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Integrated management law creates research needs

Groundwater researchers at the University of Nebraska-Lincoln have an important and perhaps expanding role to play in the implementation of the new water-management realities entailed in Legislative Bill 108, said Jim Goeke, research hydrogeologist with the University of Nebraska-Lincoln Conservation and Survey Division (CSD).

LB 108 is Nebraska's "conjunctive use" water law, reflecting a concept also known as the "integrated management" of groundwater and surface water. It was passed in 1996 after vigorous debate spanning more than two years. The bill was introduced in 1995 and passed this spring with several

amendments. It went into effect July 19.

One of the forces behind the law was a need to legally recognize groundwater-surface water interaction. The bill has been prompted in part by the threat of a lawsuit in which Kansas could charge that Nebraska isn't delivering enough Republican River water to Kansas at Guide Rock as required by law. Kansas has called for changes in the management of the Republican Basin in Nebraska to forestall such a suit. In addition, concerns about interstate agreements with Wyoming and Colorado

(See *Integrated Management* on pg. 3.)

International remote sensing symposium in Lincoln a success

Hosting a successful international symposium in the Midwestern United States is no small feat, but the city of Lincoln and all of the supporting agencies behind the 16th International Geoscience and Remote Sensing Symposium--IGARSS '96--managed to pull it off with flying colors, according to Ram Narayanan, associate professor of electrical engineering at the University of Nebraska-Lincoln and general chair of the symposium.

IGARSS '96 was held May 27-31, 1996, at the Cornhusker Hotel in Lincoln and attracted more than 750 participants from many nations who converged on Lincoln with a common interest in remote sensing and geographic information systems

(GIS). Remote sensing generally involves using satellite imagery and aerial photography to monitor the earth, and GIS are computer-based systems for displaying and analyzing spatial information.

About 45 percent of the conference participants--mostly university faculty and students, environmental researchers, geographers and geologists--hailed from outside the United States, Narayanan said. Representatives from India, Japan, New Zealand, Europe, Canada and Russia were in attendance. The symposium's theme was "Remote Sensing for a Sustainable Future," which reflected

(See *IGARSS '96* on page 2.)

CSD displays real-time weather satellite data and virtual landscapes in Nebraska Hall window display

Who says there's nothing good on television?

No one who has visited the offices of the University of Nebraska-Lincoln Conservation and Survey Division (CSD) recently, or so scientists at the state natural resources survey are hoping.

Since mid-spring, two televisions have been showing data from space and from sophisticated image processing near the division's front office, showcasing information now available to students, educators and technical clientele through the CSD Center for Advanced Land Management Information Technologies (CALMIT). The screens have been installed in a display window on the first floor of Nebraska Hall in the easternmost hallway.

One shows tapes of simulated "fly-overs" of the western Sand Hills and the Omaha area, a potential aid to students and earth science educators, according to Jim Lacy, CALMIT facilities manager. Videos of other earth science subjects also

are shown. The second screen shows real-time images from weather satellites, which transmit to a receiving station installed on the roof of Nebraska Hall this spring.

The display is part of CALMIT's outreach work with the Consortium for the Application of Space Data to Education (CASDE), a program designed to supply data from space to educators, students, resource managers and conservationists in a manner they can use. CASDE, established by CALMIT and the California Institute of Technology's Jet Propulsion Laboratory, was created as a result of a \$1.5 million grant from the National Aeronautics and Space Administration's (NASA) Mission to Planet Earth.

The weather display alternates between images from the Geostationary Operational Environmen

(See *Window display* on page 2.)

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

NEWS
RESOURCE

IGARSS '96 continued from page 1

the goal of improving resource management through advanced technology.

"Holding a symposium of this magnitude in Lincoln was quite a privilege, and we made the most of it," Narayanan said. Lincoln edged out Boulder, Colo., for the honor of hosting the symposium, which was held in Florence, Italy, in 1995. The 1997 meeting will be in Singapore. Lincoln was selected to host IGARSS '96 in 1991, he said, and that selection served as a tribute to the strength and support of remote-sensing programs such as the Conservation and Survey Division's (CSD) Center for Advanced Land Management Information Technologies (CALMIT), and others at UNL and in the Midwest. "We had fantastic technical, administrative and organizational support from so many people and organizations at UNL, in Lincoln and throughout the U.S.," Narayanan said.

