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Research Indicates Sprinkler Irrigation Use Could Reduce Groundwater Nitrate Levels

by Steve Ress

Irrigating with sprinkler instead of furrow irrigation systems can reduce shallow groundwater nitrate contamination, University of Nebraska research shows.

Results from a six-year study of irrigation systems on three corn test fields near Shelton, Neb., leave little doubt that if more center pivot sprinklers were used to irrigate crops, groundwater nitrate contamination could be significantly reduced, said Roy Spalding, an NU hydrochemist and co-leader of this research.

“Compared to conventional furrow and surge irrigation, nitrate-nitrogen contamination in shallow groundwater can be kept consistently at or near 10 parts per million using a center pivot,” the NU Institute of Agriculture and Natural Resources researcher said.

“The U.S. Environmental Protection Agency’s safe drinking water standard for nitrates is 10 ppm. Much of Nebraska’s shallow groundwater exceeds that standard, which forcings many communities and private water well users to treat the contamination or use bottled water,” he said.

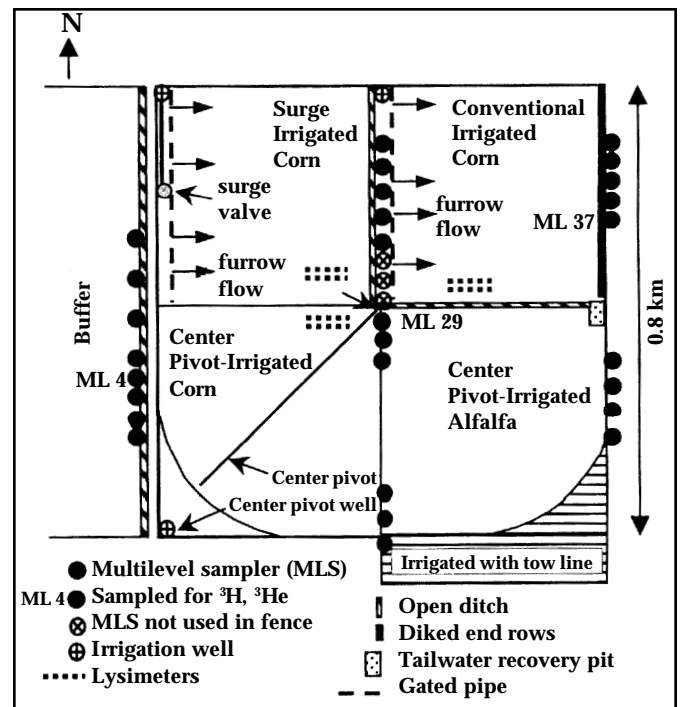
Nitrate contamination has been linked to health risks such as Blue Baby Syndrome, which lowers oxygen-carrying capacity of infants’ blood and bladder cancer in middle-aged women.

“The best way to control nitrate leaching to groundwater is to control irrigation water usage and to spoon-feed just the right amount of nitrogen fertilizer to crops through a sprinkler system,” Spalding said.

He and fellow NU researchers came to that conclusion after six years of controlled testing of gravity-type furrow and surge irrigation and sprinkler-type center pivots. Studies were conducted in three adjoining, 40-acre corn plots at the university’s Nebraska Management System Evaluation Area near Shelton from spring 1991 to fall 1996.

Irrigation methods and fertilizer management techniques on the test fields were closely monitored using more than 30 multi-level sampling wells. These wells allowed researchers to analyze water samples from as many as 16 different depths throughout the underlying aquifer.

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Layout of research and demonstration fields and sampling locations for a multi-year study of irrigation efficiency by UNL researchers at the Management Systems Evaluation Area near Shelton.

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Life With No Central Air-Conditioning.... Or How I Spent My Summer Vacation

from the DIRECTOR



Kyle D. Hoagland

I had the opportunity to teach Aquatic Botany this summer at UNL's Cedar Point Biological Station, near beautiful Lake Ogallala, with a colleague and close friend of mine, Dr. Bill Glider from NU's School of Biological Sciences. This is a new field course designed for senior undergraduate and graduate students in biology and natural resources majors from UNL and other regional universities.

It was a great experience for us all since it is such a rare opportunity for both students and instructors to become immersed in a biological topic through combined lecture, field and laboratory work. We spent many hours with these interesting plants, learning about their

diversity, physiology, ecology, and morphology, as well as their importance in wetlands, lakes, and riparian areas throughout the Sandhills and beyond. I highly recommend that any student in biology or natural resources take a course at Cedar Point, or some other field station, as part of a well-rounded academic program. It's interesting, exciting and a great learning experience for students and instructors alike.

We are now back in our UNL offices as a new academic year is once again in full-swing and I see that we have our usual full plate of upcoming events. In particular, these include ongoing plans for next year's Summer Water and Natural Resources Tour and the annual March Water Conference.

The water tour will focus on the North Platte River, with stops in Nebraska, Colorado and Wyoming. Initial planning includes a return to a mid-to-late July departure date, as this year's June dates didn't work-out as well as we had hoped. Mike Jess and Steve Ress will be making a planning trip to the area next month....before all the points of interest are snowed-in for the winter. We'll keep you posted on how this is progressing.

