February 2006

Water Current, Volume 38, No. 1. Winter 2006

University of Nebraska–Lincoln Water Center

WATER CURRENT

Vol. 38, No. 1 Winter 2005

Third Annual Water Law, Policy and Science Conference to Nebraska City's Lied Lodge in May

By Steve Ress

The third in a series of water law, policy and science conferences sponsored by the University of Nebraska–Lincoln will explore adaptive management approaches for the Great Plains increasingly besieged water resources.

The Third Annual Water Law, Policy and Science Conference, "Adaptive Management for Resilient Water Resources," is May 4-5 at Nebraska City's Lied Conference Center.

Lance Gunderson of Emory University, Atlanta, GA kicks-off the two-day event with his views on the theory and practice of adaptive management.

(continued on page 16)

Arbor Day Farm's Lied Lodge and Conference Center in Nebraska City will host UNL's Third Annual Water Law, Policy and Science Conference in May.

Pallid sturgeon (photo: U.S. Army Corps of Engineers).

Monitoring and Stocking Pallid Sturgeon

By Mark Drobish
U.S. Army Corps of Engineers

(Editor's Note: This is a continuation of articles on issues facing the Missouri River Mainstem System and efforts by the Omaha District of the U.S. Army Corps of Engineers to address them. This series of articles began in the last issue of the Water Current and conclude in this issue. The UNL Water Center particularly wants to thank Rose Hargrave and Mary Roth at the Corps for their involvement in this project - SWR).

(continued on page 18)

Inside

IANR

HUT, HUT-HUT!

from the DIRECTOR

Kyle D. Hoagland

Much has happened since the last edition of the *Water Current*, so here are a few instant replays that will hopefully be of interest to you. None are especially controversial, so I don't expect any to be overturned.

Our second Water Initiative research retreat was held on Friday, January 20. An impressive turnout of 50 water faculty representing 11 departments in four colleges on both UNL and UNO campuses, as well as two of UNL's research and extension centers. A wide variety of water-related disciplines were also represented at the retreat, including biology, hydrology, chemistry, climate modeling, economics, geosciences, natural resources, computer science, public policy, engineering, toxicology, agronomy, and law to name a few.

Clearly, we are thinking about water issues more broadly than ever before, so that crossing disciplinary lines is becoming the norm rather than the exception. Even more importantly, we are now beginning to do more than just think in interdisciplinary terms with respect to water challenges, we're acting on ideas. Several large grant proposal outlines took shape at the retreat in areas such as emerging contaminants, large-scale monitoring systems, watershed modeling, Great Plains climate change, and societal dimensions of water resources management. We plan to post the PowerPoint summary slides that were generated in these working group sessions on the Water Initiative web site (http://wrri.unl.edu) in the very near future. No flags on this event!

The Water Initiative team (Sheri Fritz, Sandi Zellmer, Ron Yoder, and I) was very fortunate to receive continued support for building upon UNL's strengths in water research, education and outreach via a successful Program of Excellence award which will fund two additional faculty positions in the water area (touchdown!): water policy and hydrologic information systems (throw the flag for unnecessary verbiage!). The latter position is envisioned as a hybrid between GIS and cyberinfrastructure, with a joint appointment between the departments of Civil Engineering and Computer Science. These are key additions to the team of faculty recently hired in water chemistry, surface hydrology, water economics, climate modeling, and river ecology.

We intend to begin these hiring searches by this spring and hopefully have the new faculty members at UNL by the coming fall semester (we'll need to get our backfield in motion to accomplish this task).

High fives are certainly due Senior Vice Chancellor Barbara Couture, NU Vice President and IANR Vice Chancellor John Owens, and UNL Vice Chancellor for Research Prem Paul for their outstanding continuing commitment to water research, education and outreach at UNL (MVP awards all around).

The third annual Water Law, Policy and Science Conference is shaping up very nicely. Please mark your calendar for May 4-5, 2006 to attend what promises to be a very interesting and insightful meeting (or be flagged for a personal foul), entitled "*Adaptive Management for Resilient Water Resources*". This year's venue has shifted to Arbor Day Farm's Lied Lodge and Conference Center in Nebraska City, so please register as soon as you receive your brochure, as lodging space will be somewhat

(continued on page 11)

WATER CURRENT

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

Meet the Faculty

Durelle T. (Scotty) Scott, Ph.D.

Assistant professor, Aquatic Chemist/Surface Water Hydrologist, in the University of Nebraska-Lincoln Department of Geosciences, beginning in 2005.

Durelle T. (Scotty) Scott

Education:

Ph.D., Environmental Engineering, University of Colorado at Boulder, 2001.

M.S., Environmental and Water resources Engineering, University of Colorado at Boulder, 1997.

B.S., Department of Civil, Environmental and Architectural engineering, University of Colorado at Boulder, 1996.

Primary Research Interests:

— My research interests primarily lie in the fate and transport of material (e.g. nutrients, organic carbon, metals, aquatic contaminants) within watersheds. My primary research seeks to understand the controlling factors (e.g. physical, chemical) altering biogeochemical reactions in order to provide a perspective on (1) the fundamental processes and (2) potential remediation/management approaches to address water quality.

— My current focus, continued from my NRC postdoctoral fellowship at the USGS, pertains to the excess delivery of nitrogen to coastal estuaries, with particular emphasis on in-stream nitrogen alterations resulting in decreased riverine nitrogen loads.

Floodplains are one component of the river network where high biochemical processing rates occur. My floodplain research includes (1) quantifying nitrogen fluxes into/out of floodplain sloughs, (2) identifying and measuring nitrogen transformations during/between flooding, and (3) understanding the reach /regional scale influence of floodplains to downstream water quality.

— Small, headwater streams are another component of the river network where high rates of

(continued on page 14)

Shashi B. Verma, Ph.D.

Dr. Verma is a Charles Bessey Professor of Natural Resource Sciences in the University of Nebraska-Lincoln School of Natural Resources and directs the Great Plains Regional Center of the National Institute of Global Environmental Change (NIGEC). In the past five years, working with fifteen faculty members from six UNL departments, he has been leading an interdisciplinary research program to quantify carbon sequestration in dryland and irrigated agroecosystems and to improve our understanding of relevant biophysical controlling factors. The Carbon Sequestration Program has been funded by three major grants from the U.S. Department of Energy and the U.S. Department of Agriculture, and received UNL's Institute of Agriculture and Natural Resources Team Award in 2004. Dr. Verma has been a faculty member at UNL for more than 30 years.

Education:

Ph.D., Colorado State University, Fort Collins, CO, 1971.

M.S., University of Colorado, Boulder, CO, 1967.

B.S., Ranchi University, Ranchi, India, 1965.

Selected Current Research:

— Carbon Sequestration: Year-round quantification of uptake and release of carbon dioxide in agricultural ecosystems.

— Evapotranspiration: Seasonal and interannual variability in water use in agricultural crops and native prairies.

Selected Past Research:

— Carbon dioxide, water vapor and energy exchanges in grasslands of Kansas and Oklahoma, agricultural crops of Nebraska and Oklahoma and wetlands of Nebraska Sandhills, Minnesota and Saskatchewan, Canada.

— Methane emissions from wetlands in Nebraska Sandhills, Minnesota and Saskatchewan.