Including staffed, "interactive," poster sessions, the symposium featured about 900 presentations on topics ranging from remote sensing's educational applications to the technical aspects of improving GIS images. Narayanan said holding the symposium at the Cornhusker Hotel proved to be a big advantage, because everything was housed in a single facility so participants could "hop sessions" as they pleased. High-

Window display continued from page 1

tal Satellite 8 and images from the Advanced Very High Resolution Radiometer, displaying visible, near-infrared and thermal-infrared parts of the electromagnetic spectrum.

CALMIT's satellite-data receiving station--acquired as the result of a multi-year effort by a number of IANR units--provides data used to monitor drought, watersheds and land cover, among other applications, Lacy said. Lacy and CALMIT research assistant Brian Tolk have been trained in how to install and manage the receiving station and its software.

The idea of installing the screens originated in late 1995, Lacy said, with CALMIT Director Don Rundquist. CSD Associate Director Duane Eversoll then agreed to provide the necessary administrative support.

"Our goal was to put real-time satellite images out where people could see them," Lacy said, "but we needed a little help convincing people to let us cut a big hole in the wall."

"We also want to put satellite images on a closed-circuit, campus television channel, rather than just on a single televi-

Remote sensing venture begun between CALMIT and Ben-Gurion University in Israel

Remote sensing researchers from Israel visited the Midwest this summer as part of a cooperative research project with faculty and students from the University of Nebraska-Lincoln Conservation and Survey Division (CSD). In addition, CSD researchers from the Center for Advanced Land Management Information Technologies (CALMIT) will be visiting Israel in the near future to learn from Israeli remote sensing ventures.

A three-year project on developing methods for estimating concentrations of algae in lakes and ponds through remote sensing is being conducted in Israel and the United States, according to Don Rundquist, director of CSD's CALMIT. The project arose, Rundquist said, after he and John Schalles of Creighton University in Omaha met Anatoly Gitelson, a professor at Ben-Gurion University in Israel, at a meeting in Miami two years ago. Research began after their funding pro-

lights of the symposium, Narayanan said, included the opening session on the 28th featuring four keynote speakers and speeches by Lincoln Mayor Mike Johanns, former UNL Interim Chancellor Joan Leitzel and UNL Dean of Engineering James Hendrix, as well as the banquet held on the 30th at the Treetop Restaurant in the Henry Doorly Zoo's Lied Jungle in Omaha, the world's largest indoor rain forest.

Another new idea was a major factor in helping with the planning process before the symposium began, Narayanan said. Jim Lacy, facilities manager for CSD's CALMIT, maintained an informational "homepage" on the World Wide Web for IGARSS '96. Narayanan's office received fewer telephone calls asking for general information about the symposium than he had expected. He said he thought the Web page was the main reason.

IGARSS '96 was organized by the Institute of Electrical and Electronics Engineers, of Piscataway, N.J. The International Union of Radio Science is served as a technical sponsor for the symposium. CALMIT also provided valuable technical support and planning assistance, Narayanan said. Other sponsors were IEEE, Geoscience and Remote Sensing Society, NASA, NOAA, the Office of Naval Research, UNL and many other UNL units.

sion," Lacy said. CALMIT is working with Nebraska Educational Telecommunications on the project.

In addition to immediate use of the satellite images, Lacy said the image data is also being stored by CALMIT for possible later use by a variety of researchers. The center wants to allow some archived data to be used by outside agencies, Lacy said. In particular, CALMIT wants to be able to provide satellite data for the purpose of education.

"This data is perfect for school kids and teachers because it's practical and easy to visualize," Lacy said. "It's easier to understand environmental and weather concepts when you can see things moving and changing on the screen."

One Nebraska teacher--Rick Perk from Waverly--already has begun working on a lesson plan using elements of satellite imaging and remote sensing. In addition, because the images are archived, they provide a historical record that gives researchers a better idea about how conditions change over time, Lacy said.

posals was accepted by the U.S./Israeli Bi-National Science Foundation.

The first phase of the joint project was conducted from May 26 to June 6 when researchers from both countries visited Lake Okoboji and nearby lakes in Iowa to conduct baseline research. Phase II moves to the Sea of Galilee in Israel. Possible future research sites include Tuttle Creek in Kansas, selected lakes in Michigan, Carter Lake, Iowa, and other lakes in western Nebraska.

