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## Resource News-Winter 1996-97

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## 'Let's generate light, not heat, on LB 108' say experts

Nebraska may have a long way to go before enough data is available to apply regulations on integrated management of groundwater and surface water in the state's river basins. But some key information is available now and work will begin this spring on gathering more data, according to water scientists and policy specialists with the University of Nebraska-Lincoln.

When LB 108—Nebraska's integrated water management law—went into effect last July, Nebraska became one of the last Western states to legally recognize the connection between groundwater and nearby surface flows. The law allows

for joint regulation of the resources.

However, implementing LB 108 will be most successful if the state's natural resources districts can acquire enough detailed information about water relationships in that area to allow the NRDs to make sophisticated management decisions, said Dave Aiken, UNL professor of agricultural economics.

"There is widespread agreement in Nebraska that we won't be able to make good regulatory decisions without the right background knowledge," he said.

*Generate light* continued on p. 3

## Geologists look at natural dams to explain ancient Sand Hills

Ordinarily, the prospect of a dam made of sand would be a depressing one—because it's bound to leak—or perhaps a comical one, but not usually something to get excited about. However, if you're a geologist looking into the earth history of the Nebraska Sand Hills, evidence of such a landscape feature can get you pretty charged up.

That's the message from two researchers with the University of Nebraska-Lincoln Conservation and Survey Division (CSD) who presented their research at the annual meeting of the Geological Society of America in Denver in early November.

Research geologist Jim Swinehart and groundwater geologist Darryll Pederson have each worked extensively to determine the intimate

connections between sand and water in the Sand Hills, and how those relationships have shaped the region's earth history.

One unique concept both researchers have worked with is natural damming—the blocking of rivers by blowing sand or other sediment during a major drought.

"By studying the theory of (sand) dune dams, we hope to find clues to past climate changes, as well as future changes," Swinehart said.

Swinehart and colleague Dave Loope, chair of the UNL geology department, have worked on the dune dam idea for several years in sediments in the southern and western Sand Hills, mostly dating from 10,000 years ago or younger.

*Ancient Sand Hills* continued on p. 2

## Ecology of saline wetlands better understood due to water study

A rare and vanishing type of plant and animal habitat in southeastern Nebraska should be better managed thanks to findings by a University of Nebraska-Lincoln researcher.

Saline wetlands—ecosystems characterized by salt-tolerant plants growing in salty soils and surface waters—are unique wetlands that have been reduced to about 10 percent of their original area in Nebraska. Only 1,200 acres of the wetlands still exist in the state.

Jerry Ayers, groundwater geologist with the Conservation and Survey Division of the UNL Institute and Agriculture and Natural Resources, is studying the saline wetlands area of the Rock Creek watershed in Lancaster and Saunders counties.

Little is known about the physical makeup of the wetlands, Ayers said, which has led to problems with their preservation.

"The number of saline wetlands has decreased substantially, partially because we've never

known much about them," Ayers said. "You can't manage anything if you don't know how it works."

These wetlands, also called "salt marshes," are home to many plant and animal species which are specially adapted to thrive in that kind of ecosystem, said Randy Stutheit with the Nebraska Game and Parks Commission.

Plants such as "saltwort" and "sea blite" grow in saline wetlands, Stutheit said. And the rare Salt Creek tiger beetle makes its home only in the saline environments of the Salt Creek watershed.

Stutheit said two types of saline wetlands are recognized in Nebraska. "Eastern salines" are found in the southeastern part of the state, and their salinity is thought to be derived primarily from sodium salts—probably deposited by an ancient sea that once covered the state.

"The theory is that a vast interior sea covered the Midwest and left behind prehistoric ocean salts," Stutheit said.

*Saline wetlands* continued on p. 2

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## **Ancient Sand Hills** *continued from p. 1*

But the recent discovery by Swinehart of two 40,000-year-old lake beds in the Niobrara River valley in north-central Cherry county has allowed for study of dams much older than what they have seen in Nebraska to date. Both ancient lake beds—named Wobig and Cobb, after the landowners where they were discovered—are thought to have been formed by dune dams. Fossilized algae, fish and mammals now fill the deposits left behind by the ancient lakes.