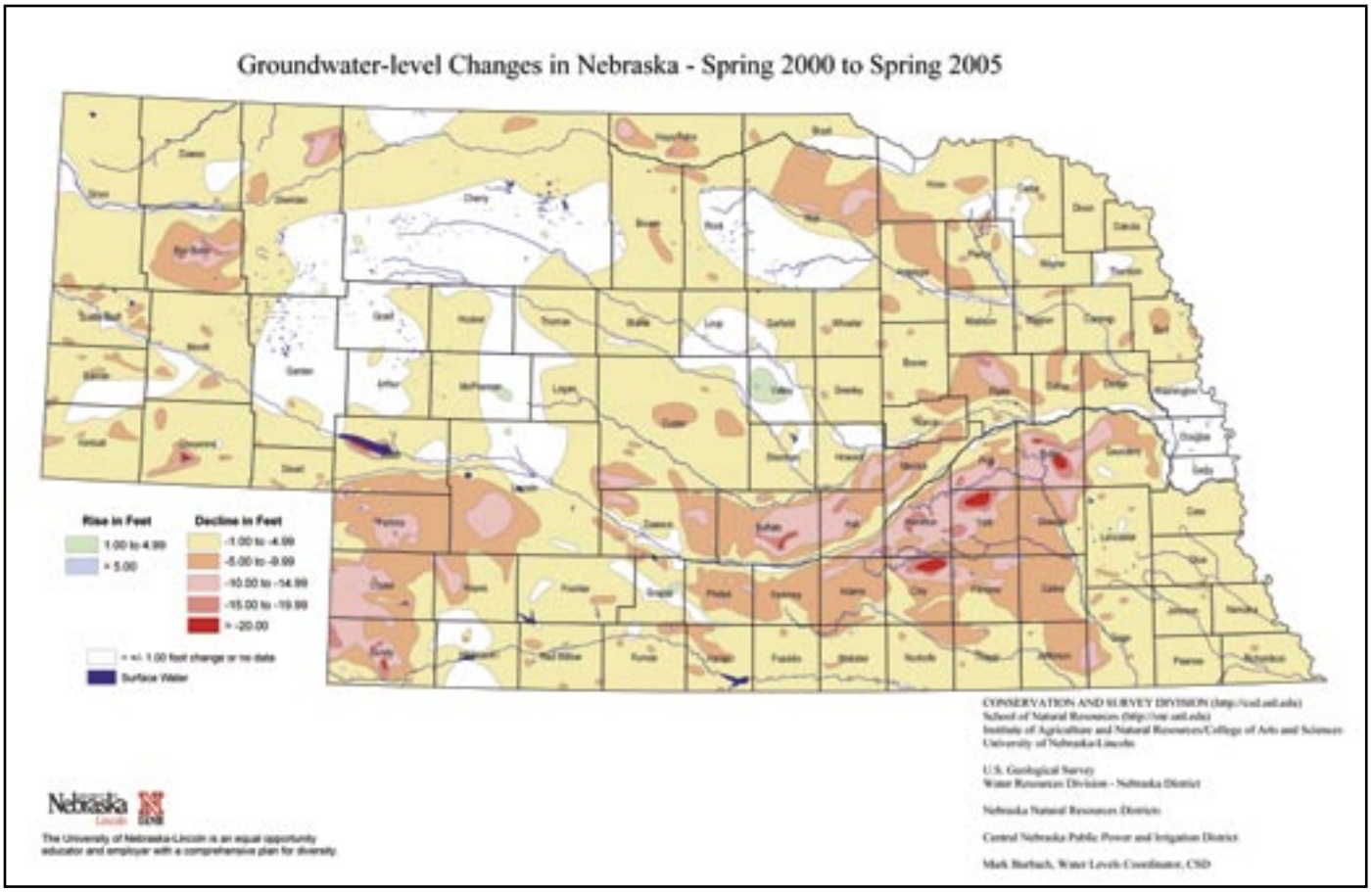
Recent Awards:

— Distinguished Professor (2002-present), University of Nebraska, Lincoln, NE.

— University of Nebraska Institute of Agriculture and Natural Resources

(continued on page 15)

Shashi Verma



UNL Monitoring Program Records Persistent Groundwater Declines

By Steve Ress

Five years of drought have steadily diminished the state's groundwater resources, according to monitoring by University of Nebraska-Lincoln researchers.

"We're very fortunate to have the extent of groundwater resources that we do, yet the persistency of the declines in aquifer groundwater levels in aquifers underlying Nebraska are becoming increasingly more obvious as the current drought continues," said Mark Burbach, an assistant geoscientist in UNL's School of Natural Resources.

Burbach coordinates UNL's statewide groundwater level monitoring program that collects aquifer water level data from more than 5,400 wells across Nebraska. The data is used to annually produce color maps showing rises and declines in groundwater levels. The maps typically show the changes in terms before the development of irrigation, generally regarded as 1952, to the present and over the past year.

Earlier this year, Burbach published a third map showing changes in aquifer levels from spring 2000 to spring 2005, the period of the current drought that has swept the state.

"From this map, it's very easy to see large areas of the state showing groundwater level declines of up to five feet. In some areas corresponding to the heaviest concentrations of irrigation wells, declines of up to 20 feet over the past five years are not uncommon," Burbach said.

Many of the largest declines are in the heavily irrigated Platte, Republican, Lower Loup, Blue and Elkhorn river basins. as well as further west in Box Butte and Cheyenne Counties.

Only a few isolated areas of the state showed minimal rise in groundwater over the past five years, notably in Valley, McPherson and Gosper counties.

"These persistent and growing declines in the aquifer over a large area of the state are due mainly to current drought conditions and resulting increases in groundwater pumping for irrigation," Burbach said.

To produce the maps, spring water level information from more than 5,400 irrigation, domestic, observation and monitoring wells in all 23 of Nebraska's natural resources districts is compiled. Although most are NRD wells, some belong to the U.S. Geological Survey, Central Nebraska Public Power and Irrigation District, U.S. Bureau of Reclamation and UNL.

(continued on page 19)

UNL Assists State With Research and Survey Work

By Steve Ress

Researchers in the University of Nebraska-Lincoln's School of Natural Resources are conducting a variety of research and scholarly survey work that will soon benefit land use and hydrologic modeling studies being done by the Nebraska Department of Natural Resources (DNR).

"One of our most fundamental tasks is conducting research and scholarly survey work used by the state to further practical understanding of natural resources and which can be used in modeling that promotes conservation and fair and wise uses of our land and water," said UNL Water Center director Kyle Hoagland, who is UNL's project manager for contracted research and survey work for DNR.

Several new service agreements have been signed with DNR over the past several months.

Two of them delve into mapping statewide land use patterns using satellite imagery and GIS technology by researchers at UNL's Center for Advanced Land Management Information Technologies (CALMIT), which is part of the School of Natural Resources.

CALMIT associate director and geographer Jim Merchant and remote sensing and GIS specialist Patti Dappen are using remote mapping methods and skills developed in their 1997 and 2001 cooperative hydrology study (COHYST) land cover research to develop updated agricultural land cover classifications for the 2005 growing season.

"By capitalizing on the seasonal dynamics of crops and native plant communities, accurate maps of land use and land cover can be developed," Merchant said.

One of the projects is specifically mapping the Platte River basin upstream of Columbus, while the second encompasses the entire state.

(continued on page 18)

UNL Spring Water and Natural Resources Lectures Continue Through April 19

Local, national and international experts are addressing a range of water and environmental issues in a series of free public lectures at the University of Nebraska-Lincoln, that continue through April 19.

Weekly lectures begin at 3:30 p.m. each Wednesday, except March 15, in Room 116, L.W. Chase Hall on UNL's East Campus.

Many of the speakers are from UNL or within Nebraska. Others hail from Illinois, Arizona, Iowa, Texas, Indiana, Minnesota and British Columbia.

"This year's seminar covers a range of current environmental topics, opinions and research findings that should be of interest to all," said UNL Water Center director and seminar organizer Kyle Hoagland.

On Mar. 8, water resources attorney Walter James III of Grapevine, TX will speak on implementing the Clean Water Act, followed on Mar. 22 by Lincoln attorney Don Blankenau, former assistant director of the Nebraska Department of Water Resources, discussing his work to help resolve eastern interstate water disputes.

UNL School of Natural Resources hydrogeologist Dave Gosselin will discuss finding answers to the scientific, economic and public policy challenges of getting toxic uranium and arsenic out of Nebraska's public water supplies on Mar. 29.

On April 12, Curtis Suttle of the Department of Earth and Ocean Sciences at the University of British Columbia, Vancouver, will talk about viruses in the sea.

The following week, Harry Ankley of the U.S. Environmental Protection Agency delivers the series' final lecture on the ecological impacts of confined animal feeding operations.

Lectures are co-sponsored by UNL's Institute of Agriculture and Natural Resources, Water Center, School of Natural Resources and Water Resources Research Initiative.

Remaining presenters and topics are:

Feb. 15: Michael Dosskey, National Agroforestry Center, USDA-Forest Service, UNL: Current Issues in the Use of Buffers to Improve Water Quality.

Feb. 22: Gary Woodard, SAHRA, University of Arizona, Tucson, AZ: Raising Hydrologic Literacy: A Multifaceted Approach to Better Informed Water Resources Policy-making.

Mar. 1: Raymond W. Arritt, Department of Agronomy, Iowa State University, Ames, IA: The North American Monsoon in Current and Future Climates.

Mar. 8: Williams Memorial Lecture: Walter James III, Walter D. James III, PLLC, Grapevine, TX: Clean Water Act Implementation.

Mar. 15: No Seminar (UNL Spring Break)

Mar. 22: Don Blankenau, Fennemore Craig, P.C., Lincoln: Eastern Interstate Water Disputes.

Mar. 29: David Gosselin, UNL School of Natural Resources: Uranium and Arsenic in Nebraska's Public Water Supplies: A Scientific, Economic and Public Policy Challenge.

Apr. 5: Todd Royer, School of Public and Environmental Affairs, University of Indiana, Bloomington, IN: Temporal Patterns in Nutrient Export from Agricultural Watersheds: Implications for Water Quality in the Mississippi River.

Apr. 12: Williams Memorial Lecture: Curtis Suttle, Department of Earth and Ocean Sciences, University of British Columbia, Vancouver, BC: Viruses in the Sea.

Apr. 19: Gary Ankley, U.S. Environmental Protection Agency, Duluth, MN: Ecological Impacts of Concentrated Animal Feeding Operations: Lab and Field Studies with Endocrine-disrupting Chemicals.