We will hold our annual water conference in March, 2002 at the new civic center in Gering. this will be a cooperative venture with a number of other institutions and organizations and will focus, in part, on a history of U.S. Bureau of Reclamation water projects over the past one hundred years.

We are also continuing to plan for this spring's Water Seminar Series, which we've tentatively titled, "Current Water Issues in Nebraska." We've

developed a list of very broad, and hopefully interesting, topics that fall under that broad topic and we hope to bring in several national speakers to address topics such as TMDLs, CAFOs and endocrine disruptors, all of which have immediate impacts on Nebraska water users. As for location, the seminar series will return to the auditorium at L.W. Chase Hall on the UNL East Campus. If you are unable to attend a presentation of interest to you, we again plan to offer videotapes of each presentation, which we will loan at no charge.

Our overall goal is to make this an outstanding year for these Water Center related events.

A panel of state water agency representatives will soon be reviewing proposals for this fiscal year's USGS Section 104b program sometime in mid-November. If you have not already seen the call for proposals (which we sent on Oct. 4) and would like to receive one, please contact Tricia Liedle at (402)472-3305 or email pliedle2@unl.edu. Although we have not yet received our USGS budget for this year, we anticipate that it will be close to the same amount as this past year, which in an era of government budget cutting, is good news indeed.

You may find that this issue arrived a week or so later than usual. That is due in part to a change in project representatives at the UNL printing and copying center and also because our editor (Steve Ress) was detained on annual duty with the Naval Reserve a bit longer than usual due to the terrorist bombings on Sept. 11. We should be back on schedule for the December issue.

WATER CURRENT

Water Center
University of Nebraska-Lincoln
103 Natural Resources Hall
Lincoln, NE 68583-0844
Phone: (402) 472-3305
Fax: (402) 472-3574
E-mail: sress1@unl.edu

<http://watercenter.unl.edu>

Kyle D. Hoagland – Director
Edward F. Vitzthum – Associate Director
J. Michael Jess – Assistant Director
Roy F. Spalding – Director,
Water Sciences Laboratory
Steven W. Ress – Editor
Patricia A. Liedle – Editorial Assistant

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Meet the Faculty

Dr. Edward J. Peters

Fisheries Ecologist and Professor of Resource Sciences, School of Natural Resource Sciences, University of Nebraska-Lincoln since 1976.

Education:

Ph.D. in Zoology, Brigham Young University, 1974.

M.S. in Zoology, Brigham Young University, 1970.

B.S. in Conservation and Biology, Wisconsin State University at Stevens Point, 1967.

Current Research:

Ecology and management of sturgeon in the Lower Platte River of Nebraska. Studies have centered on Pallid Sturgeon, Shovelnose Sturgeon and associated species of both gamefish and federally threatened and endangered fish.

Other Recent Research:

Development of habitat suitability criteria for Channel Catfish and other species of fish on the Lower Platte River of Nebraska.

Teaching:

1997 to present in Fisheries Science, Ichthyology, Fisheries Biology and Food, Agriculture and Natural Resource Systems (recitation). Other courses taught since 1975 have included Fisheries Biology, Introduction to Natural Resources and Integrated Resources Management, among others.

Publications:

- Messaad, I.A., E.J. Peters and L. Young, 2000. Thermal tolerance of red shiner (*Cyprinella Lutrenis*) after exposure to atrazine, terbufos and their mixtures. *Bulletin of Environmental Toxicology*, v64: 748-754.
- Yu, S-L. and E.J. Peters, 1997. Use of Froude Number to determine habitat selection by fish. *Rivers*, 6(1): 10-18.
- Porath, M.T. and E.J. Peters, 1997. Walleye prey selection in Lake McConaughy, Nebraska: A comparison between stomach content analysis and feeding experiments. *Journal of Freshwater Ecology*, 12(4):



Ed Peters

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- Porath, M.T. and E.J. Peters, 1997. Use of walleye relative weights (W_r) to assess prey availability. *North American Journal of Fisheries Management*, 17: 628-637.
- Hofpar, R.L. and E.J. Peters, 1997. Population structure, distribution, habitat use and food habits of shovelnose sturgeon in the Lower Platte River,

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Dr. Tian C. Zhang

Environmental Engineer, UNL Department of Civil Engineering (offices on the UNO campus). Faculty member since 1994.

Education:

Ph.D. in Environmental Engineering, University of Cincinnati, Cincinnati, OH, 1994.

M.S. in Environmental Engineering, Tsinghua University, Beijing, China, 1985.

B.S. in Civil Engineering, Wuhan



Tian Zhang

Polytechnic University, Wuhan, China, 1982.

Current Research Programs:

- Non-point source pollution control technologies. Pesticides and nitrate removal systems. Sulfur-based autotrophic denitrification process.
- Effects of microscale environmental conditions on transport and transformation processes in contaminated water and soil. Application of microelectrode techniques in remediation of hazardous wastes. Modeling the fate of contaminants based on measured microscale environments.
- Constructed wetlands for wastewater treatment pollution control. Fundamental studies on lab-scale constructed wetlands. Monitoring and developing field-scale constructed wetlands.
- Biofilm processes for water, wastewater and hazardous waste treatment. Modeling biofilm processes. Biofilm structure and population dynamics.