Visiting the United States from Israel this summer were Gitelson; Yosef Yacobi, of the Kinneret Limnological Institute; and Robert Stark and Sharon Plotnizky of Ben-Gurion. U.S. participants included Rundquist, John Schalles from Creighton University and Rollie Fraser from CSD. Rundquist and Fraser were scheduled to visit Ben-Gurion in the spring, but security concerns arose and the trip was postponed.

Integrated Management continued from page 1

regarding Platte River water, stemming in particular from the federal relicensing process for Kingsley Dam near Ogallala, have contributed to the need for a legal means of dividing up groundwater and surface-water use.

LB 108 will be first applied in the Republican River basin, which includes the Upper, Middle and Lower Republican natural resource districts (NRDs) and the Tri-Basin NRD. It consolidates existing statutes regarding groundwater control areas, groundwater (quality) management areas and special (groundwater quality) protection areas, creating a single category—a management area. It authorizes NRDs and the state Department of Water Resources (DWR) to resolve state, interstate and general contract disputes affecting groundwater users and surface water appropriators.

Goeke, who is stationed at the West Central Research and Extension Center in North Platte and works closely with the affected NRDs, recently attended a few meetings on the implications of the bill. He has been particularly interested in the need for subsequent studies by Conservation and Survey, DWR and others on the Republican Basin. He noted recent negotiations with Kansas and said they probably bode well for a negotiated solution that would avoid siphoning state and local dollars into expensive lawsuits, but any negotiated solution probably will require more research in the basin. The Nebraska Association of Resources Districts has said it intends to establish an interagency, interdisciplinary technical task force that will examine research needs. So far, a fund for integrated management research has been established, but no money has been appropriated.

"We have a good working relationship with the Kansas (Geological) Survey," he explained, adding that any attempt to model the Republican Basin will have to include areas south of the river that Nebraska researchers have previously not studied intensively, largely because the previous control area in the Upper Republican NRD stopped at the north bank of the

river. "We've got some good opportunities to cooperate with the Kansas survey," he said.

From a June 27 meeting in Cambridge of state and local officials and scientists on the general effects of LB 108 and another on the Republican Basin with officials from affected NRDs in Lincoln July 9, Goeke said he emerged with these key questions for groundwater officials and researchers: 1) how do we determine the nature of the connection between water in the alluvial aquifer near the river and that in the upland aquifer farther away? (The bill has allowed for different treatment of groundwater irrigators if it is determined that upland irrigators have a "different," presumably lesser, effect on streamflow.); 2) how do we quantify the effects of alluvial pumping on streamflow and compare these effects with those of stream diversions? 3) how do we measure the impact of water use by the river valley forest on streamflow? 4) how do we characterize and quantify water use across the whole basin? 5) given limited research funds, by what means do state and local officials come to an agreement on what studies are most needed?

In addition, in Kearney on June 4 more than 150 scientists, administrators, legal experts and citizens gathered for "Exploring Conjunctive Use—LB 108: What Now?" Regarding the bill, keynote speaker state Sen. Curt Bromm of Wahoo, cochair of the Natural Resources Committee, said confusion and disagreements always arise whenever groundwater management is involved, but he predicted that the legislature would let the bill develop without further changes for at least four years. He is confident the bill will work if the NRD boards are willing to deal with new challenges; if discussion is encouraged and public awareness is kept high and concerned with facts; and if a spirit of cooperation and compromise is embraced by lawmakers, groundwater regulators and users.

"The initial battles will occur in the Republican Basin," Bromm said. "The basin is serving as an experiment, and other districts are waiting to see how LB 108 is approached there."

Total value of state's mineral production down about 7.5 percent

An increase in the production value of three of Nebraska's important non-fuel minerals was not enough to offset a total decrease of about \$17 million in mineral production in 1995. This represents about a 7.5 percent drop, largely because of a decrease of \$15.3 million in the value of "fuel minerals" such as petroleum and natural gas, according to a University of Nebraska-Lincoln researcher.

From 1994 to 1995, the value of industrial mineral production in the state increased for sand and gravel (\$49 to \$55 million), clays (\$867,000 to \$1 million) and uranium (\$6 to \$8.3 million). Decreases occurred in the production value of cement (\$53.6 to \$45 million), crushed limestone (\$41.6 to \$39 million) and lime (\$904,000 to \$668,000). The estimated value of gemstones remained constant at about \$1,000.