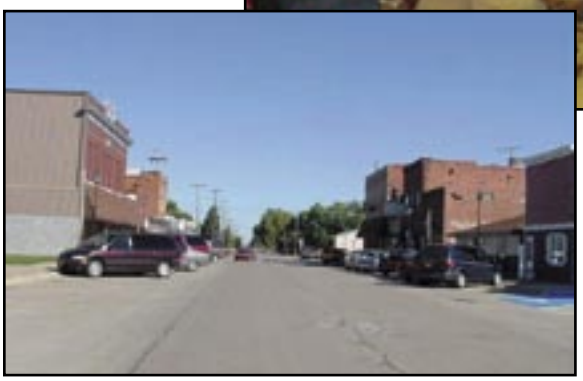
Public Policy Center Works With Communities For Development and Safe Drinking Water

By Steve Ress

More than one small Nebraska community is wondering how to meet new federal regulations on arsenic in drinking water that went into effect earlier this year, along with ways to improve their local economies.

Several have gotten help from the University of Nebraska Public Policy Center through a joint water task group that looked at public water quality and also at getting neighboring towns to cooperate on community development.

Project partners were University of Nebraska Extension, Rural Initiative, Institute of Agriculture and Natural Resources, Water Resources Research Initiative, Public Policy Center and School of Natural Resources, Biology and Political Science Departments at the University of Nebraska at Kearney, The Groundwater Foundation, Midwest Assistance Program, local schools, Nebraska Departments of Environmental Quality and Health and Human Services System, Southeast Development District, Great Plains RC&D, Upper Big Blue Natural Resources District and USDA Rural Development.



The project had its roots in a U.S. Environmental Protection Agency change in the amount of arsenic allowed in drinking water that took effect earlier this year. The change lowered the 1975 Safe Drinking Water Act standard of 50 parts per billion of arsenic to 10 parts per billion due to growing evidence that long-term exposure to arsenic can result in increased risks of certain types of cancer and other potential health problems.

"More than 82 public water systems in Nebraska, 59 of them in small communities, are impacted by the new arsenic standard and with multi-million dollar cost estimates for them to meet the new standard, we felt there was an opportunity to engage the University through its rural sustainability agenda to help in a larger way than just sharing information," said project coordinator and Public Policy Center research specialist Linda Kleinschmit.

Researchers at UNL's School of Natural Resources began testing wells for arsenic in 2002. Those tests identified many communities needing help meeting the new EPA standard.

Public Policy Center director Alan Tomkins said an immediate project goal was to help smaller communities look at what options were available and economically feasible to help them decrease arsenic levels in their drinking water and to find funds to deal with the problem.

Involving and educating the communities to make their own informed decisions on how best to meet the new federal arsenic standard was at the forefront of the project.

"The objective was to join with several communities in working through the process of resolving compliance with the new arsenic standard while considering their individual and collective development needs and opportunities," Tomkins said. Creating alliances among neighboring communities to work toward the same health and economic goals was part of the thinking.

" A partnership between the University and communities focusing on the challenges of arsenic reduction can result in more comprehensive and better informed decision-making and can provide information useful for other rural communities that must also reduce arsenic levels in their drinking water," Tomkins said.

The first two communities to take advantage of the joint project, in early 2004, were Stromsburg and Shelby in Polk County, both of which wanted to be proactive in meeting the new arsenic standard along with exploring mutually beneficial economic growth possibilities, Kleinschmit said.

Citizen meetings began in both communities in the spring of 2004 involving Lynne Klawer from the UNL School of Natural Resource Science's Arsenic Information System and Carrie Wiese of The Groundwater Foundation leading a water task group, Randy Cantrell and Dennis Kahl from NU's Rural Initiative leading the community development task group and facilitator Larry Scherer from the Mediation Center.

The water task group worked to identify options for compliance with the new arsenic standard in a way that costs and regional collaboration would be taken into account. They also wanted to increase community knowledge of drinking water standards, testing procedures and options for water treatment and identifying possible new sources of drinking water.

(continued on page 19)

Saving Recreation Water in McConaughy Might Offset Irrigation, Power Losses

By Dan Moser,
IANR News Service

The long-term economic benefits of leaving more water in Lake McConaughy for recreational purposes may in some circumstances offset the costs of compensating irrigation and power interests for one year of reduced supplies, a University of Nebraska-Lincoln study shows.

The state's largest reservoir, north of Ogallala, reached historic lows in 2004 after several years of drought. Levels rebounded slightly this year, but the lake is currently at only 31 percent of its capacity.

UNL agricultural economist Ray Supalla set out to determine how declining lake levels have affected the region's recreation industry and whether short-term water management strategies to reduce that impact could be "economically justifiable."

Those strategies would make less water available to irrigators or hydro power interests for one year by holding back more water in the reservoir. This one-year holdback could increase the lake's water level for recreational use for several years to come, depending on how quickly the reservoir refills.

The economic impact of the shrinking lake on nearby businesses is clear, Supalla said. Lakeside businesses report steady declines since the drought began in 2001, and businesses within three miles of the lake saw sales drop 20 percent in 2004 from an already depressed five-year average.

Supalla estimated that recreational use of the lake in 2004 was 32 percent below the most recent 10-year average. Half of the 836 McConaughy visitors Supalla interviewed said they'd visit the lake more often if its levels were normal.

In his study, Supalla considered three alternative ways of increasing the amount of water in McConaughy — a one-time 100,000 acre-foot reduction in irrigation releases, a one-time 200,000 acre-foot reduction in winter hydropower releases, and a one-time combined irrigation and hydropower reduction of 300,000 acre-feet. Staff at Central Nebraska Public Power and Irrigation District and the Nebraska Public Power District helped develop and analyze the scenarios.

Supalla considered those alternatives in context with three water-inflow scenarios: favorable inflows of 700,000 acre-feet; mid-range inflows of 500,000 acre-feet; and drought-level inflows of 450,000 acre-feet.

An acre-foot is the amount of water it takes to cover one acre one foot deep — or about 326,000 gallons.

Supalla evaluated costs and benefits of each option, including impact on irrigators, electric power costs, recreation benefits and overall benefits to both the McConaughy area economy and the state economy. He concluded that reducing irrigation or hydro power releases when the reservoir is low would under some circumstances increase recreation benefits enough to offset the costs quantified in the study.

"At low reservoir levels even a small amount of additional water in storage significantly increases recreation use," Supalla said. "The benefits to recreation interests appear to be greater than what it would cost to compensate irrigation and power interests for leaving some of their water in the reservoir at appropriate times."

Supalla emphasized that his study envisions one year of reduced releases, but that the impact of more water in the lake could be felt for several years with increased recreational use.

Critical to how costs and benefits would balance out is how long it would take for McConaughy to refill to a fall level of 63 percent of capacity, the level at which maximum recreational use of McConaughy occurs with average weekend and holiday weather. Another factor is how much, if any, of the hydro power lost in the one-year period ultimately could be recovered.

Lake McConaughy, on the Platte River near Ogallala, has declined to record low levels due to prolonged drought conditions that have plagued the region (Central Nebraska Public Power and Irrigation District photo).

Supalla estimated annual recreation benefits for several years, adjusted for evaporation losses and a rising reservoir level. He found that if 100,000 acre-feet were retained in the lake for one year, benefits would exceed costs if it took at least three or four years for the lake to refill to about 60 percent of capacity in the fall, Supalla said. That's assuming the additional recreation water is protected during that period and there's no hydro power recovery at any time.

Supalla also found that net economic benefits could be increased with a scenario that permitted earlier release of the recreation water, starting at about 40 percent of capacity, rather than 60 percent. Under this plan recreation benefits are reduced slightly in exchange for recovery of some of the forgone hydro power.

Under the scenarios that would hold back more than 100,000 acre-feet of water, it would take a recovery period of four to five years or more before benefits would exceed costs. Reservoir recovery periods of this length are less likely to occur.

Supalla said a "reservoir augmentation program" could take a variety of forms, including periodic purchase of water by recreation-related interests, the purchase of storage rights or the purchase of a long-term insurance policy in which

(continued on page 19)

UNL Drought Research Gets $7.4 Million from USDA

By Dan Moser,
IANR News Service

More than $7 million in new federal funding will finance further refinement of University of Nebraska–Lincoln-based Web tools to help agricultural producers and others nationwide to monitor drought impacts and manage its risks.

One partnership agreement, $6.4 million, will fund an effort by climatologists and computer scientists to bring cutting-edge computer science technologies to producers' age-old decision-making processes. The other cooperative agreement, for $1 million, will support continued work on a tool that uses satellite technology and climate information to detect vegetation stress on the ground for a much more detailed view of drought's scope and potential impact.

The three-year partnership agreements are between the U.S. Department of Agriculture's Risk Management Agency, UNL's Department of Computer Science and Engineering and the UNL-based National Drought Mitigation Center.

UNL's National Drought Mitigation Center (NDMC) recently received $7.4 million from the USDA to expand its drought mitigation research. Pictured from left are Steve Goddard, director of the Laboratory for Advanced Research Computing, NDMC director Don Willhite and UNL Vice Chancellor for Research Prem Paul (IANR photo by Brett Hampton).