- Current projects include: 1.) simultaneous transformation of atrazine and nitrate in contaminated water, sediment and soil by zero-valent iron-promoted processes, 2.) evaluation of constructed wetland performance for upgrading wastewater treatment and environmental restoration in Nebraska, 3.) utilization of coal ash in concrete products used by OPPD, 4.) treatment of small community's wastewater using a central septic tank system with enhanced nitrification and denitrification processes and 5.) innovative environmental processes for bioremediation of hazardous contaminants in soil and water.

Past Research Programs:

Examples include: 1.) Instruction equipment to support undergraduate environmental laboratory classes and the master of science in environmental engineering pro

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Time for Change on the Missouri River

By Chad Smith

Like all rivers, the driving force behind the mighty Missouri River was its “natural hydrograph” — the seasonal rise and fall of water. The Big Muddy experienced rising flows in the spring and early summer from melting snow and rain. Higher flows were followed by declining flows during the late summer and throughout the fall.

Today, these seasonal fluctuations are gone, replaced by stable flows to support commercial barge traffic. Fish and wildlife, people, and local communities have paid the price. Three native Missouri River species are on the brink of extinction, and many more are in decline. Recreation on the river is given little priority in management decisions.

Last November, the U.S. Fish and Wildlife Service released a Final Biological Opinion on Missouri River dam operations that recommends changes incorporating modestly higher flows in the spring (“spring rise”) and lower flows in the summer (“split navigation season”). These changes are designed to prevent the extinction of three endangered and threatened species, but would also benefit all native Missouri River fish and wildlife.

On Aug. 31, the U.S. Army Corps of Engineers released a summary of its new environmental impact statement (EIS) detailing possible changes in how the Missouri’s six big dams in Montana, North Dakota, South Dakota, and Nebraska should be managed. That summary document includes analysis of two alternatives that basically represent the status quo and four alternatives that incorporate some degree of the flow changes recommended by the Fish and Wildlife Service.

We believe the facts should guide public opinion as the Corps evaluates options for Missouri River dam operation reform. Let’s take a look at some of the facts, as they should help alleviate any unease about changes in Missouri River management.

First, according to the Corps’ analysis, the recommended flow changes would provide 99 percent of the flood control benefits provided by the current water control plan. In the EIS summary, the Corps writes “Overall, impacts to flood control benefits resulting from any of the alternatives are considered insignificant.” The Corps also notes the proposed spring rise would occur only an average of once every three years,

and “would not be provided in years with high downstream tributary flows like 2001.”

Second, for most floodplain farmers the news is good. The Corps writes in the EIS summary that “groundwater and interior drainage impacts would be largely experienced on lands that are (already) affected by current operations.”

Third, according to the Corps’ analysis, implementing the recommended flow changes on the river would result in an overall increase in hydropower benefits from the Missouri River system.

Fortunately, implementing more natural flows on the Missouri would provide many other substantial economic benefits. Recreational opportunities on the lower river would be greatly increased. Exposed sandbars and shallower water, coupled with restored habitat, would make the lower Missouri River much more inviting and accessible for camping, birding, angling, hunting, and recreational boating. Sport fisheries and water-based recreation in the Dakotas and Montana would benefit as well. As recreation and tourism increase, new jobs would be created in riverside communities along the Missouri’s length.

For more than 50 years, Missouri River management has been driven by the needs of a single industry - navigation. In that time, three species have been listed as endangered or threatened and the Missouri has become more ditch than river below Sioux City. More than 500,000 acres of habitat have been lost and riverside communities continue to lose the economic potential of countless recreation and tourism opportunities.

As we approach the bicentennial of the Lewis and Clark expedition, it is time to let the Missouri River be a river again and to manage it to benefit all of us. If we focus on the facts, we can do what’s right for the river, its fish and wildlife, and recreation, and at the same time do what’s right for farmers and others that depend on the Big Muddy.

(Editor’s Note: Smith is a Lexington native and 1994 UNL Fisheries and Wildlife graduate. He directs the American Rivers’ Missouri River Field Office in Lincoln. In April, American Rivers named the Missouri River as the nation’s Most Endangered River. For more information go to www.savethemissouri.org.)

*For more than 50 years,
Missouri River management
has been driven by the needs of
a single industry - navigation.*

Four States Irrigation Council Tour Visits Western Kansas in July

By Steve Ress

Kansas State University research on subsurface drip irrigation (SDI) and irrigation scheduling, and a weather modification program were centerpieces of a mid-August tour to western Kansas by members of the Four States Irrigation Council.

The council represents irrigators and irrigation interests in Colorado, Kansas, Nebraska and Wyoming. It presents tours in one of the member states every other year.

Tour presentations on research and cooperative extension programming in irrigation scheduling, water management and water use efficiency were led by KSU research agricultural engineer Freddie Lamm, extension irrigation engineer Danny Rogers and other faculty operating from KSU's Northwest Research-Extension Center, Colby, KS.



Examining a field of confectionery (edible) sunflowers near Colby, KS, during the Four States Irrigation Council's July tour (photo: Steve Ress).