“This could really change our thinking about the development of the Niobrara River valley,” Swinehart said. “If we can prove that the river was blocked by dunes, this could be the first direct evidence we have of dune-damming of this nature.”

Swinehart presented “Thick Pleistocene Lake Sediments Discovered in the Ancestral Niobrara River Valley, North-central Nebraska” at the GSA annual meeting.

Pederson’s work has focused on how physical properties of sand have influenced natural damming, river formation and the occurrence of groundwater and surface water. His presentation was “Interrelationship of High Plains Aquifer Thickness, Sand Fields, Rivers and Groundwater.”

Pederson, also a UNL professor of geology, said the presence of surface sand has been historically important in determining the availability of groundwater and the nature of surface-water flow in the Sand Hills. Many people don’t realize the massive amounts of groundwater present beneath the Nebraska Sand Hills, he said.

“You look at the Sand Hills and see sand, but that’s just the ‘skin’ on top of an abundant water supply,” he said. The Sand Hills and most of Nebraska rest above the High Plains (Ogallala) aquifer, a massive groundwater reservoir stretching from South Dakota to western Texas and eastern

## **Saline wetlands** *continued from p. 1*

The other type of saline wetland is the western alkaline, found in western Nebraska. Their salinity is thought to come from magnesium, sodium and calcium salt deposits, he said.

Ayers’ research was a consequence of The Nature Conservancy—a nonprofit group that acquires critical habitat and turns it over to local managers—buying the land, which was then given to the Nebraska Game and Parks Commission. To establish a management plan for the area, it requested help from the then Soil Conservation Service, which enlisted Ayers

New Mexico. And the greatest thickness of water-holding deposits in the entire aquifer is beneath the Sand Hills. The key to the massive volume of that water, as well as to his work in this area, is that water flows through sand with little resistance.

“Naturally, where water can seep down more easily you have a higher potential for great aquifer thickness,” Pederson said. “You can’t have an aquifer without some degree of permeability.”

This permeability also increases the possibility for deposition of new aquifer material, and reduces the potential for erosion of existing aquifer material, he said, because water seeps through readily instead of running off in erosive gullies and streams.

And because the Sand Hills also have abundant underground sand and gravel deposits, which hold a great deal of groundwater, the result is a perfect blend of surface recharge and adequate underground storage. Some areas of the Sand Hills have a potential aquifer thickness of more than 1,000 feet, Pederson said, compared with an average of 100 feet in areas with less sandy and less permeable soils.

After the meeting, Swinehart helped lead a field trip to dune dams and related phenomena. Thirty geologists from across North America attended the trip, also led by Loope and Daniel Muhs of the U.S. Geological Survey. The group also visited a groundwater-fed wetland known as a “fen” in Jumbo Valley, Cherry County. The fen had been ditched and drained, and is now being restored through a Nature Conservancy-funded project in which Swinehart and Ed Harvey, CSD research hydrogeologist, are monitoring the fen’s hydrology.

Interest in the trip was high, Swinehart said, because the Sand Hills have become widely known for dramatic evidence of relatively recent regional climate change. The region also provides real-life applications of scientific theories of sand-dune structures, water and ancient climate.

and former CSD surface-water researcher Anne Matherne.

While it was once thought the saltiness was caused by salts concentrating through evaporation at the surface, Ayers said the real answer most likely lies well below the surface.

The subsurface of the site consists of a top layer of silt 35 feet deep, a sand and gravel layer 10 to 40 feet deep and an 82 to 120-foot deep layer comprised of silt and clay over a layer of coarse sand and fine gravel. The latter units have been assigned to the Dakota Group, a geological unit representing

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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. **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.

Cretaceous-age deposits from more than 70 million years ago.

Within the Dakota Group, Ayers said, is a layer of sand where water has been observed flowing upward quite rapidly toward the surface. These units are known as the Dakota sand and are probably the main source of the wetland's salinity.