"We're excited and proud to have this opportunity to significantly expand our research on drought mitigation tools, an area in which we have long been the leaders," said Prem Paul, UNL's vice chancellor for research. "This is work that serves both Nebraskans and the global community.

"In bringing together the expertise of climatologists and computer scientists, it's also an excellent illustration of how interdisciplinary research enables UNL to do its best work," Paul added.

James Callan, acting administrator of USDA's Risk Management Agency, said, "RMA is pleased to fund the development of this important information system, which will provide much needed impact analysis of major drought events. We look forward to continuing USDA's long and valued relationship with the University of Nebraska-Lincoln to bring benefits to America's agricultural community."

In addition to enhancing the strong existing partnership between the National Drought Mitigation Center and the computer science and engineering department, the two agreements give the drought center a prominent role in developing a set of decision-support tools for agricultural producers to improve drought impact assessments and in developing a Web-based electronic drought atlas.

In its first 10 years, the National Drought Mitigation Center focused on helping state, national and tribal governments in the U.S. and around the world better understand drought as the world's costliest natural disaster and the importance of improved monitoring and preparedness to help reduce the damage it causes. That challenge continues, but the projects toward which the new agreements are targeted represent a new emphasis: developing better decision-support tools to help agricultural producers better cope with drought on their individual farms.

"This has been an evolution for us," said Don Wilhite, the center's director and professor in UNL's School of Natural Resources. "We have made tremendous strides in building awareness of the need for improved drought monitoring, mitigation and preparedness, but there is much additional work that needs to be done."

"We're working together to identify the needs and then tailor the tools for producers," said Steve Goddard, an associate professor of computer science and director of the Laboratory for Advanced Research Computing.

The new agreements will enable the drought center to hire additional research scientists and technical specialists, nearly doubling the size of its staff, which now numbers 10 faculty and staff.

Similarly, the Laboratory for Advanced Research Computing expects to hire at least three more programmers, four graduate research assistants and a post-doctoral researcher.

Goddard said UNL computer scientists and climatologists started working together on drought monitoring and mitigation in 1998 with an initial investment of $1 million from the state of Nebraska for geospatial analysis and decision support systems. Additional grants followed from the National Science

(continued on page 16)

Shallow Water Habitat for Pallid Sturgeon

By John Remus
U.S. Army Corps of Engineers

Several methods in the Missouri River to provide shallow water habitat for endangered pallid sturgeon have been introduced by the U.S. Army Corps of Engineers (Corps).

Before development, the Missouri River's natural features offered a wide range of flows, depth and water velocity for native species such as pallid sturgeon.

At that time, the river channel and adjacent flood plain consisted of a main channel, secondary channels, side channels, emergent and submerged sandbars, backwater areas and oxbow lakes. The continuous meandering of the river and large floods kept these natural features of the river intact.

After the Corps developed the river to support navigation and flood control a number of changes affecting native species began to occur.

Development confined the river to a single channel, prevented it from meandering and removed larger floods from the hydrologic cycle. The result is a nearly uniform channel in the lower 735 miles of the river.

In 2000, U.S. Fish and Wildlife Service issued a biological opinion (BiOp) requiring the Corps to provide 20-30 acres of shallow water habitat per river mile from Sioux City, Iowa to the mouth.

There are several ways the Corps can meet BiOp objectives. Currently, there are about 3,000 acres of shallow water habitat in the lower river. In addition, modifying discharges from Gavins Point Dam can create a maximum of 1,200 acres of shallow water habitat, or less than two acres per river mile. The goal is an overall increase in depth and velocity diversity across the cross section with at least 20-30 acres in the five-foot deep range and 2.5 feet per second range.

Seining the Missouri River for pallid sturgeon (photo: U.S. Army Corps of Engineers).

An aerial photograph showing Missouri River dike notches under construction(photo: U.S. Army Corps of Engineers).

Finally, the remaining 14-25 acres per mile of habitat are being provided through a reconstruction of the Bank Stabilization and Navigation Project. The Corps has begun using techniques designed for depth diversity.

Success of the shallow water habitat program relies on the ability of these methods to sustain habitat over time. This will require continued monitoring and assessment. The Corps is in the beginning stages of a comprehensive monitoring and evaluation plan that will verify the effectiveness of these treatments and aid in developing new activities.

(continued on page 13)

Sedimentation in the Upper Missouri River Basin

By John Remus
U.S. Army Corps of Engineers

Since construction of the six mainstem dams and filling of the Missouri River mainstem system in 1967, sediment continues to deposit where streams enter the reservoir pools.

These deposits increase water surface elevations and groundwater problems. As a result, the U.S. Army Corps of Engineers (Corps) has increased its project boundaries at a number of locations and settled damage claims at nearly every mainstem reservoir due to sedimentation/erosion-related problems.

The entire upper Missouri River mainstem system has increased flooding and groundwater problems, bank and shoreline erosion, and legal claims over government boundary lines, water quality issues and loss of hydroelectric power generation capacity as a result of sedimentation in the headwaters areas of the mainstem reservoirs.

Shoreline erosion threatens dozens of cultural sites and contributes to water quality problems for at least three municipal water intakes. Stream bank erosion downstream of the dams threatens residential areas, causes loss of agricultural and forested land, degrades wetlands and damages irrigation intakes.

Problem areas are located throughout the entire basin and include the White River delta that has effectively cut Lake Francis Case (Fort Randall Dam) in half, resulting in increased flooding upstream of the delta and decreased head for hydropower downstream of the delta. The decrease in head is as much as 12 feet.

Flooding and power constraints in the Bismarck-Mandan, ND area, where potential buyouts are estimated at over $100 million.

Flood and power constraints at Pierre/Ft. Pierre, where acquisition, relocation, and/or flood proofing of just a portion of the affected area is estimated to cost more than $70 million.

Aggradation-related problems include raising Highway 12 near Niobrara at an estimated cost of more than $30 million. Property claims along the Niobrara River have resulted in $100,000 in payments with pending lawsuits valued at more than $10 million.

Claims along Ponca Creek total $600,000 and land acquisition in the Buford-Trenton area is estimated at more than $35 million.

Cost of lost hydropower generation varies depending on time of year and the value of power; however, restrictions are generally associated with severe cold weather, when the need for power is highest.

Cultural resource losses have required the Corps to alter reservoir operations. These adjustments reduce flexibility to meet project purposes resulting in loss of hydropower, decreased flood control capacity and impacts to endangered species.

Recent and ongoing efforts within the Corps to address sediment-related problems on the mainstem reservoirs are:

1. Niobrara and Missouri River, SD and NE, Reconnaissance Study Update. Primary purpose was to determine if a plan exists with federal and non-federal interests to serve as the basis for initiating a feasibility study. A plan of study was developed and coordinated with local interests, and ranges of alternatives were studied including dredging, canals, diversions, sediment transport methods and a plan to maintain access to recreation areas. Study findings indicate there is no cost effective plan with federal interest. No non-federal sponsor was identified, thus the study has been terminated. Although this study was terminated, sedimentation problems still exist and will continue to worsen. Because of the significance and severity of this problem, the Corps pursued additional investigations into sediment flushing. A concept-level study indicated there might be a technically viable sediment-flushing plan. Sediment flushing is also included as an element of the Missouri River biological opinion. The Corps has included additional study of the sediment flushing at Gavins Point Dam in the Missouri River recovery plan. If recovery funding is sufficient additional sediment flushing studies will begin in fiscal year 2006.

2. Pierre/Ft. Pierre Flood Mitigation Project. Since Oahe Dam was put into operation in 1958, flooding in the Pierre and Fort Pierre area has been confined to low-lying lands adjacent to the river. This shallow flooding in the low-lying areas has been caused primarily by water backing up in the storm sewer system of Pierre and out into the streets, businesses and homes, most frequently in the southeast Pierre subdivisions. During the winter ice cover in the Missouri River downstream causes additional problems from Oahe Dam resulting in significantly higher stages for a given discharge than during open flow conditions. This causes increase in operation constraints on hydropower production during the winter. Additionally, sediment, primarily from the Bad River, continues to accumulate in the Missouri River adjacent to and downstream of the Pierre/Fort Pierre area and continues to contribute to higher stages in water surface during summer and winter conditions increasing the severity and reoccurrence of flooding problems. The Corps' Omaha District is in the final stages of completing a $35 million buyout/flood proofing project in the Pierre/Fort Pierre area that will alleviate a significant portion of this problem. However, the problem will not be completely solved. If no further action is taken the present constraints to power generation will continue to gradually increase. Ultimately, power generation could be limited to 25 percent of capacity during the three-week constraint period of highest demand in the winter.

3. Buford-Trenton Land Acquisition (Williston, ND Area): The project consists of the acquisition of permanent flowage and saturation easements on approximately 11,750 acres from about 55 landowners. The primary problem is increased groundwater levels making it impossible to grow sugar beets. Sugar beets are a very high dollar cash crop compared to corn, wheat and alfalfa. High groundwater is caused by sediment deposited in the headwaters of Lake Sakakawea (Garrison Dam) just west of Williston, ND.