Tour participants looked at practical and in-field research applications of SDI in corn, soybean and alfalfa fields throughout the area. SDI is a form of microirrigation where water is applied to the crop root zone below the soil surface using small emitters in buried plastic lines commonly referred to as "T-tape." The T-tape is normally buried between crop rows at depths varying between eight and 24 inches. KSU researchers have been testing the system and its economic feasibility for the past 12 years.

In total, Kansas currently has about three million acres of cropland under irrigation, compared to about 7.5 million acres in Nebraska.

The tour also took a close look at a field of confectionery sunflowers. Though not as prevalent a crop as corn, wheat, soybeans, grain sorghum or alfalfa, both oil and confectionery sunflowers are still widely grown in Kansas.

On the second day, the tour looked at additional SDI demonstration sites in the Garden City area, including one utilizing livestock wastewater.



Weather modification programs have met with mixed results in Western Kansas, where a cloud-seeding project has been operating for more than 25 years. Recent program evaluations have indicated a 27 percent drop in crop hail damage, however. Here, Four States Irrigation Council summer tour participants examine one of the cloud-seeding aircraft at a field near Lakin, KS (photo: Steve Ress).

Another stop was at the Western Kansas Weather Modification Program in Lakin, KS. A cloud-seeding project has been operating there for more than 25 years. A recent evaluation by the Kansas Water Office found about \$4 million per year in economic benefit from the program as a result of a 27 percent reduction in crop-hail damage in cloud-seeded areas. That same evaluation conceded that the program's impact on net rainfall has not been significant, however.

Concluding the tour were visits to the Reeves Cattle Co., which combines cattle feeding, grain ethanol production and fish production as means of optimizing on-site water use, and an overview of the Garden City Ditch Co., which owns and operates about 30,000 acres of irrigated cropland in the Garden City area.

If Four States follows its traditional tour pattern, the organization's next tour will take place in Nebraska in the summer of 2003.



Kansas State University irrigation engineer Danny Rogers delivers a presentation on irrigation scheduling, water management and subsurface drip irrigation methods at a KSU cooperative extension facility in Colby, KS (photo: Steve Ress).

Pumpkin Creek Surface-Ground Water Dispute

by J. David Aiken
UNL Water and Agricultural Law
Specialist

Pumpkin Creek, a tributary of the North Platte River, historically flowed from eastern Wyoming into the Nebraska panhandle through Banner County, joining the North Platte River in Morrill County near Bridgeport.

Over 20 years ago, Pumpkin Creek was closed to the issuance of new surface water rights by the Nebraska Department of Water Resources (now the Department of Natural Resources or DNR) due to streamflow reductions. In March 2001 the North Platte Natural Resources District (NRD) established the Pumpkin Creek ground water management subarea and closed the subarea to new well drilling. Existing wells must be metered in 2003 and quantities withdrawn reported in 2004.

The Pumpkin Creek subarea was established pursuant to a 1996 Nebraska statute authorizing NRDs to restrict ground water uses to address conflicts between surface and ground water users. The Pumpkin Creek subarea was established to deal with declines in both ground water levels and streamflows.

The 1996 Nebraska integrated water management statutes authorize NRDs to control ground water uses in response to conflicts between surface and ground water users, and authorizes the DNR to similarly control surface water uses. The statute does not establish, however, the legal basis for resolving disputes between competing surface and ground water users, leaving to NRD and DNR discretion the issue of whether surface or ground water uses should be restricted and to what extent.

This crucial gap in Nebraska water law may be filled as a result of a lawsuit that may be filed by Pumpkin Creek surface water appropriators against ground water users for

depleting Pumpkin Creek streamflows. This paper discusses the legal framework for resolving such disputes in the West, generally, and in Nebraska.

Subflow/Tributary Ground Water Rule

Most western states apply the doctrine of prior appropriation to both surface and ground water. This means that the *priority* rule of “first in time is first in right” would apply to both surface and ground water uses when those uses come into conflict. If “junior” wells interfered with senior surface appropriations, the junior wells would be required to either quit pumping or else provide makeup water to the stream. In Arizona, California, Texas and Nebraska, state law does not apply the prior appropriation doctrine to ground water. However in Arizona, California and Texas, if well pumping depletes streamflow, the well is treated as part of the stream and is subject to the priority rule of first in time, first in right. Nebraska is the only western state that has legally rejected the subflow or tributary ground water rule.

Nebraska Rule

In 1966 the Nebraska Supreme Court ruled that water pumped by Omaha from wells on Platte River islands was ground water and not surface water. This allowed the court to avoid invalidating the movement of ground water from the Platte River basin to the Papio River basin as an illegal transbasin diversion of surface water. The decision also set Nebraska water law at odds with the law of every other western state in saying that wells pumping water from a stream are not subject to surface water law.

The 1936 prohibition against transbasin diversions of surface water, which probably was the primary

reason for the court’s rejecting the subflow/tributary ground water rule, was in turn overruled by the Nebraska Supreme Court in 1980. This provides the Nebraska Supreme Court with an opportunity to undo the legal mistake it made in rejecting the subflow/tributary ground water rule in 1966.

