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Fen hydrology monitors secured with Environmental Trust award

The Nebraska Environmental Trust has given an award of \$200,000 to one of the most ambitious landscape-restoration projects in state history for its second year of funding.

When combined with a \$385,000 award in 1996—which went largely to retire a land-purchase debt—the money allows about \$52,000 to go toward understanding and monitoring a crucial part of the restoration effort: the regional groundwater system surrounding rare Sand Hills wetlands known as “fens,” said Edwin Harvey, research hydrogeologist with the University of Nebraska-Lincoln Conservation and Survey Division.

The Nature Conservancy has bought land on which the fens are located from Sand Hills ranchers and will sell it back to ranchers with environmental easements once the restoration is complete. It has also issued a statement of intent recommending that the project get \$315,000 in 1998.

Fens are groundwater-fed wetlands with soils high in moisture and organic matter. In Nebraska, most fens are found in the flat, low-lying areas of grassland in Cherry County.

Harvey said work on the fens is exciting because it involves many hydrogeologic unknowns,
Fen hydrology continued on p. 2

Water-levels program gets jump-start into the 21st century

In a state where ample water is lifeblood, in an era of shrinking public coffers, the water-level monitoring program shared by the state and federal geological surveys in Nebraska is getting an infusion of resources, talent and technology.

Receiving a jump-start into the 21st century is the network of organizations and observation wells that has produced an annual report on Nebraska’s groundwater-level changes that often has been required reading for irrigators, natural resource managers and others. The program, managed by the Conservation and Survey Division (CSD) and the U.S. Geological Survey, is entering a new era of information and communications technology that will deliver less costly, more timely and more extensive data.

Since the early 1990s, due to budget and personnel considerations at CSD and the USGS, the water-levels report has shrunk and been published less frequently than the traditional annual document that characterized the program for 40-some years.

Mohan Khisty, the new water-level program coordinator at CSD, a unit of the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources, is expanding the scope of the water-levels program by taking advantage of the latest developments in electronic delivery of information, and saving money at the same time.

“This is not just traditional water-level monitoring we’re working on here,” Khisty said.

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CALMIT joins precision ag research at MSEA site and elsewhere

A University of Nebraska-Lincoln center for geographic information systems (GIS) and remote sensing will help with precision agriculture research to be conducted this spring in conjunction with UNL research at the USDA Management Systems Evaluation Site (MSEA) near Shelton. The MSEA site research has examined better water and agricultural-chemical management in crop production since 1990.

In early May, the UNL Center for Advanced Land Management Information Technologies will be looking at the use of a close-range remote sensor in measuring soil moisture, texture and organic matter at the MSEA site in cooperation with the USDA Soil Water Conservation Research unit of the Agricultural Research Service and the UNL agronomy department, said Mike Schlemmer, GIS specialist with the agronomy department and former CALMIT student. This testing is part of a study led by Jim Schepers of Agronomy on tailoring variable rates of application of water and ag chemicals to specific field conditions. This kind of site-specific tailoring is the keynote of the im-

proved crop management possible with precision farming. If the system works, a sensor could be mounted on a center-pivot irrigation boom to send signals to the pump for precision application of water and ag chemicals.

Precision agriculture—crop production aided by satellite or aerial imagery and computer mapping—is generating a great deal of excitement in the farming community. Also called “site-specific farming,” it combines geographic data from satellites with field performance results. In site-specific production, signals from a global positioning system (GPS)—satellite technology allowing for exact location of any spot on the globe—are collected by receivers on harvesting machines, for example, as they move across the field. On-board electronic recorders combine the GPS coordinates with harvest data such as grain yield and moisture content.

Precision ag technology is especially helpful in fields that vary greatly in elevation, soil type and nutrient content. And CALMIT’s contributions to

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Fen hydrology *continued from p. 1*

and could help researchers better understand ancient climate change and the hydrology of the region.

"We're not only learning how to manage water levels to maintain these rare wetlands," he said. "We're learning about the dynamics of water in the Sand Hills and in the region."

Fens are home to about 200 unique plant species—some relicts from the last glacial period—and help form a complex ecological network essential to the natural beauty and integrity of the Nebraska Sand Hills. These glacial relicts include bogbean, marsh marigold and cottongrass.