Tribal Consultation in the Missouri River System

By Mary Lee Johns
U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) has a trust responsibility to work with federally recognized American Indian Tribes. The Corps recognizes tribal governments are sovereign entities retaining powers of self-government.

It is the Corps' responsibility to work directly with tribal governments as sovereign nations on a government-to-government basis in accordance with treaties, statues, court decisions, executive orders and regulations.

There are 22 federally recognized tribes within the boundaries of the Corps' Omaha District. Of these, 10 are located along the Missouri River and seven were directly impacted by Corps construction of five Pick/Sloan hydroelectric dams.

These tribes are directly impacted by Corps decisions regarding operation of the Missouri River Mainstem System. Impacts range from municipal drinking water intakes to exposing tribal burial sites, and destruction of old village sites from bank erosion and looting.

Representatives of the U.S. Army Corps of Engineers consult with tribes on Missouri River issues (photo: U.S. Army Corps of Engineers).

The Corps recognizes and respects the importance tribes place on resources and properties based on religion or culture. It therefore becomes essential that consultation occur before a proposal that may potentially affect tribal interests.

Tribal consultation is seen as a process for initiating and carrying out discussion between the Corps and tribes on proposed and on-going federal actions in a way that is meaningful for both parties.

The most important element of consultation is beginning discussions with tribes before decisions impacting tribal interests are made.

Consultation includes an invitation to potentially affected tribes to provide information concerning actions that may significantly affect tribal interests. Meaningful consultation demands that information from tribes is given particular consideration, which can only happen if tribal input is solicited early enough that it may actually influence the decision-making process.

The Omaha District recognizes tribal consultation is a process, not an event. An example of this was development of a "Programmatic Agreement for the Operation and Management of the Missouri River Mainstem System for Compliance with the Nation Historic Preservation Act, as amended." This agreement defines a system for managing the resources of the Missouri River Mainstem System in a cooperative and culturally sensitive manner.

The agreement took three years to complete from sitting down with a tribal task force where 27 tribes were invited, to the signing ceremony on April 13, 2004.

Of the 27 tribes invited to participate in developing this historic document, the majority participated in some manner during the three years. Sixteen eventually signed the document.

For all of those who participated, this consultation is recognized as a model for others to follow.

From the Director *(continued from page 2)*

limited (otherwise, you may end up sleeping on the locker room floor). We plan to send out postcards announcing the meeting this week, followed by a conference brochure shortly thereafter.

One of our seasoned scouting teams also is now on the road looking things over for the summer water and natural resources tour to the Missouri River basin that will occur July 18-20. Mike Jess and Steve Ress should have a scouting report on that event in the next *Water Current*.

For updates on these activities, please visit our web site at http://watercenter.unl.edu or give us a call at 402-472-3305 HIKE. It's clearly a good thing that the football season is over — my apologies!

Armchair QB Hoagland

Guest Editorial:
Moving Forward on the Missouri River

By Chad Smith,
American Rivers

Each fall, I spend much of my free time duck hunting on the central Platte River. My experiences as a waterfowl hunter in Nebraska during the last 30 years shape who I am and bind me to the place I call home. I share this deep personal connection to the Platte with countless others, and the passion and commitment people express when discussing Platte River issues exist because of similar ties to the river that originate not only from duck blinds but also farms, businesses, and communities.

For the Missouri River, the future lies in building these very connections, which I believe are now in too short supply. The Missouri no longer looks or acts much like a river, the result of decades of river management that have hastened the loss of the river's natural form and function. Failing to manage the river to balance uses like fish and wildlife and recreation with navigation and flood control have disconnected most people from the Missouri and left us with tremendous untapped economic potential.

For years, it has been clear that restoration of both habitat and flow is imperative to boosting the health and economic value of the Missouri River. During that time, debate has raged over how best to change our approach to managing Missouri River water. The possibility of restoring a more natural flow pattern has been a chief issue of discussion. But, at its core, this debate is about change and whether we can embrace a new way of doing business to ensure the Missouri is a true "economic engine" for the basin. After doing things a certain way on the river for decades, it is time for change.

Last summer, I was a member of a group of about 60 basin stakeholders that deliberated over how the Corps should implement a so-called "spring rise" on the river. Though we did not come to a full consensus recommendation, we worked well together, explored a host of ideas and concerns, and came to some general agreements.

The Corps of Engineers listened, and now its Missouri River flow plan for 2006 includes a two-part spring rise much as the basin stakeholder group began designing over the summer. The planned 2006 spring rise is just a first step toward restoring Missouri River flows, but it is an important step.

Concerns remain among about flood risk, water intakes, and the impacts on reservoir storage of implementing a spring rise during a drought. The proposed spring rise recognizes and addresses these concerns and strikes a fair balance between the biological needs of the river, the science behind making flow changes, and the concerns of river users.

The 2006 spring rise is the result of many years of debate, litigation, and study. But most importantly, it is the result of collaboration intended to engage basin stakeholders in river management decision-making. After years of acrimony, the best way forward is to bring everyone to the table to decide together how to maximize the Missouri's many benefits.

Because farmers, navigators, power producers, conservationists, and others worked together to try and develop an agreement on river flows, I believe we made more progress toward that end in three months than was made in three decades. Listening, cooperating, and building trust – that's where the momentum is now in the basin.

It is clear that our vision for the Missouri from the 1930s needs updating. We certainly benefit from flood control, hydropower, and productive floodplain farms, but the Missouri can be so much more. For example, a National Academy of Sciences study concluded that Missouri River rehabilitation will "enhance the valuable fishery resources ...increase waterfowl populations... increase the abundance of largemouth bass...attract more anglers to the region...and result in marked increases in user-days for recreational fishing, commercial fishing, and hunting."

It's time to tap into that very potential. Let's get more people out enjoying the Missouri, spending their money in local communities and building personal connections with the river that will last a lifetime. We can still grow corn in the floodplain, make electricity, provide drinking water, and protect people from flooding. But, we can also ensure that the Missouri serves as a gathering place for the people of this basin, a beacon attracting businesses and dollars to our communities and giving everyone a place to enjoy the outdoors.

This is our opportunity to secure a better future for the Missouri River and the people that depend on it. More natural flows, floodplain farming, navigation, hydropower, and other uses of the river are not mutually exclusive. Together, we can find ways to improve the health of the Missouri, protect existing uses, and tap into the rivers' true economic potential.

As seen from my duck blind on the Platte, the Missouri River's future could not be more exciting.

(Editor's Note: Smith is Director of American Rivers' Nebraska Field Office in Lincoln).

Chad Smith

Shallow Water Habitat for Pallid Sturgeon *(continued from page 9)*

Shallow Water Habitat Construction Techniques Used by the Army Corps of Engineers in 2004

Type	Construction	Benefits	Projects Completed in 2004
Dike Notches	Part of an existing dike is removed or a lowered section is left un-repaired. Generally are 50 feet wide and 3-5 feet below the normal water surface elevation.	Allows flow into and out of the dike fields at a wider range of flows, can create complex sandbar/side channel habitats, provide for a sandy rather than silt substrate, and develop greater overall depth and velocity diversity.	420 dike notches, (about 492 acres of SWH)
Revetment Notches	Part of an existing revetment or kicker structure is removed a lowered section is left un-repaired. Vary from 50 to 100 feet wide and are typically 5 feet below the normal water surface elevation	Connect existing pool areas to the main channel at lower flows, provide for a sandy rather than silt substrate, and develop greater overall depth and velocity diversity.	91 revetment notches, (about 120 acres of SWH)
Bank Notches and Type B Notches	Remove part of an existing dike and excavation of the high bank. Vary from 50 to 100 feet wide; are generally at least 75 feet long. Depths vary but are generally 5 feet below the normal water surface elevation.	Create new habitat immediately and afterwards. Introduce sediment to the river and increase the alluvial dynamics. Allow flow into and out of the dike fields at a wider range of flows, can create complex sandbar/side channel habitats, provides for a sandy rather than silt substrate, and develops greater overall depth and velocity diversity.	200 notches (about 460 acres of SWH)
Major Dike Modifications	Remove a large part of the dikes in a bend and the construction of additional structures in the main channel (chevrons). This treatment is a major top width widening technique.	Creates new habitat immediately and afterwards. Introduces sediment to the river and increases the alluvial dynamics. Can create complex sandbar/side channel habitats, provides for a sandy rather than silt substrate, and develops greater overall depth and velocity diversity.	16 miles (about 8 acres of SWH). However, this technique created greater depth diversity of the entire channel that other techniques, and it is expected to create 8-15 acres per mile once the areas mature.
Pilot Channels	Excavated trenches between two or more revetment notches. The purpose is to provide SWH along the outer sides of the bends where the water is generally deeper and velocities are faster	Creates new habitat immediately and afterwards. Introduces sediment to the river, increases the alluvial dynamics, and develops greater overall depth and velocity diversity.	Nearly 11,000 feet pilot channels (about 43 acres of SWH).
Chutes	Excavated trenches between two or more pool areas or a channel excavated across a point bar. Provide off channel habitat that would be similar to the side chutes in the natural river.	Creates new habitat immediately and afterwards. Introduces sediment to the river, increases the alluvial dynamics, and develops greater overall depth and velocity diversity. Can also create a small delta area in the vicinity of their outlet that also has SWH benefits.	Three chutes (about 78 acres of SWH).
Dredged Backwater Areas	Dredging remnant backwater and oxbow lakes to create shallow off channel areas.	Creates habitat immediately and introduces sediment to the river. Areas are not dynamic.	4 backwater areas (about 135 acres of SWH.)