The key to wetland formation in southeastern Nebraska, Ayers said, appears to be the presence of a source layer

### **Generate light** *continued from p. 1*

Various agencies are working toward creating detailed "models" of water movement in the state's river basins, Aiken said. Of particular interest is the Republican Basin, which is, under LB 108, the only area where the Department of Water Resources can apply any water regulations until 1999. NRDs are free to start such actions anywhere in the state at any time.

However, accurate data is going to be needed before regulations of any kind go into effect, so state and NRD officials are not rushing the process, said Bob Kuzelka, water-use planner and assistant to the director of the UNL Water Center/Environmental Programs unit.

"Things are moving relatively slowly, which was expected because of the work involved," Kuzelka said. "But that's definitely better than having things move too quickly—these are important decisions."

Kuzelka said he has noticed similarities between the implementation of LB 108 and another significant water regulation in Nebraska history—the Groundwater Protection Act of 1975, which, appropriately enough, is the state law LB 108 amended to recognize the influence of conjunctive use in the state's water budget.

Whenever water policy is adopted, some people experience the anxiety that accompanies change and may tend to overreact, Kuzelka said.

Although it's impossible to predict how soon water regulations will be brought about by LB 108, Aiken and Kuzelka agreed that by simply adopting the law, the state took a valuable step toward the wise, "conjunctive" use of its water.

"LB 108 is a good, cooperative venture that addresses the issues at hand—now its progress depends on getting the right data," he said.

The four natural resource districts (NRDs) in the Republican River basin—the Upper, Middle and Lower Republican NRDs and part of the Tri-Basin NRD—are forming an "integrated (water) management area" in the basin. While the NRDs can use the original groundwater management areas process to implement a plan for an integrated management area, the area then consolidates any existing groundwater control, management or special protection areas into the one category. The area could then be managed by NRDs, irrigation districts and the state Department of Water Resources (DWR) to resolve state, interstate and general contract disputes affecting groundwater

### **Colder winter allows for research on lake beds in Sand Hills**

After a late January thaw, a brief return to cold weather was just what two University of Nebraska-Lincoln geologists needed to continue research of lake beds in the Sand Hills.

One year ago, ongoing research on the interaction of dune sand, streams and lakes in the region received a helping hand from the National Geographic Society. But last year field work on the project was delayed by, oddly enough, a lack of

coupled with a high water table that has an upward gradient—a tendency to flow toward the surface rather than down. Upward flow can then carry salt concentrations to the surface.

Also supporting the Dakota sand as the source of the salinity is the fact that some areas of the wetland have higher saline concentrations than others. For the most part, the highest concentrations, Ayers said, existed where a confining

users and surface-water appropriators in the basin.

If LB 108 proceeds as expected, a plan will be established that splits the water-use conflicts between groundwater and surface-water users. The first part deals with how NRDs will manage groundwater in their respective districts, and the second part relates to surface water and its management.

Acquiring the data necessary to authorize state regulations within management areas will be a challenge, said Jim Goeke, research hydrogeologist with UNL's Conservation and Survey Division (CSD). NRDs that start an integrated management area process are ultimately responsible for acquiring the needed information, said Goeke, who is stationed at the University of Nebraska West Central Research and Extension Center in North Platte.

Goeke said the Republican River basin NRDs have applied for more than \$3 million from the Environmental Trust Fund for research and data analysis. But because the trust has historically wanted to fund action- or project-oriented proposals, receiving such money seems doubtful.

In the meantime, the state still faces the threat of a lawsuit from the state of Kansas, which contends that Nebraska is using more than its share of water in the Republican River basin before the river flows into Kansas near Superior.

Goeke said CSD, the state water survey, has already agreed to work with the Republican River NRDs, state Natural Resources Commission and U.S. Geological Survey to develop detailed models of the Republican Basin. CSD has also agreed to provide and interpret any data it may have in its files on water interactions in the state.

But because this is a long-term project, CSD and DWR are also planning a series of "pump tests" this spring, according to Perry Wigley, CSD director. "The tests are a quick way to give us some idea of the connection between groundwater and surface water," Wigley said.

The tests need to be done in late spring, so the results accurately reflect the effect of groundwater pumping on regional surface flows, Goeke said.