"Fens are unique because of the special hydrogeologic conditions required for their formation," Harvey said. "They are definitely worth studying because we don't know very much about the hydrologic and chemical variables determining where fens can form and thrive—but we do know they can exist in the Sand Hills."

Increased interest in fens has helped a coalition of the Nature Conservancy and the Sandhills Task Force secure funding for the restoration project, which also involves Nebraska ranchers and cooperators from a number of state and local agencies.

Water-level program *continued from p. 1*

There are many other aspects to consider, he said, such as interpretation of rises and declines, timely delivery of information and improved working relationships with clients.

In cooperation with the USGS and other agencies, CSD is putting the report on the World Wide Web and on CD-ROM—both of which should be accomplished within a year. A general consensus among program participants, particularly the NRDs charged with addressing groundwater declines, supports a move away from printed information to electronic data and analytical products, Khisty explained.

Experience as a research assistant for CSD hydrogeologist Dave Gosselin has given Khisty knowledge that applies directly to his new position, he said, particularly in improving

Precision agriculture *continued from p. 1*

center's knowledge of GIS, software that allows researchers to display and analyze volumes of spatial data, explained Brian Tolk, CALMIT research coordinator.

"This task would be virtually impossible without such a tool," he said. More and more farmers are getting into

Two Cherry County fens in Jumbo and Pullman valleys are being studied and restored in response to continued degradation of the fens in recent decades. Some areas of the fens have been altered from their natural state because of ditching and the seeding of exotic plants to improve conditions for hay production.

The goal is to try to understand the surface water and groundwater relationships related to the fens and figure out ways to manage them, balancing conservation methods and the need to maximize agricultural production, Harvey said.

Harvey, graduate student Tina Kurtz and CSD geologist Jim Swinehart are responsible for the groundwater part of the project, he said. They are monitoring hydrologic conditions in and around the fens—most importantly, their geochemistry and the level of the water table, which are essential to providing water and nutrients to the fens. Restoration involves filling drainage ditches, removing unwanted vegetation and reseeded native plants to help keep water within the fen.

Of the nearly 150 requests submitted this year, the restoration received the third highest project rating. The ratings are one of the major factors the trust uses in evaluating grant requests.

the quality of CSD's electronic groundwater databases, which will be aided by using global positioning system technology to obtain more accurate locations of wells. Some of the NRDs have already been doing so, and Khisty wants to integrate their information into CSD databases. Program staff are organizing historical water well data dating back to the 1930s and matching it with global positioning system (GPS) spatial data to create "clickable" digital maps of well data for all monitored wells in the state.

"We anticipate that the vast majority of our clients will be 'online' in the next few years, and we need to plan to meet their informational needs," Khisty said. "The aim is to customize information for our clients," he said.

precision agriculture because it offers them the advantages of detailed, high-resolution perspectives on their land, Tolk said. Field data can be added to a GIS to produce color-coded maps of entire fields, giving farmers valuable information about grain yield, moisture content and other crop data.

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To receive it free of charge, write to the address above. In addition, *Resource News* subscribers will also receive *Resource Notes*, the annual news magazine of the division that is the fall edition of the news package. **The Conservation and Survey Division (CSD) is the agency designated by statute to investigate the natural resources of the state, to make available to the public the results of these investigations and assist in the development and conservation of these resources.** CSD provides information to all people regardless of sex, age, race, color, religion, national origin, sexual orientation, veteran's status or handicap. Background of nameplate depicts the rock column from the *Geologic Bedrock Map of Nebraska*. Shown are (from bottom) Precambrian, Cambrian, Ordovician, Silurian and Devonian rocks.

CALMIT staff are involved in a new campus-wide committee designed to promote precision agriculture at UNL and throughout Nebraska, Tolk said. Because precision ag is a relatively new area of research, he explained, CALMIT first needs to conduct fundamental research with ground-based remote sensing systems for verification. The center also plans to make use of its existing satellite and aerial image archives to aid in the development of site-specific production.