The Supreme Court made some interesting comments in a 1994 case. This case involved an application for a Platte River instream flow appropriation by the Central Platte NRD. The NRD’s instream flow application was opposed by the state of Wyoming on several grounds. One issue raised by Wyoming was that there was insufficient streamflow in the Platte for the instream appropriation because 100-200 cubic feet per second (cfs) of flow was needed to recharge alluvial aquifers depleted by irrigators. In essence Wyoming contended that the 100-200 cfs of streamflow had already been appropriated by ground water pumpers and therefore was not legally available for CPNRD’s instream appropriation. To this novel argument the Nebraska Supreme Court responded:

“To the extent that ground water will be withdrawn in the future, this ground water remains, at the present, *unappropriated water*. In part II(1)(a)(i) of this opinion, we held that for purposes of an instream flow application, surface water that had not been diverted from the Platte River for a beneficial use constituted unappropriated water.

It logically follows that ground water that has not been removed also constitutes unappropriated water. We therefore hold that the director was not obliged to reduce the historic flow records to account for future ground water depletions.” 245 Neb at 451 (emphasis added). This statement is interesting in that it suggests that ground water may be appropriated similar to surface water appropriation.

The court then went on to state: "We note that the relative rights of those using ground water and those using surface water are often unclear. The courts can begin to give outlines and shape to these rights, but only in a case-by-case, piecemeal fashion, and only when those rights are brought into direct conflict. Wyoming's evidence regarding ground water depletion does not establish a direct conflict but, rather, an anticipated conflict.

This anticipated conflict is best resolved by the policy-based decision making process that is the province of our Legislature. In fact, the Legislature has recently created a system whereby public water suppliers — municipalities, water districts, irrigation districts, and the like — can apply for appropriation rights and thus secure their priority. See 1993 Neb. Laws, L.B. 301."

The court continued: "It is the Legislature, and not the courts, which can paint a water rights picture with broad strokes and bold colors. It is to the Legislature that Wyoming must direct its argument regarding future ground water depletion."

The court clearly states that it will establish legal rules to deal with direct conflicts between surface and ground water users, if there are no statutes to resolve the situation. The court's statement, read in its entirety, suggests at a minimum that the court would be willing to consider applying appropriation concepts (first in time is first in right) in resolving such conflicts.

Kansas v. Colorado

If the Pumpkin Creek lawsuit against ground water users is filed, it is likely to follow a pattern established for so-called "conjunctive use" lawsuits in *Kansas v. Colorado*. In this case Kansas sued Colorado on the basis that junior wells in Colorado were depleting Arkansas river streamflows into Kansas, depriving senior Kansas surface appropriators of their water. In the first "liability"

phase of the lawsuit, Kansas and Colorado respectively spent tens of millions of dollars establishing that the Colorado wells were depleting streamflows into Kansas.

When Kansas won that phase of the lawsuit, the states then litigated the second "penalty" phase to establish (1) what Colorado would be required to do to compensate Kansas for its past water shortages and (2) how Colorado would prevent future water shortages for Kansas. Colorado will be required to pay Kansas for economic losses associated with past streamflow depletions, and junior wells in Colorado will be required to either provide makeup water to the stream or else stop pumping.

The makeup water could come from new water storage, paying surface appropriators for storage and/or direct flow rights, or by supplying ground water directly to senior surface appropriators. A successful Pumpkin Creek lawsuit against "junior" ground water users would probably yield a similar result.

The Pumpkin Creek case does present a somewhat different twist: for the surface water users to be successful (as they were in *Kansas v. Colorado*), the plaintiff-surface water users must ultimately persuade the Nebraska Supreme Court that it made a mistake in rejecting the

conjunctive use law of every other western state (the subflow doctrine) in 1966.

The 1980 reversal of the 1936 transbasin diversion prohibition indicates that this is possible, however, and in some regards there is less law to overrule in the 1966 conjunctive use case than in the 1936 transbasin diversion case. In any event, surface water users must make a convincing case that "junior" wells are depleting Pumpkin Creek streamflows before their case can make its way to the Nebraska Supreme Court. While that showing may be possible, it will be an expensive and complicated undertaking.

In an influential 1973 law review article, UNL Law Professor Richard Harnsberger observed that if Nebraska ground water were red, Nebraska streams would be various shades of pink. Nebraska water law is slowly beginning to recognize that inescapable hydrologic fact. Statutes enacted in 1993 and 1996 clearly recognize and acknowledge that surface water and ground water may be physically connected, but stop short of establishing a comprehensive legal framework for resolving surface-ground water disputes. The Pumpkin Creek lawsuit may provide a significant piece of that unsolved puzzle.



Summer in the great outdoors....Aquatic Botany students at the University of Nebraska-Lincoln's Cedar Point Biological Station, near Lake Ogallala in August (photo: Kyle Hoagland).

Water Issues in 2001

By Tim Anderson

As 2001 comes to a close, it is appropriate to reflect on water related activities for the year.

The year's most significant news to many in the water resources field was the settlement of the Nebraska v. Wyoming case that was pending in the U.S. Supreme Court. The lawsuit over the use of water in the North Platte River was filed by Nebraska 16 years ago and was scheduled for trial in March.

After several attempts, Nebraska and Wyoming were able to work out an agreement that both sides found acceptable. Although some parties believed Nebraska would have fared better by pursuing the case in court than it did in the settlement, it is good that the two states now can concentrate on the Platte River Cooperative Agreement.