Goeke said the pumping might be funded by a \$225,000 research request that has been presented to Gov. Ben Nelson by DWR for LB 108 research and other activities. If funding is not available, CSD may do the tests without advance funding.

"At this stage of the game, we'd be willing to do that," Goeke said. "We need this data and we need it soon."

cold weather. The society awarded a \$17,000 grant for work in the western Sand Hills of Nebraska on geologically recent shifts in ancient climate, mostly within the last 10,000 years.

"We need thick ice on these lakes so we can get the trucks (and coring equipment) out and take samples of the sediment on the lake bottoms," said Jim Swinehart, research geologist with the UNL Conservation and Survey Division.

Swinehart and David Loope, chair of the UNL geology department, tried to take samples a year ago, but were thwarted by mild temperatures. Because January and early February are the best times for collecting samples, Swinehart said the researchers plan to complete a round of sampling this month and have data compiled by summer.

Advancing work begun with a National Science Foundation grant, Swinehart and Loope have been collecting

and analyzing core samples from lake beds in the Sand Hills to determine the depositional relationships among the sand, an organic muck called "peat," and the area's ancient water supply. They want to know how the formation of the region's unique landscape was influenced by ancient shifts in climate. The presence of peat, in particular, in between layers of sand offers evidence of a cooler, wetter climate sandwiched between periods that were much hotter and drier.

## Maintaining present good water quality is the key to the future of the resource

**A fundamental truth in geology is that understanding the present is the key to the past.** But concerning good quality water, the present may also be the key to the future, according to a University of Nebraska-Lincoln researcher.

Darryll Pederson, groundwater geologist with UNL's Conservation and Survey Division and UNL professor of geology, presented these ideas for a national audience at the fall meeting of the American Geophysical Union in San Francisco in December.

Pederson's presentation was entitled "Sustainability! Is the Present the Key to the Future in Water Resources Planning?" and focused on the worldwide distribution of water and its use and preservation.

The main theme in the sustainability issue, Pederson said, is the adage "there's no such thing as a free lunch."

"If you do something with or to the resource, there will be impacts and someone or something will pay the costs," he

said. If the present generation doesn't prevent contamination or pay for cleanup, the costs will be borne by future generations, he added.

Pederson also compared some aspects of water resource planning to the conservation and wise use of fossil fuels.

"When freshwater is irreversibly contaminated or otherwise removed from availability, the same factors come into play," he said.

The world's freshwater resource is renewable but limited, Pederson stressed, but the total amount of renewable water will depend on adequate prevention of contamination. And prevention is the most practical and economically viable means of preserving water resources for the next generation, he said.

"It is in maintaining quality that we maintain sustainability," Pederson said.

## Coming up: state and local meetings, symposia and lectures

### March

**March 4:** "Remote Sensing of Surface Waters and Wetland Systems," Don Rundquist, CSD. Forestry, Fisheries and Wildlife lecture, 3 p.m., UNL East Union (room posted).

**March 10-12:** *Annual Nebraska Water Conference and The Great Plains Symposium: "The Ogallala Aquifer: Managing for Drought and Climate Change."* Lincoln. Call (402) 472-3305 for information.

**March 25:** *Children's Groundwater Festival*, Grand Island. Sponsored by The Groundwater Foundation, Lincoln. Call 1-800-858-4844 for information.

**March 27:** *Earth Wellness Festival*. Southeast Community College, 8800 "O" St., Lincoln. Contact either

Arlene Hanna or Soni Erickson by phone at (402) 441-7180.

### April

**April 1:** "Lakes and Wetlands of the Western Sandhills," David Gosselin, CSD. Forestry, Fisheries and Wildlife lecture, 3 p.m., UNL East Union (room posted).

**April 8:** "Hydrology and Wetland Chemistry of a Sandhills Fen," Ed Harvey, CSD. Forestry, Fisheries and Wildlife lecture, 3 p.m., UNL East Union (room posted).

**April 30:** "Planning for an Uncertain Climate: Policy Implications," Rosina Bierbaum, White House Office of Science and Technology Policy, 116 L.W. Chase Hall, UNL East Campus, 3 p.m.

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