It has been estimated that by the year 2000, at least half of all crop producers in the United States will have harvest monitors, he added, often a "first step" in establishing precision ag systems. It is possible that precision farming technology in the near future could also be used to tailor pesticide applications to specific field characteristics. However, most precision ag researchers have said that until a few years of production data have been collected and compared to determine trends, farmers should probably hold off making drastic production changes.

A "core group" of CALMIT staff working with the technology includes Tolk and Rick Perk, research associate,

Don Rundquist, director, and Jim Lacy, facilities manager. Other active NU faculty include Mason, Schepers, Gary Hergert, extension soils specialist and associate director at the NU West Central Research and Extension Center near North Platte, and Richard Ferguson, soils specialist at the extension center near Clay Center, who heads up the Precision Agriculture Working Group.

Recent precision ag programs have included a tour of CALMIT's facilities for interested UNL faculty and a meeting with staff at NU's Agricultural Research and Development Center near Mead to talk about future precision ag research. CALMIT staff also participated in last year's Precision Decisions conferences, sponsored by Cooperative Extension and the Nebraska Farmer magazine in Omaha last November, as well as and the Agronomy Highlights symposium and an agricultural technology workshop in Kearney earlier this year.

"Analyzing these images from the past and present can help farmers make wise management decisions for the future," Tolk said.

Value of mineral production in Nebraska rose by \$13 million in 1996; petroleum, natural gas, uranium, sand and gravel and clay revenues all rise

Mineral production in Nebraska in 1996 increased by \$13.15 million, or 6 percent, over the production value for 1995. Value of production increased in petroleum, natural gas, uranium, sand and gravel and clays.

The overall rise was led by a 9.5 million increase in the value of petroleum production, a 16 percent rise due to an increase in the price of petroleum, according to preliminary figures offered by a University of Nebraska-Lincoln research geologist. Even though production went down by about 250,000 42-gallon barrels from 1995, a 7 percent drop, the jump in value was the result of an increase in the price of oil that varied depending on the region of the state but was about \$4 a barrel in each area.

A 93,000-pound increase in production of uranium yellowcake slurry yielded a 37 percent hike in value—a \$3.1 million increase in revenue, the next highest rise from 1995. The price of uranium increased from \$11.50 to \$14 per pound in 1996.

Construction sand and gravel showed the third highest increase in value from 1995, a \$900,000 rise, spurred on by a production increase of 220,000 short tons, said Ray Burchett, of the UNL Conservation and Survey Division. Burchett compiled his data from confirmed figures for 1995 and preliminary figures for 1996 from the U.S. Bureau of Mines—

now defunct—the U.S. Geological Survey, the Nebraska Oil and Gas Commission and Crow Butte Uranium Resources, Inc. They are available from the Conservation and Survey Division, a unit of the UNL Institute of Agriculture and Natural Resources, in a flyer on mineral production data in Nebraska.

Natural gas showed the next highest rise in value, from about \$2.26 million to about \$2.5 million, a 10 percent increase, even though production fell by 16.3 percent, from about 2.2 million to about 1.9 million cubic feet. The price of natural gas increased from \$1.19 to \$1.33 per thousand cubic feet in 1996.

The total value of non-fuel minerals rose by 1.3 percent, or about \$70,000, from \$5.55 million to \$5.62 million, the report said. Contributing to this increase was a rise in the value of clay production from \$1.13 million to \$1.14 million, reflecting an increase of 3,000 short tons produced.

Crushed stone and lime decreased in value of production from 1995 by \$900,000, a 2 percent drop, and by \$66,000, or 8 percent, respectively. Crushed stone production amounted to about 7 million short tons, worth \$40.9 million, down from 7.3 million tons in 1995, which were worth \$41.8 million. Lime produced tallied 20,000 short tons, worth \$737,000, down from 22,000 tons in 1995, which were worth \$803,000.

Conservation and Survey, Water Center reprint volume on drought humor by Roger Welsch

Roger Welsch says, On the plains it's foolish to consider rainfall in terms of averages. Averages are the least likely occurrences. The extremes, on the contrary, determine feast or famine, boom or bust, and the extremes have also produced the best of plains folklore: that most famous plains yarn, the tall tale.

