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Iowa flooding study offers lessons for Nebraska

When the floods come and you want to study them, you go to where the torrents ran about as fast as you can.

That's how Anne Matherne, research hydrologist with the Conservation and Survey Division (CSD) of the University of Nebraska-Lincoln described her reasons for spending September studying last summer's flooding in west-central Iowa with Karen Prestegaard, professor of hydrology at the University of Maryland, and students from that university on a project supported by the National Science Foundation. Helping Prestegaard and Matherne were Brendan Shane, Kevin Houghton, Mike O'Connell and Nancy Karyl, graduate students at the University of Maryland.

While researchers at CSD, the state geological, water and soil survey, normally work only in Nebraska, similarities to the geology, topography and land-use practices of eastern Nebraska, combined with the dramatic nature of a 500-year flood, made Iowa the place to be.

"The heaviest precipitation and the major flooding happened in Iowa. The effects were the largest and the most dramatic, which makes them the easiest to study, but under other circumstances it might have been Nebraska," Matherne said.

When the Raccoon River basin received an 8-inch rain in a region where the soils were already saturated, a 500-year flood crest hit Des Moines, (See *Flooding continued on page 3*)

Publication on guidelines for plugging abandoned wells to be out soon; slide set is available now

Since 1986, Nebraska landowners have been required by law to plug abandoned wells on their property, but guidelines for accomplishing that, largely produced by local natural resource districts or county extension agents, have been spotty and differ from area to area. That will soon change thanks to a joint effort by the University of Nebraska-Lincoln Conservation and Survey Division (CSD), the Cooperative Extension Service of the UNL Institute of Agriculture and Natural Resources and the Nebraska Department of Health.

According to Duane Eversoll, the associate director of CSD, a set of comprehensive statewide guidelines for plugging abandoned wells should be published early next year. Tentatively titled "Guidelines for Plugging Abandoned Water Wells,"

the publication is being coauthored by Eversoll, DeLynn Hay of the Cooperative Extension Service and Rod Tremblay of the Nebraska Department of Health, with input from Nebraska well drillers, public health officials and other interested parties. A slide set detailing the process of well-plugging, put together by Hay, is already available through CSD and the Cooperative Extension Service.

Plugging abandoned wells is of paramount importance in Nebraska because wells that are left unsealed can allow harmful chemicals and other contaminants to reach the water table and pollute the aquifer. Eversoll said the main objective of the 1986 Water Well Standards and Contractors Licensing Act, which requires landowners to seal (See *Abandoned wells continued on page 2*)

Imaging radar aids satellite land-use classification

By combining the capabilities of a traditional earth-observation satellite and the unique abilities of imaging radar, researchers at the University of Nebraska-Lincoln Conservation and Survey Division (CSD) have developed a method of devising more accurate crop and land-use classifications.

Their research can be applied to improving interpretations of land-use characteristics from satellite images, said Chris Keithley, facilities manager and research analyst with the CSD Center for Advanced Land Management Information Technologies (CALMIT). Keithley and Fiona Renton, also a research analyst with CALMIT, presented their findings at Pecora 12, a symposium on remote-sensing applications held Aug. 24-26 and sponsored by the U.S. Geological Survey's

Earth Resources Observation Systems Data Center in Sioux Falls, So. Dak.

The first set of data came from the Landsat Thematic Mapper, which discerns differences in electromagnetic reflectance in the visible, near- and mid-infrared wavelengths. Two dates of imagery of western Nebraska near the Alliance area were used from the 1991 growing season. The first Thematic Mapper scene was from March 31, 1991, the second from Aug. 6, 1991. Five crops were included in the classification: alfalfa, dry edible beans, corn, sugar beets and small grains. Surrounding uncropped lands, consisting of pasture and urban land, were also classified.