Progress in the Cooperative Agreement process continues to be slow and challenging for all involved parties. Earlier this year, the team preparing the Environmental Impact Statement issued a report concluding that the Platte River's "Channel has become narrower and deeper in response to water resources development," that further degradation is likely, and that such degradation would reduce habitat needed by the endangered species for which the long-range recovery program is being designed unless remedial measures, in addition to those already planned, are taken.

In order to study the sediment transport and vegetation encroachment issue (referred to as the "sed/veg" issue) more closely, Nebraska, Wyoming and Colorado commissioned a study by an independent

consultant to assess if a problem with channel stability exists and whether additional measures are required in the long-range recovery program.

Additional funding for the proposed program also appears to be an issue. The original program was estimated to cost \$75 million, but new estimates indicate that it may require \$125 million.

In other issues related to the Cooperative Agreement, Nebraska continues its work on a plan to offset or mitigate new depletions to target flows in the Platte River while work on the Cooperative Hydrology Study — an effort to improve understanding of the hydrological and geological conditions in the Platte River Basin — continues to progress.

Another important issue is developing in the Panhandle concerning the use of water in the Pumpkin Creek watershed. Surface water irrigators have maintained for years that groundwater development in the watershed has dried up Pumpkin Creek, rendering their state water rights worthless. Surface water irrigators have filed a claim with the state asking for damages in excess of \$4 million for failure to protect their water rights.

This development could result in major changes to Nebraska water law, either through a Nebraska Supreme Court decision or legislation. The manner in which the issue is addressed bears watching in 2002 because of potential ramifications for other surface water/groundwater conflicts in the state.

Also in 2001, the lawsuit between Kansas and Nebraska over use of Republican River water became more active as decisions were made relative to how the case will proceed.

Nebraska learned that the Special Master appointed to the case by the U.S. Supreme Court would not allow Kansas to pursue damages alleged to have had occurred over several years. However, the Special Master did inform the parties that groundwater use and its effect on Republican River flows will be considered in the case. Trial is scheduled for March, 2003 and indications are that this case will progress more quickly than did the Nebraska v. Wyoming case.

All in all, 2001 was replete with a number of significant water issues in Nebraska. As one looks ahead to 2002, most of these issues will continue to unfold. Some resolution of issues is expected to occur within the Cooperative Agreement and the Pumpkin Creek matter should be headed toward some form of conclusion.

However, in order to guide such decision-making in the future, Nebraska needs to develop a long-term comprehensive water plan. The state's policy-makers must develop a plan that protects Nebraska's water and guides the use and development of this important resource.

Nebraska should take this initiative before the influence of outside forces plays too great a role in how Nebraska allocates and uses its water. The University of Nebraska, with its wealth of knowledge and experience, can and should play a key role in the development of such a plan.

(Anderson is Public Relations Manager for The Central Nebraska Public Power and Irrigation District in Holdrege. He is a frequent columnist and contributor to the state's media outlets).

Meet the Faculty

Dr. Edward J. Peters (continued from page 3)

Nebraska. *Proceedings of the 1997 Platte River basin ecosystem symposium, Kearney, NE.*

— Laux, E.A., M.T. Porath and E.J. Peters, 1996. Alewife and trout

studies in Lake Ogallala. Final Report to the Nebraska Game and Parks Commission. *Federal Aid in Fish Restoration Project. No F-112-R Study I.*

— Yu, S.L. and E.J. Peters and W.W. Stroup, 1995. Application of logistic regression to develop habitat suitability criteria for sand shiner (*Notropis stramineus*). *Rivers* 5(1): 22-34.

gram requirements, 2.) pilot plant study for high rate anaerobic treatment system, 3.) in-situ remediation of septic-system nitrate using sulfur-limestone denitrification processes, 4.) remediation of nitrate-contaminated water by sulfur-limestone autotrophic denitrification, 5.) environmental processes for accelerated bioremediation of xenobiotic contaminants in soil and water, and 6.) zero-valent iron promoted electrokinetic processes for in-situ remediation of contaminated groundwater and soil.

Teaching:

Has taught several courses related to water and wastewater treatment, biological wastewater treatment, bioremediation of hazardous wastes, unit operations and processes in environmental engineering, environmental engineering processes design, environmental laboratory, hazardous and solid wastes management, etc.

on undergraduate and graduate levels. Typically teaches two, three-credit hour courses per semester.

Publications:

- Zhang, T.C. and J. Shan, 1999. In-situ septic tank effluent denitrification using a sulfur/limestone process, *Water Environ. Res.*, 71(7) 1283-1291.
- Zhang, T.C. and S.C. Emary, 1999. Jar tests for evaluation of atrazine removal at drinking water treatment plants, *Environ. Eng. Sci.*, 16(6), 417-432.
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Zhang, 1999. The effect of low temperatures on ammonia removal in a lab-scale constructed wetland, *Water Environment Research*, 71(3), 340-347.

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Email:

tzhang@unomaha.edu

Research Indicates Sprinkler Irrigation Use Could Reduce Groundwater Nitrate Levels (continued from page 1)

When research began, samples showed nitrate-nitrogen levels averaging 30 ppm, three times the EPA's safe drinking water limit. Nitrate levels were generally highest in the fall, when groundwater levels were the lowest, indicating that irrigation water and rainfall had flushed much of the nitrate from the soils to the shallow groundwater.