"Perhaps the essence of water is not so much to be measured in inches and gallons as in hope, agony, drouth and flood," is another of Welsch's observations in the introduction to a booklet by the Nebraska folk humorist. Welsch writes columns for state and national magazines and hosts a segment

of a Sunday morning news show with a national network. The work was first published in 1978 but is available again from the University of Nebraska-Lincoln.

"The Summer It Rained: Water and Plains Pioneer Humor" was published when Welsch was an adjunct professor of English and anthropology at UNL. The 13-page booklet—a collection of tall tales on water and its absence in Great Plains history—was reprinted earlier this year by the UNL Water Center/Environmental Programs and the Conservation and Survey Division, both units of the Institute of Agriculture and Natural Resources. The Water Center first published the

collection and, along with the Conservation and Survey Division, the Water Conference Council, the UNL Institute of Agriculture and Natural Resources and UNL, is a sponsor of the annual Nebraska Water Conference, for which the reprint was prepared.

Karen Stork, CSD administrative assistant and Water Conference co-chair, said the decision to reprint the book was made after Welsch agreed to serve as banquet speaker for the 1997 Nebraska Water Conference, held in Lincoln in mid-March on "The Ogallala Aquifer—Managing for Drought and Climate Change." The volume features material published in Welsch's first two books— "Shingling the Fog and Other Plains Lies" and "Catfish at the Pump," which had not yet been published when the booklet came out.

"We decided it would be appropriate to reprint the book and distribute it at the conference, while Welsch was there to

talk about it and autograph copies," Stork said.

A total of two thousand books were reprinted, Stork added, 300 of which were distributed at the conference. The remainder will be available to the public through CSD. The Water Center will also use the reprints in its promotional activities, Stork said.

One dollar from each book sold will benefit the Nebraska Water Conference Council, which is responsible for organizing the annual conference.

Copies of the book can be obtained by sending \$2, plus \$1.25 for shipping and handling, to: Map and Publication Sales, Conservation and Survey Division, 113 Nebraska Hall, University of Nebraska-Lincoln, Lincoln, NE, 68588-0517. Nebraska residents should add city and state sales tax. Checks should be made out to the University of Nebraska-Lincoln. People who want to order multiple copies should call CSD at (402) 472-7523.

Coming up: federal, state and local meetings and workshops

May

May 10-11: North-Central Nebraska Rockhounds show, Norfolk, Neb.

May 20-22: 12th Annual Conference on Hazardous Waste Research. Sponsored by the Great Plains/Rocky Mountain Hazardous Substance Research Center. "Building Partnerships for Innovative Technologies." Write: Conference on Hazardous Waste Research, HSRC, 101 Ward Hall, Kansas State University, Manhattan, KS 66506-2502.

May 28-31: IAIA '97 (International Association for Impact Assessment 1997) - Reflections on Water: Learning From History and Assessing the Future, New Orleans, La. IAIA: FAX (701) 231-1007.

June

June 2-5: Digital Mapping Techniques '97, hosted by the Kansas Geological Survey, Lawrence, Kan. For information on the Web, see: <http://crude2.kgs.ukans.edu/DMT97>.

June 14-15: Grand Island Earth Science Society Swap, Grand Island, Neb., So. Locust Skagway parking lot.

June 15-19: American Water Works Association annual conference, Atlanta, Ga. Early registration dates of March 21 and May 16. Contact the AWWA, 6666 W. Quincy Ave., Denver, CO 80235. Phone: (303) 794-7711. e-mail: mparme@awwa.org.

June 23-25: The U.S. Environmental Laws and Regulations Compliance Course, Albuquerque, N.M. Contact: Government Institutes, 4 Research Place, Rockville, MD 20850 or call (301) 921-2345 (Course also offered July 23-25, Chicago, Ill., and Aug. 11-13, Hilton Head, S.C.).

June 27-28: Platte Valley Rock and Mineral Society Swap, North Platte, Neb., Cody Park shelter.

June 29-July 3: Water Resources, Education, Training and Practice: Opportunities for the Next Century. Keystone Resort, Colo. Phone: (703) 904-1225. awrahq@aol.com.

July

July 8: Abstracts due for 1997 GSA meeting; Salt Lake City, Utah, Oct. 20-23.

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