The new wrinkle in land use classification involved using imaging radar from the European (See *Imaging radar continued on page 3*)

The bimonthly newsletter of the Conservation and Survey Division
Institute of Agriculture and Natural Resources/University of Nebraska-Lincoln

News
Resource

Centennial open house attended by more than 400

More than 400 people attended the open house sponsored Sept. 23 by the Conservation and Survey Division (CSD) in celebration of the centennial of the Nebraska Geological Survey. The state geological survey was officially constituted in 1893 with the legislature's designation of the head professor of geology at the University of Nebraska as state geologist. It has been a unit of CSD since 1921.

The open house and a banquet for current and former employees Sept. 24 capped off the division's centennial activities.

"I believe this number far exceeded anyone's expectations," CSD Director Perry Wigley said of the open house attendance. The count was based on the guest list and the number of door prize slips signed.

During the open house visitors to the east half of the first floor of UNL's Nebraska Hall were able to see displays on virtually every aspect of CSD's mission and history. These ranged from the early days of test drilling, brought up to date with two contemporary rigs on display in the north parking lot, to the history of geologic mapping, to the activities of the geographically oriented Center for Advanced Land Management Information Technologies (CALMIT), to the display showing soils and their related parent material.

Displays on current water quality and quantity research, as well as some on studies of the formation of the dunes in the Nebraska Sand Hills and one on landslides, graced the hallway walls and some offices. Recent and past publications were also on display.

In addition, three recurring video tapes on research and coring techniques in the Sand Hills were available for viewing in a conference room where refreshments were

served. The Nebraska Well Drillers' Association and the U.S. Geological Survey also had displays on view.

"Those who visited our open house now have a clearer idea of what the Conservation and Survey Division is all about," Wigley said. "We had many compliments on the attractiveness of our displays. Many people couldn't believe that all the display work was done in-house," he added.

"Our cartographers (who did the displays) are among the most talented of any such group in any organization and we're lucky to have them."

Leading up to the centennial week activities, which also included a luncheon for faculty and honored guests on Sept. 22, were three lectures by guest speakers on each of three Tuesdays prior to the centennial week. On Sept. 7, Marilyn Suiter of the American Geological Institute spoke on "The status of earth science education." On Sept. 14, Jonathan Price, of the National Research Council, talked about "Earth science research," and on Sept. 21, Charles Mankin, state geologist of Oklahoma, spoke about "The role of state geological surveys."

In addition to publishing its annual news magazine, "Resource Notes," on a centennial theme, CSD released two new publications to coincide with the centennial. One was the first in the professional papers series, a scholarly series that includes outside peer review. It was an examination of the crinoids of the South Bend Limestone entitled "Taxonomy, Paleocology and Biostratigraphy of the Crinoids of the South Bend Limestone (Late Pennsylvanian-Missourian ? Virgilian) in Southeastern Nebraska and Southeastern Kansas." The other was a primer on Nebraska's geology called "Geology, Geologic Time and Nebraska," intended in part as a resource for elementary and secondary education.

Abandoned wells *continued from page 1*

abandoned wells on their property, was to protect water quality. There was also concern about the threat to human and animal life. Abandoned wells can be very dangerous, and the Baby Jessica incident in Texas, in which a small child fell into an abandoned well and became the focus of national media attention, brought home that fact, Eversoll said. The number of abandoned wells in Nebraska has been

estimated to be anywhere from 150,000 to 500,000.

Eversoll said that the original plan was to release a set of comprehensive guidelines for plugging wells a couple of years ago, but the project was delayed by changes in the 1986 law (it was fine-tuned, and the definition of an abandoned well was made more precise). Eversoll said he expects the new guidelines to be available in early 1994.

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Resource News is a bimonthly publication of the Conservation and Survey Division, 113 Nebraska Hall, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, 68588-0517. It is distributed free to all interested in earth science in the state. To receive it, write to the address above. In addition, the Resource News audience will receive Resource Notes, the annual report of the division. The Conservation and Survey Division is the agency designated by statute to investigate and interpret the geologically related natural resources of the state, to make available to the public results of these investigations and assist in the development and conservation of these resources. The Conservation and Survey Division provides information and educational programs to all people without regard to race, color, national origin, sex or handicap. Background of nameplate on page one depicts the layered rock column from the Geologic Bedrock Map of Nebraska. Layers shown are (from the bottom) Precambrian, Cambrian, Ordovician, Silurian and Devonian rocks.