These figures come from two recently updated reports, "Mineral Facts for Nebraska," and "Oil and Gas Facts for Nebraska." Written by Ray Burchett, research geologist at the University of Nebraska-Lincoln Conservation and Survey Division (CSD), they note that the preliminary, or estimated, value of Nebraska's total mineral production in 1995 was \$211.2 million--down from a final value of \$228.6 million in 1994.

Petroleum production decreased from \$72.6 to \$58.5

million, a drop of about 19.5 percent, while natural gas production dropped from \$3.8 to \$2.6 million, by about one third. The remaining \$2.1 million of the \$17.4 million decrease occurred in the production of industrial or "non-fuel" minerals--metallic and nonmetallic minerals, not including oil and gas, used primarily for industrial purposes. Industrial minerals produced on a large scale in Nebraska are cement, chalky limestone, clay or shale, gemstones, sand and gravel, sandstone or siltstone, limestone and uranium. These minerals made up about 71 percent of the state's total mineral value in 1995.

In the past, CSD has presented an annual inventory of Nebraska's mineral production by output and value for each type of mineral, as well as acres mined and reclaimed for each county, which was funded in part by the U.S. Natural Resources Conservation Service. The division also has cooperated with the U.S. Bureau of Mines on a state-by-state minerals inventory. Federal budget cuts have eliminated funding for the first inventory and have dissolved the Bureau of Mines. CSD is pursuing other means of supplying mineral data and will continue to monitor total production for various kinds of minerals. In 1995, Nebraska had eight clay or shale pits, three lime plants, 21 limestone quarries, about 650 sand, gravel, silt or siltstone pits, 25 sandstone pits and one active uranium mine.

Coming up: national, state and local meetings, symposia and workshops

August

August 20-22 - PECORA Thirteen: Human Interactions with the Environment--Perspectives from Space. Sioux Falls, South Dakota.

September

September 5-6 - The Groundwater Foundation's Annual Fall Symposium: "Under the Microscope: Examining Microbes in Groundwater." Colonnade Hotel, Boston, MA. Contact The Groundwater Foundation, Lincoln, 1-800-858-4844.

September 14 - UNL Festival of Color. John Seaton Anderson Turfgrass and Ornamental Research Facility, University of Nebraska Agricultural Research and Development Center, Ithaca.

September 20 - Preregistration Due, 1996 Geological Society of America Meeting. Contact GSA Meetings Dept., Boulder, Colo.

September 22-26 - 32nd Annual AWRA Conference and Symposium on GIS and Water Resources. Fort Lauderdale, American Water Resources Association. Phone: (703) 904-1225. FAX: (703)904-1228.

September 25 - High Plains Water Expo., North Platte. High Plains 6 EPU. Contact Larry Peterson, (308) 352-4340.

September 25 - Wonderful World of Water, Willow Lake, Pierce. Contact Vickie Greve, (402) 584-2806.

September 29-October 1 - 41st Annual Midwest Groundwater Conference, Lexington, KY. Contact Jim

Dinger, Kentucky Geological Survey, (606) 257-5500 or e-mail dinger@kgs.mm.uky.edu

September 30 - Deadline for National Ground Water Association award nominations. Awards to be announced at NGWA's annual meeting in Las Vegas, Dec. 8-11.

October

October 1 - Deadline to submit abstract titles for Marine Clastics in the Southern Midcontinent workshop, March 25-26, 1997

October 1-2 - Conservation Day, Summit Lake, Tekamah. Contact John Wilson, (402) 374-2693.

October 5-6 - Gem & Mineral Show, Radial Social Hall, Omaha.

October 20-21 - The Groundwater Foundation's Annual Water Festival Workshop, Nebraska City. Contact The Groundwater Foundation at 1-800-858-4844.

October 28-31 - 1996 Geological Society of America Meeting, Boulder, Colo. Contact GSA Meetings Dept., Boulder, Colo.

October 29-30 - The Seventh Annual South Platte Forum: "Bringing the River Back...To the Future Urban and Rural Watershed Management." Denver, Colo. Contact David Graf, Colorado Water Resources Research Institute, (970) 491-2293.

October 26-29 - World '96--World Environmental Congress: Promoting the Science, Technology and Business of the Environment. Cincinnati, Ohio. (519) 858-5055, e-mail: sti.ekabi@info.london.on.ca.



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