There were significant climatic differences in each of the growing seasons during the research, including an unusually wet season in 1993 followed by dry seasons in 1994 and 1995. However, shallow groundwater sampling consistently found higher average nitrate-nitrogen levels under furrow and surge-irrigated fields than beneath the center pivot-irrigated field.

"There also were larger fluctuations in the nitrate-nitrogen concentrations associated with the furrow irrigation method. This again suggests that center pivots are vastly superior in applying uniform

amounts of water," Spalding said.

After the wet 1993 growing season, shallow nitrate levels dropped about 10 to 15 ppm under the fields. Levels began building up in the 1994 growing season beneath the furrow-irrigated field but remained at about 10 ppm beneath the sprinkler-irrigated field.

Researchers carefully monitored the amounts of nitrogen fertilizer and irrigation water applied to the fields. Compared to the furrow-irrigated field, the surge-irrigated field received 60 percent less water and 31 percent less nitrogen, while the center pivot field used 66 percent less water and 37 percent less nitrogen.

Although the surge-irrigated field received almost as much water as the center pivot field, it wasn't able to limit nitrate contamination nearly as well, Spalding said.

"With a center pivot, the producer can uniformly apply water and nitrogen at optimum times for crop uptake, thereby using substantially

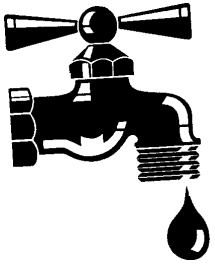
less water and nitrogen," he said.

"The good news is that it's clear that careful management by the producer and innovative agricultural practices can maintain groundwater nitrate concentrations at more acceptable levels without significantly compromising crop yields," Spalding said.

Center pivot is the primary irrigation system used in Nebraska, accounting for more than 4.6 million of the state's more than 7 million acres of irrigated cropland, according to an NU agricultural economist's recent inventory of Nebraska's irrigated acres.

The research findings were published in the July-August edition of the *Journal of Environmental Quality*.

This research, conducted in cooperation with IANR's Agricultural Research Division, was funded in part by the U.S. Department of Agriculture, the Nebraska Research Initiative and the Central Platte Natural Resources District.



Water News Briefs

Free Tabloids

Copies of *Wetlands-Understanding a Resource (1997)* and *Drinking Water-Understanding a Resource (1999)* are available free from the UNL Water Center.

Organizations wanting copies for educational use or general distribution can have up to several hundred copies of either or both publications at no cost, providing they make arrangements to pick them up from our UNL East Campus offices. If you need copies shipped to you, we will only ask that you pay the actual costs of shipping/mailing.

If you want copies of either or both tabloids, call the Water Center at (402)472-3305 or email sress1@unl.edu. For a list of other free publications available through the Water Center, access us online at <http://watercenter.unl.edu>.

Water Conservation Guide

The International Turf Producers Foundation has published *Water Right: Conserving Our Water, Preserving Our Environment*. To request a free copy, phone (800)405-8873 or email Turf-Grass@msn.com.

Plover Habitat

Nearly 200,000 acres of prairie alkali wetlands and reservoir lakes and 1,338 river miles in Minnesota, Montana, North Dakota, South Dakota and Nebraska are being proposed by the U.S. Fish and Wildlife Service as critical habitat for the piping plover, a threatened migratory shorebird.

The *Billings (MT) Gazette* reported early this summer that the FWS was to hold informational meetings through late summer to take public comment before issuing a final rule.

New EPA Site

The U.S. Environmental Protection Agency's Office of Water has launched a new website featuring water quality

information listed by geographic area.

The site is called "WATERS: Watershed Assessment, Tracking and Environmental Results." It is intended to meet state agency needs for better data and tools to establish appropriate water quality standards, determine whether standards have been violated and develop restoration plans.

The site currently contains information on impaired waters in all states except Alaska. Go to www.epa.gov/waters/.

Natural Resources Inventory

The USDA Natural Resources Conservation Service conducts a natural resources inventory every five years. The latest was completed in 1997. Excerpts of analysis from that inventory revealsome interesting developments:

- Developed land in Nebraska increased by more than 94,000 acres from 1982 to 1997. That is an eight percent increase compared to 25 percent nationally.
- Irrigated land in Nebraska increased from 6.89 million acres in 1982 to 7.75 million acres in 1997. That is a 12.5 percent increase, compared to 0.35 percent nationally.
- National land use is composed of (in millions of acres): 407 forest land, 406 range land, 402.1 Federal land; 377 cropland; 98.3 developed land; 32.7 land in the federal Conservation Reserve Program (CRP) and 12 of pasture land.

For more information on land conditions and trends, go to www.nhq.nrcs.usda.gov/NRI/1997.

Nebraska Trivia

In 1927, Edwin E. Perkins of Hastings invented the powdered soft drink Kool-Aid.

J. Sterling Morton founded Arbor Day in Nebraska City in 1872.

The Naval Ammunition Depot, located in Hastings, was the largest U.S. ammunition plant providing 40% of WWII's ammunition.

The Lied Jungle located in Omaha is the world's largest indoor rain forest.

Nebraska has the U.S.'s largest aquifer (underground lake/water supply), the Ogallala aquifer.