Flooding *continued from page 1*

flooding the water treatment plant and leaving 250,000 people without drinking water for 19 days. In a project entitled, "Spatial Variations in 1993 Flood Discharges and Stream Erosion in the Raccoon River Basin," Matherne and Prestegaard and their students are trying to determine how much water moved through the Brushy Creek, Raccoon River and South Raccoon River during that early July period and also during flooding in late August. They also looked at ditching upstream, bank erosion and sediment movement.

One of the reasons they spent most of September in the area was that the evidence of high water marks begins to fade rather quickly.

"You need to get in there and get the information because it's going to disappear," Matherne said. She cited an example of judging high water by corn stalks left in trees in a pasture with no other high water marks.

By measuring the flow and slope of the current channel and surveying the high water marks, the researchers acquired estimates of how much water ravaged the area at peak flood.

"Once we put it all together, we can say where the flooding intensity was highest, whether it was because of the rainfall amounts, because the storm came up from a particular direction or built up in one place. And we're studying the erosion, because in some areas, the flooding

wasn't as severe as the erosion," Prestegaard said in an earlier interview with the Carroll (Iowa) Times Herald.

Prestegaard also noted that during the July floods, some gauging stations on the South Raccoon River recorded flows 50 percent higher than any earlier record highs. Peak flows at Van Meter of 68,900 cubic feet per second and at Redfield of 44,000 cubic feet per second broke records of 41,000 and 35,000 cubic feet per second, respectively. Among other damage done by the Brushy Creek were three bridges washed out. The creek has wiped out five since 1986.

Documenting how floodwaters move and how the basin responds to floods will better prepare the region to respond to flooding in the future, Matherne explained.

The researchers also asked residents to fill out a questionnaire on the summer's flooding to gather as much additional information as possible. They sought data on rainfall, high flows and oral histories of the floods of 1958, 1986 and 1990.

They were also looking at ditching and channelization upstream, Matherne said, because these activities move water faster and contribute to more erosive forces further downstream. Practices that retard water movement such as minimum tillage, grassed waterways and terraces were also documented.

Imaging radar *continued from page 1*

Space Agency's ERS-1 satellite to enhance the accuracy of the classifications.

"Landsat imagery has been of interest to researchers since the 1970s. The use of radar imagery has been of interest in the last decade, but until recently it has only been available on aircraft. Only in the last year or two have we had radar on satellites, which can provide us with continuous coverage of the earth's surface," Keithley said.

While Landsat imagery is a passive sensor picking up reflected energy, radar is an active imaging technique, sending out a microwave pulse and recording the energy reflected, called "backscatter."

One of the advantages of using radar is that it is not affected by cloud cover the way Landsat imagery is, Keithley said.

The radar also measures different land-cover characteristics, he added, such as the physical structure of the crop and canopy, as opposed to the Thematic Mapper, which records information determined in part by the molecular structure of the target. The radar image is also affected by the slope, surface roughness and moisture content of the target surfaces.

After filtering out "noise" in the radar image, these two kinds of images were then integrated through a computer program, the result being a color composite of agricultural and urban lands in western Nebraska that shows promise for more accurate land-use and land-cover classification.

Keithley also said that he and CSD head soil scientist Mark Kuzila are working on applying imaging radar to monitoring soil moisture conditions in Clay County.

Professional papers series debuts with crinoids report

The premiere paper in the Conservation and Survey Division's (CSD) new Professional Papers series is now available. The paper, titled "Taxonomy, Paleoecology and Biostratigraphy of the Crinoids of the South Bend Limestone (Late Pennsylvanian-Missourian, ? Virgilian) in Southeastern Nebraska and Southeastern Kansas," is by Roger K. Pabian, a CSD research geologist, and the late Harrell L. Strimple of the University of Iowa's Department of Geology.