Meet the Faculty

Durelle T. (Scotty) Scott, Ph.D. *(continued from page 3)*

denitrification are measurable. I am involved in a larger USGS research project with NRP scientists examining both the physical and biogeochemical controls on denitrification within highly enriched agricultural streams.

— I am also working larger spatial scales examining nitrogen loads across the continental U.S. Nitrogen loads vary spatially across the U.S., primarily due to differences in terrestrial inputs (e.g. fertilizer application, atmospheric deposition). Additionally, nitrogen speciation varies both spatially and seasonally, which in turn alters nitrogen reactivity within the river network. In conjunction with U.S.G.S. scientists, the goal of this research is to provide a regional scale perspective of in-stream nitrogen processing and interactions between inorganic and organic riverine nitrogen pools.

Past research:

— Riverine carbon export from New Zealand. New Zealand sits at the junction between 2 tectonic plates, which results in high rates of uplift and subsequent erosion on the landscape. The high erosional rates result in large fluxes of particulate organic carbon delivered to the river network and ultimately to the coast. During my 2-year tenure, I worked on quantifying the net annual riverine fluxes of particulate and dissolved organic carbon, as well as the gas-evasional CO_2 flux from the river network. Additionally, I examined in-stream removal of organic matter resulting in CO_2 evasion.

— Metal cycling in acid-mine drainage impacted streams. AMD affects thousands of miles of streams throughout the Rocky Mountains resulting in degraded water quality and habitat. Two of the more common metals that are associated with AMD include iron and manganese. The focus of my AMD studies pertained to the diurnal fluctuations of Fe, Mn, dissolved organic carbon (DOC), and DOC photoproducts, with emphasis on the dominant reactions altering these species over a diurnal cycle.

Examples of Outreach Programming:

— Community outreach: Assisting in the design and implementation of stream-scale trace injection experiments to address local water quality issues.

— Grade-school outreach: Introducing hydrology and water quality to K-Third grade students in a "hands on" experience.

Teaching:

— Although I do not have any specific responsibilities, I am interested in developing classes at the upper-level undergraduate/graduate level in the broad area of material fate and transport within river networks. Possible classes include aquatic environmental chemistry in freshwater environments, surface-water solute modeling, and a field-oriented water quality/hydrology course.

Selected publications:

— Scott, D.T., Harvey, J.W., Noe, G. Nitrogen retention and processing within a Southeastern US floodplain: Influence of hydrology on biogeochemical processing. *In review*.

— Scott, D.T. M. Gooseff, K. Bencala, and R. Runkel. 2003. Automated calibration of a stream solute transport model: implications for interpretation of biogeochemical parameters. *Journal of the North American Benthological Society* 22(4): 492–510.

– Scott, D. T., R. Runkel, D. McKnight, B. Voelker, B. Kimball, and E. Carraway. 2003. Transport and cycling of iron and hydrogen peroxide in a freshwater stream: Influence of organic acids Iron and hydrogen peroxide. *Water Resources Research* 39: 1308 [doi:10.1029/2002WR001768].

— Scott, D.T., D. McKnight, D. Hrncir, and B. Voelker. 2001. Redox processes controlling manganese fate and transport in a mountain stream. *Environmental Science and Technology* 36: 453–459.

— McKnight, D., D.T. Scott, D. Hrncir, and D. Lovley. 2001. Photochemical and microbial processes influencing iron-humic interactions in stream and lake sediments. Pages 351–370 *in* C. Clapp, M. Hayes, N, Senesi, P. Bloom and P. Jardine (editors). *Humic Substances and Chemical Contaminants*. Soil Science Society of America, Madison, Wisconsin.

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2004 Team Award for the Carbon Sequestration Program. S.B. Verma: Co-principal Investigator.

— Fellow, American Society of Agronomy, November 2004.

— The Award for Outstanding Achievement in Biometeorology, American Meteorological Society (2006).

Teaching:

— Upper class/graduate-level course, NRES 408/808, Microclimate: The Biological Environment (Team teaches with Dr. E. Walter-Shea).

— Freshman/sophomore-level course, NRES 208, Introduction to Bio-Atmospheric Resources (Team teaches with Dr. K. Hubbard and other colleagues in SNR).

— Graduate-level course, NRES 954: Turbulent Transfer in the Atmospheric Surface Layer.

Selected Publications:

— Verma, S.B., N.J. Rosenberg, B.L. Blad, and M.W. Baradas. 1976. Resistance-energy balance method for predicting evapotranspiration: Determination of boundary layer resistance and evaluation of error effects. *Agron. J.* 68:776-782.

— Rosenberg, N.J., and S.B. Verma. 1978. Extreme evapotranspiration by irrigated alfalfa: A consequence of the 1976 midwestern drought. *J. Appl. Meteorol.* 17:934-941.

— Baldocchi, D.D., S.B. Verma, and N.J. Rosenberg. 1981. Mass and energy exchanges of a soybean canopy under various environmental regimes. *Agron. J.* 73:706-710.

— Verma, S.B., D.D. Baldocchi, D.E. Anderson, D.R. Matt, and R.J. Clement. 1986. Eddy fluxes of CO_2, water vapor and sensible heat over a deciduous forest. *Boundary-Layer Meteorol.* 36:71-91.

— Kim, J., and S.B. Verma. 1990. Components of surface energy balance in a temperate grassland ecosystem. *Boundary-Layer Meteorol.* 51:401-417.

— Verma, S.B. 1990. Micrometeorological methods for measuring surface fluxes of mass and energy. In: *Instrumentation for Studying Vegetation Canopies for Remote Sensing in Optical and Thermal Infrared Regions*, N.S. Goel and J.M. Norman (co-editors), Special Issue of *Remote Sensing Reviews* 5(1):99-115.

— Verma, S.B., J. Kim, and R.J. Clement. 1992. Momentum, water vapor and carbon dioxide exchange at a centrally located prairie site during FIFE. *J. Geophys. Research* 97:18,629-18,640.

— Verma, S.B., P.J. Sellers, C.L. Walthall, F.G. Hall, J. Kim, and S.J. Goetz. 1993. Photosynthesis and stomatal conductance related to reflectance on the canopy scale. *Remote Sens. of Environ.* 44:103-116.

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— Suyker, A.E., S.B. Verma, and T.J. Arkebauer. 1997. Season-long measurement of carbon dioxide exchange in a boreal fen. *J. Geophys. Res.* 102:29,021-29,028.

— Burba, G.G., S.B. Verma, and J. Kim. 1999. Energy fluxes of an open water area in a midlatitude prairie wetland. *Boundary-Layer Meteorology* 91:495-504.

— Burba, G.G., S.B. Verma, and J. Kim. 1999. A comparative study of surface energy fluxes of three communities (*phragmites australis*, *scirpus acutus* and open water) in a prairie wetland ecosystem. *Wetlands* 19:451-457.

— Suyker, A.E., S.B. Verma, and G.G. Burba. 2003. Interannual variability in net CO_2 exchange of a native tallgrass prairie. *Global Change Biol.* 9:1-11.

— Verma, S.B., A. Dobermann, K.G. Cassman, D.T. Walters, J.M. Knops, T.J. Arkebauer, A.E. Suyker, G.G. Burba, B. Amos, H. Yang, D. Ginting, K.G. Hubbard, A.A. Gitelson, and E.A. Walter-Shea. 2005. Annual carbon dioxide exchange in irrigated and rainfed maize-based agroecosystems. *Agricultural and Forest Meteorology.* 131, 77-96.

— Burba, G.G., and S.B Verma. 2005. Seasonal and interannual variability in evapotranspiration of native tallgrass prairie and cultivated wheat ecosystems. *Agricultural and Forest Meteorology.* (in press)

Web/email Addresses:

Great Plains Regional Center (GPRC) of the National Institute for Global Environmental change (NIGEC): http://gprcnigec.unl.edu/

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Third Annual Water Law, Policy and Science Conference to Nebraska City's Lied Lodge in May *(continued from page 1)*

Keynote speakers include Stephen Light, Sustainability Science and Policy Director, Institute for Agriculture and Trade Policy, Minneapolis, MN; Bonnie Colby, Department of Agricultural and Resource Economics, University of Arizona; and Christopher Lant, Department of Geography and Environmental Resources, Southern Illinois University discussing water resource economics and agricultural landscape evolution in an adaptive management context.

