the management of saltcedar and Russian olive.

The report, *Saltcedar and Russian Olive Control Demonstration Act Science Assessment*, was completed to fulfill requirements in the Salt Cedar and Russian Olive Control Demonstration Act of 2006 (Public Law 109-320).

The full report, *USGS Scientific Investigations Report 2009-5247,* is available online along with *USGS Fact Sheet 2009-3110* that summarizes the findings.

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Invasive Saltcedar, Russian Olive Consume Similar Amounts of Water as Cottonwoods and Willows

Long considered heavy water users and poor wildlife habitat, non-native saltcedar and Russian olive trees that have spread along streams and water bodies in the West may not be as detrimental to wildlife and water availability as believed.

In a U.S. Geological Survey (USGS) report requested by Congress, scientists conducted a review of the scientific literature to assess the existing state of the science on the distribution and spread, water consumption, and control methods for saltcedar (also called tamarisk) and Russian olive. They also assessed the considerations related to wildlife use and the challenges associated with revegetation and restoration following control efforts.

Invasive Salt Cedar, which are a common sight along Nebraska riverbanks. These particular plants are on the Pecos River in New Mexico (photo: Steve Ress).

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