The 55-page paper is the culmination of 15 years of

work on the South Bend Limestone in southeastern Nebraska and southeastern Kansas. The paper offers a detailed look at the stratigraphy and types of crinoids present in the rock unit and, based on correlations between the Nebraska and Kansas sites, suggests renaming several facies of the unit. Most significantly, it suggests revising the boundary between the Missourian and Virgilian ages in the Nebraska section of the South Bend Limestone. The paper offers a new look at some possible solutions for placing geologic time-unit boundaries, Pabian says.

New publications on Nebraska geology, geography and water

Available from Conservation and Survey

--**Native Vegetation of Nebraska:** Robert B. Kaul and Steven B. Rolfsmeier; color print with text (1:1,000,000 scale) (GIM-54) - \$3.50

--**Taxonomy, Paleoecology and Biostratigraphy of the Crinoids of the South Bend Limestone (Late Pennsylvanian-Missourian, ? Virgilian) in Southeastern Nebraska and Southeastern Kansas:** R. K. Pabian and H. L. Strimble (PP-1) - \$6.50

--**Geology, Geologic Time and Nebraska:** M. P. Carlson (EC-10) - \$5.50

Please use order numbers (in parentheses) and add \$1.50 for shipping. Nebraska residents should add city and state sales tax.

Available from the U.S. Geological Survey

--**Maps showing areal extent of selected Paleozoic shales in the northern Midcontinent, U.S.A.:** compiled by W.P. Pratt. Prepared in cooperation with the geological surveys

Coming up: National, regional and state meetings, shows and workshops

--**Gem and Mineral Show, Ft. Kearney Gem and Mineral Club,** Nov. 6-7, Hilltop Mall, Kearney, Neb.

--**Wellhead Protection Workshop, Conservation and Survey Division,** Nov. 9-11, Nebraska Center for Continuing Education, Lincoln, Neb.

--**Nebraska Well Drillers Association annual fall workshop,** Nov. 9-10, Beatrice

--**Nebraska Aquaculture Update and autumn meeting, Nebraska Fish Farmers Association/Nebraska Department of Agriculture/University of Nebraska Cooperative Extension/North Central Regional Aquaculture Center,** Nov. 13, North Platte Holiday Inn, North Platte

--**"Water: Risks and Costs," Nebraska Water Resources Association and Nebraska State Irrigation Association,**

of Arkansas, Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma and Wisconsin. 1992. Seven sheets. Latitude 36 degrees to 46 degrees; longitude 88 degrees to 100 degrees. Each sheet 1:1,000,000 scale (MF-1835-H) - \$26.25

--**A reconnaissance study of radon levels in soils developed in the Upper Cretaceous Pierre Shale just above the Sharon Springs Member in the Missouri River valley in southeastern South Dakota and northeastern Nebraska:** by K.A. Dickinson, 1992. 11 p. (OF 92-0592) Microfiche \$4, paper \$2.

--**Water resources activities of the U.S. Geological Survey in Nebraska, fiscal years 1990-91:** compiled by D.J. Fitzpatrick and J.E. McKinney, 1992. 48 p. (OF 92-0663) Microfiche \$4, paper \$2.

To order, contact the Nebraska district office of the USGS at 100 Centennial Mall, Lincoln, Neb. 68508 (402) 437-5082

Nov. 14-16, Holiday Inn, North Platte, Neb.

--**National Water Resources Association annual conference,** Nov. 30-Dec. 3, Hotel del Coronado, Coronado Island, San Diego

--**American Geophysical Union, fall meeting,** Dec. 6-10, Convention Center, San Francisco

--**Platte River Basin Ecosystem Symposium, U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service,** Dec. 7-9, Interstate Holiday Inn, Grand Island, Neb.

--**Fifty-fifth Midwest Fish and Wildlife Conference--New Agendas in Fish and Wildlife Management: Approaching the Next Millennium,** Dec. 11-15, St. Louis, Mo.

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