"Stress on water resources in the Great Plains, not only from the current prolonged drought but also from increasing consumptive demands and water for threatened and endangered species, among other issues, demand a conference where international, national and local experts can focus on a range of economic, human dimension, agricultural, legal and adaptive management topics directly connected to how we perceive and use our water resources," said conference co-organizer and UNL Water Center director Kyle Hoagland.

International perspectives on adaptive management will be offered by Jan Sendzimir of the International Institute for Applied Systems Analysis, Laxenburg, Austria.

Local experts including W. Don Nelson, state director, Office of U.S. Senator Ben Nelson and UNL hydrogeologist Jim Goeke will give a panel discussion on adaptive management challenges in the context of challenges with the Missouri and Platte River basins and high plains groundwater aquifer.

John Lavale of New Mexico State University and others will address the legal implications of adaptive management strategies.

Several speakers will delve into the art and science of translating adaptive water management strategies to the public. These include William Lambrecht of the *St. Louis Post-Dispatch* and recent author of "Big Muddy Blues" on the history and politics of the Missouri River.

Conference co-sponsors are the University's Water Resources Research Initiative, Institute of Agriculture and Natural Resources, Water Center, School of Natural Resources, Department of Geosciences, College of Law and College of Journalism and Mass Communications.

Registration options and costs have not yet been set, though students can attend the conference sessions free.

For more information, contact Jacki Loomis, UNL School of Natural Resources at (402) 472-7550, e-mail jvogel2@unl.edu or go to the conference Web site at http://snr.unl.edu/waterconference/.

UNL Drought Research Gets $7.4 Million from USDA *(continued from page 8)*

Foundation and the U.S. Department of Agriculture, including a $1.2 million grant announced earlier this fall from the Risk Management Agency.

The research led to development of a weather data collection infrastructure with a particular focus on drought. The project, titled the National Agricultural Decision Support System, provides a hands-on tool for farmers at http://nadss.unl.edu. There, producers can tap into a variety of weather data to help them make decisions about their operations.

The additional funding will enable researchers to expand and improve the system, which could include incorporating hydrological or groundwater modeling, Goddard said.

Goddard and Wilhite said their team would continue to work closely with ag producers as they refine the tools. Throughout the research, workshops have sought input from farmers. Additional workshops will be conducted throughout the projects to solicit input from producers on their decision support needs and allow producers to experiment with tools and offer suggestions for refinement. "We'll develop tools, then get feedback and do training," Wilhite said.

Mark Svoboda, a NDMC climatologist, said the team also plans to develop an online drought atlas that would provide producers with a "snapshot of drought risk on a local level."

Researchers will continue to enhance other tools such as the Drought Impact Reporter (http://droughtreporter.unl.edu), a new system developed by the NDMC that tracks drought's impact across the United States.

A separate, $1 million agreement with USDA's Risk Management Agency grant will fund further development of the Vegetation Drought Response Index, a tool that uses satellite and climate data for a square-mile-by-square-mile analysis of drought conditions. It's a more precise measurement of drought conditions than the U.S. Drought Monitor, a weekly national map that the drought center produces through its partnership with USDA and the National Oceanic and Atmospheric Administration.

"The U.S. Drought Monitor was the first generation tool and we continue to work on improving that product for a very diverse clientele across the country. It is a very popular product. The tools being developed through the new grants will build on the success of the U.S. Drought Monitor by providing improved tools to ag producers and others," Wilhite said.

The Drought Monitor, Vegetation Drought Response Index and other tools are available through NDMC's Web site, http://drought.unl.edu/.

Michael Hayes, a climate impacts specialist for the NDMC and associate professor in SNR, emphasized the importance of the other partners in the drought research, including the UNL-based High Plains Regional Climate Center, NOAA and the U.S. Geological Survey.

"We look forward to strengthening our ties with these partners through these partnership agreements," he said.

The National Drought Mitigation Center is associated with the university's Institute of Agriculture and Natural Resources. The Laboratory for Advanced Research Computing is associated with the Department of Computer Science and Engineering.

Water News Briefs

What's In the Water?

Test results from 18 sediment samples drawn from across the New Orleans, LA area, where there have been at least five flood-related oil spills since Hurricane Katrina struck, show that diesel and fuel oils make up as much as 10 percent of the weight of some sediment samples.

Earlier tests revealed dangerous amounts of sewage-related bacteria and lead in the floodwaters, as well as more than 100 different chemical pollutants.

The U.S. Environmental Protection Agency (EPA) also said it found *E. coli* bacteria in the sediment, as well as slightly elevated levels of arsenic and lead.

Fuel oils such as kerosene, jet fuel, range oil and home heating oil can irritate the skin and, if breathed, cause nausea, headaches, increased blood pressure, lightheadedness, appetite loss, poor coordination and difficulty concentrating.

Scientists also worry that as the sediment dries, pollutants in it can evaporate and once airborne, can be inhaled. Breathing diesel-fuel vapors for long periods can cause kidney damage and lower the blood's ability to clot, EPA said.

(From U.S. Water News, October 2005).

Patterson, Hanna Receive 2005 Groundwater Foundation Awards

Roger Patterson, Nebraska Department of Natural Resources director from 1999 to 2005, was presented the Groundwater Foundation's 20th annual Maurice Kremer Groundwater Achievement Award

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

"Roger Patterson has had more influence on the management of ground and surface water in Nebraska than any other individual in the past five years," said nominator Don Kraus, general manager of Central Nebraska Public Power and Irrigation District."

They also credited his knowledge of water policy and state water resources in his ability to settle lawsuits on both the Platte and Republican Rivers and his key role in partnering with former Governor Mike Johanns and State Senator Ed Schrock in initiating and leading the Governor's Water Policy Task Force.

As part of this Task Force work, LB 962 was developed and passed as a way to effectively integrate ground and surface water management. In actions taken in the waning days of his tenure, Roger put forward a 50/10 rule that will safeguard surface water flows through limits on groundwater pumping.

After receiving an engineering degree from UNL, Patterson began his water resources career at the Bureau of Reclamation in 1974, becoming the Great Plains Regional Director in 1986. He then served as Regional Director for the Mid-Pacific Region until his appointment to head DNR in 1999.

Arlene Hanna of Lincoln received the foundation's Edith Stevens Groundwater Educator Award, established to recognize individuals who understand the importance of groundwater, motivate others to protect it and lead by personal example.

Hanna was instrumental in establishing the Earth Wellness Festival, developed in 1994 in response to a petition from the Lincoln Public Schools for an environmental festival.

Hanna coordinated a 15-member festival steering committee representing 11 local educational resource agencies.

Students at the festival rotate among four 25-minute sessions focusing on water, land, air, and living resources as well as participate in a culminating activity with a featured presenter.

Held in March, nearly 3,000 Lincoln and Lancaster County fifth graders participate each year.

"Kits for Kids" a pre-festival learning kit containing curriculum, supplies, and equipment is distributed to classes that will attend the festival. Activities in the kit are correlated with Nebraska and National Science Education Standards. In 2002, Lincoln Public Schools included Earth Wellness Festival and the water and wetlands section of the "Kits for Kids' activities guide as core subjects in the fifth grade science curriculum.

Summer Tour Will Be In July

The 2006 Water and Natural Resources summer tour, sponsored jointly by the Kearney Area Chamber of Commerce, Gateway Farm Expo, Central Nebraska Public Power and Irrigation District, Nebraska Public Power District, Nebraska Association of Resource Districts (NARD), UNL Water Center and others, will be July 18-20.

Earlier dates in June were changed to July so the tour won't conflict with an NARD director's tour in western Nebraska in mid-June.

Though planning for the July tour has just begun, it appears likely the tour will concentrate on Missouri River Basin issues from approximately Omaha, north to Gavins Point Dam and Lewis and Clark reservoir.

UNL Assists State With Research and Survey Work

(continued from page 5)

Both projects rely heavily on seasonal plant growth information gathered by satellite to build the land cover maps.

Crops targeted for the mapping studies include irrigated and dryland corn, soybeans, sorghum, dry edible beans, alfalfa and other irrigated and dryland crops, as well as range and urban land, wetlands, open water, riparian forests, roads, farmsteads and feedlots and other land features and uses.

Additional information to build the maps will come from other collection mediums, as well as data from USDA's Farm Service Agency, National Wetlands Inventory and other sources, Merchant said.

Part of the information that will be delivered to the state will be a statewide inventory of center pivot irrigation locations, information on surface irrigation coverage, summary statistics on how many acres are being used for different cropping and other land uses and a Web site on land use classifications.

The project yielding land-use information specific to the Platte River Basin upstream of Columbus should be finished by the end of 2006, while the statewide project will likely conclude in summer 2007.

Another project underway for DNR is the compiling of a detailed electronic database of information on water well test holes drilled across Nebraska by UNL's Conservation and Survey Division and others.

The resulting Windows-based database will contain test hole log reports on a county, natural resources district or regional basis, as well as lithologic, stratigraphic and geophysical log illustrations for any given set of test holes.

UNL groundwater geologist Jerry Ayers and GIS specialist Les Howard are conducting the project, which will conclude in summer 2006.

Ayers and Howard are also working on a Niobrara regional and Box Butte County hydrologic model that will review an earlier Box Butte County model Ayers developed to determine its suitability for assessing groundwater pumping impacts on the Niobrara River within the Upper Niobrara White Natural Resources District.

The model will be expanded to the north of the river and incorporate new information so that groundwater well pumping impacts to the Niobrara can be more accurately determined.

Their model could be used as a template for analyzing groundwater pumping impacts on other specific segments, or stretches, of the Niobrara River.

Another Ayers' project for DNR is looking at groundwater aquifer-stream interaction on the upper reaches of the Niobrara River.

"We will establish a number of data-collection stations along the Upper Niobrara to determine stream-bed characteristics, including lithology, stratigraphy, sediment features and hydraulic conductivity," Ayers said.

The collected data, in addition to stream flow information, will form the basis for determining the hydraulic connection between the Niobrara River and the underlying aquifer, he said.

The work is planned for completion by the end of 2006.

A recently completed project used existing UNL water well test hole data to develop detailed large-scale maps of hydraulic conductivity, yield and flow of the principal aquifers for the Niobrara River east of the fully appropriated area in the Upper Niobrara White NRD; the Missouri River and its tributaries on the Nebraska side of the river; the Nemaha basin; Blue River basin; Little Blue River basin; Elkhorn River basin and Loup River basin.

The project was completed earlier this year by groundwater hydrogeologist Scott Summerside, groundwater geologists Jim Goeke and Sue Lackey and Ayers.

Monitoring and Stocking Pallid Sturgeon

(continued from page 1)

Efforts are underway by the U.S. Army Corps of Engineers (Corps) to monitor the endangered pallid sturgeon and a select group of other native species.

Complimentary monitoring programs track pallid sturgeon, shovelnose sturgeon, blue sucker, sicklefin, sturgeon, speckled chubs, plains minnow, sand shiner, sauger and bigmouth buffalo. The Corps is also evaluating effects of habitat modifications (habitat diversification) within the channelized Missouri River from Ponca to the mouth of the river on these species.

State and federal basin experts, as well as academic researchers, collaboratively developed the monitoring programs.

Stocking the pallid population

Though stocking is not a solution to recovering endangered pallid sturgeon, it is a critical piece of the puzzle.

The Corps, Montana Fish, Wildlife and Parks, Missouri Department of Conservation and U.S. Fish and Wildlife Service have worked together since 2001 to enhance stocking efforts to aid recovery.

Several hatchery improvement projects are being implemented to increase numbers of pallid sturgeon produced as well as the quality of fish being stocked.

These fish are essential to supplement the younger year classes that are absent from the wild population.

Stocking efforts are a stopgap until ecosystem restoration efforts (e.g., habitat, flow) provide conditions suitable for species recovery.

More than 70,000 pallid sturgeon have been stocked below Gavins Point Dam since 2002. Stocking will likely be necessary for at least another 15 years to provide a sufficient population to allow the species to sustain itself naturally.

UNL Monitoring Program Records Persistent Groundwater Declines

(continued from page 4)

"The number of wells grows each year. We're always looking to add wells with good potential to contribute to the accuracy of our data," Burbach said.

Well readings used to produce the maps generally are taken between March 1 and May 1 each year, after the fall and winter recharge cycle and before the summer irrigation season, he said.

The UNL program wants to make more of the information it collects available in real-time, via the Internet.

To that end, Burbach and two coresearchers have begun a partnership with the U.S. Department of Agriculture's Risk Management Agency that will place satellite uplinking equipment on 52 wells across Nebraska. Most of the wells fitted with the equipment will be located in unconfined aquifers or shallow, confined aquifers that respond to climatic fluctuations, he said.

Coresearcher Byrav Ramamurthy of UNL's Computer Science and Engineering Department will oversee a doctoral student who will develop computer hardware and software to download, store and display groundwater level readings from the wells which the public will also be able to see in a real-time format, he said.

In addition to benefiting groundwater level monitoring, data from the wells will be incorporated into state and national drought-monitoring archives to improve drought planning and response.

Coresearcher Cody Knutsen of UNL's National Drought Mitigation Center will develop workshops for decision makers and the public on how to access and interpret the program's collected information.

The program will be developed over the next three years, Burbach said.

Copies of the groundwater level change maps, including historical copies dating to 1954, can be accessed at http://csd.unl.edu. The groundwater monitoring level program at UNL dates to 1930.

Public Policy Center Works With Communities For Development and Safe Drinking Water

(continued from page 6)

"Faculty and other resource team members brought expertise in technology, funding alternatives and community and economic development practices," said Kleinschmit.

Meetings, small group discussions and educational seminars were held in the two towns through the first half of 2005. High school students were part of the task group and arsenic education curriculum was introduced into the local high schools. At meetings and discussions, community members were asked to identify goals and concerns, not just for clean drinking water, but for economic growth and sustainability, too.

"By the end of the process, the communities had more information to make decisions on how to decrease arsenic levels and be more aware of University resources available to them, along with a deeper appreciation for what regional collaboration did not only to help meet drinking water standards but also to promote mutual economic growth," she said.

NET Radio also completed a 10-part radio series on the project in May 2005 with the final broadcast being part of the "Nebraska Connects" series.

For more information on arsenic, arsenic abatement and the NU Public Policy Center, access http://nesen.unl.edu/nearsenic/index.html and http://ppc.unl.edu/ on the Web.

Program funding was from the W.K. Kellogg Foundation, UNL's Water Resources Research Initiative and NU's Rural Initiative.

Saving Recreation Water in McConaughy Might Offset Irrigation, Power Losses

(continued from page 7)

McConaughy water owners would agree to a modified set of release rules in return for a periodic premium payment.

One way to fund these options might be to charge lake-goers or area businesses a premium to boost lake levels. Eighty percent of the 836 lake-goers Supalla interviewed said they'd be willing to pay such a fee, but less than half of the 33 area businesses surveyed said they'd be willing to contribute to such a fund.

Although boosting reservoir levels could help improve the area's economy, Supalla said, it might have only a "very modest impact" compared to actions that would improve the lake's recreation infrastructure. While it was beyond the study's scope, area residents and lake-goers had lots of suggestions to boost attendance at the lake, including additional boat ramps, restroom and shower facilities closer to the water, a resort hotel, horseback riding, an ATV riding area on the beach, local hunting programs, hiking trails and a family fun park.

Supalla plans to continue his research to determine a clearer picture of benefits and costs. He said it is especially important that additional studies of the impacts on groundwater and in-stream flows in both the Platte and Republican rivers be conducted before any action can be taken. Any action would require complicated negotiations among recreation, irrigation and power interests.

Supalla's study was funded by state and federal sources and conducted in cooperation with UNL's Agricultural Research Devision. The agricultural economics department is part of the Institute of Agriculture and Natural Resources.

What's New at the UNL Water Sciences Laboratory

By Daniel D. Snow, Ph.D.
Director of Laboratory Services

The UNL Water Sciences Laboratory has had another very productive year, receiving and analyzing nearly 2,000 samples in 2005 and hiring two critical new staff members.

In addition, recently acquired analytical equipment and new areas of water research have allowed for development of several new methodologies to support NU researchers and other clients.

Some of the new methods, developed to take advantage of our new Platform XS ICP-MS, include analysis of trace level (in the parts per billion range) concentrations of iron and molybdenum in lake water to further aquatic ecology research.

Other analyses with this instrument include measuring arsenic, cadmium and lead in river water, as well as zinc, platinum, nickel, and iron isotopes in a variety of samples.

We have also processed samples for a semi-quantitative "full scan" analysis that includes around 50 elements for more complete characterization of samples.

We were very fortunate to have hired Aaron Shultis, who recently completed his M.S. in geology at the University of Wisconsin using a multi-collector ICP-MS. He is now running our Platform XS and other mass spectrometers.

In addition to ICP-MS methods, we have developed several new methods for analysis of pharmaceuticals, hormones, and algal toxins using liquid chromatography-mass spectrometry (LC/MS). Along with our tetracycline and macrolide methods, we can now offer analysis of several sulfonamide, fluoroquinolone, and beta-lactam (penicillin) antibiotics.

Lab staff has developed new methods for analysis of natural and synthetic steroid hormones including estradiol, estrone, estriol, testosterone, androstendione and trenbolone to examine occurrence of these and other endocrine disruptors in the Elkhorn River watershed.

Finally, we are in the closing stages of developing a method and have even run a few samples for analysis of microcystins (LR, LA, LW, LL, and RR), which are the hepatotoxins (liver toxins) thought to have occurred in some area lakes in recent years.

Our most recent staffing addition is research technician Monica Hollrah, who was hired into a position shared with the University's Veterinary Diagnostic Center (VDC). Hollrah has a B.S. in Chemistry from UNL and has taken on many of the standard analysis we perform on a regular basis.

She will also be responsible for preparing and analyzing samples on the ICP-MS for VDC clients. Our hope is that this collaborative arrangement will enhance diagnostic services to clients and facilitate research needs by increasing interaction between our facilities.

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