Nebraska has more miles of river than any other state.

Nebraska is both the nation's largest producer and user of center pivot irrigation.

Nebraska's Chimney rock was the most often mentioned landmark in journal stories by travelers on the Oregon Trail.

Weeping Water is the nations largest limestone deposit and producer.

The world's largest hand-planted forest is Halsey National Forest near Thedford.

Cozad is located on the 100th Meridian where the humid east meets the arid west.

Dr. Harold Edgerton of Aurora is the inventor of the strobe light.

2001 Groundwater Foundation National Conference

The 2001 Groundwater Foundation's National Conference will be November 14-16, 2001, at the Pittsburgh Hilton & Towers, Pittsburgh, PA. "Today's Technology Protecting Tomorrow's Groundwater" will focus on the importance and usefulness of technologies in groundwater protection.

The conference will explore technological advances to protect groundwater more effectively. The conference program will include: plenary presentations on federal, state, and local uses of technology for groundwater protection; presentations by youth using technology to protect local wells; spark plug breakfast presentation by William Marks, author of *The Holy Order of Water*; breakout sessions led by groundwater and technology experts on topics such as GIS basics, applications and case studies; Internet basics, uses, and introduction to groundwater-related websites; a technology exposition hosted by various technology partners; and use of geophysical tools, remote sensing and remediation techniques.

The Groundwater Foundation will also honor communities, affiliates, and national partners that will be designated as 2001 Groundwater Guardians. The Groundwater Guardian Program supports, recognizes, and connects communities taking voluntary, proactive steps toward groundwater protection.

(continued on page 11)

OCTOBER

22-25: International Conference on Contaminated Soils, Sediments and Water, Amherst, MA. Contact Denise Leonard, Environmental Health Sciences, N344 Morrill, University of Massachusetts, Amherst, MA 01003, phone (413)545-1239 or email dleonard@schoolph.umass.edu.

24-25: The 12th Annual South Platte Forum, Raintree Plaza, Longmont, CO. For information, contact Jennifer Brown at (970)213-1618, email southplatte@qwest.net or <http://southplatteforum.colostate.edu>.

NOVEMBER

5-7: Forty sixth New Mexico Water Conference: New Mexico Watershed Management: Restoration, Utilization and Protection, La Fonda, Santa Fe, NM. For registration information, phone (505)646-4337 or email wrrri@wrrri.nmsu.edu.

6-7: The Practice of Restoring Native Ecosystems National Conference, Arbor Day Farm Lied Conference, Nebraska City, NE. For information, or to register, phone (402)474-5655 or register online at arborday.org/RNEconference.

7-10: North American Lake Management Society's 2001 Conference: A Lake Odyssey, Bridging the Gaps Between Science, Policy and Practice, Madison, WI. Contact Dr. Richard Iathrop, UW Center for Limnology at (608)261-7593 or email rlathrop@facstaff.wisc.edu. On the web at www.nalms.org/symposia/madison.

12-15: American Water Resources Association Annual Water Resources Conference, Albuquerque, NM. For information, contact Michael E. Campana at (505)277-5249 or email aquadoc@unm.edu. On the web at www.awra.org

14-16: 2001 Groundwater Foundation Fall Conference and Groundwater Guardian Designation, Hilton Pittsburgh and Towers Hotel, Pittsburgh, PA. For more information, contact Cindy Kreifels at (800)858-4844, (402)434-2740 (in Lincoln) or email cindy@groundwater.org.

News Briefs

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HHD Drawing Winners

The winners of new UNL Water Center coffee mugs, from daily drawings at last month's Husker Harvest Days exposition in Grand Island were: Loretta Lueking, Oxford; Anne Wellensiek, Cook; and Dan Taylor, Holdrege.

Thanks to everyone who stopped by and put their name in our fish bowl. See you next year at Husker Harvest Days.



26-29: Water for Human Survival - International Regional Symposium, New Delhi, India. For information, e-mail chip@nda.vsnl.net.in.

27-Dec. 1: Second National Conference on Pesticide Stewardship, Marriott, Memphis, TN. Sponsored by the National Pesticide Stewardship Alliance. For information contact Kathy Brooks at (877)920-6772 or email kbrooks@arrowchase.com.

MARCH 2002

4-6: Agriculture Environment Conference, Iowa State University, Ames, IA. Contact Richard Larson at (515)294-6429.

APRIL 2002

23-27: Landscapes in Transition: Cultural Drivers and Natural Constraints, the 17th Annual Symposium of the International Association for Landscape Ecology - U.S. Regional Assoc. Conference to held in Lincoln. For information, contact Jim Merchant at (402)472-7531 or e-mail jmerchant1@unl.edu.

We're Updating!!

We are updating our mailing list. If you have a change of address, title and/or name, or would like to have your name added to or removed from the *Water Current* mailing list, please let us know. Also, if you know of anyone who might be interested in receiving our publications, please give us their names and we will be glad to add them to our mailing list.

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Journal Articles

We want to announce recently published journal articles in upcoming issues of the *Water Current*. If you have recently published an article, tell us the publication, title, authors, page numbers, etc. and we'll publish that information in an upcoming issue of the *Water Current*. Email the information to Steve Ress at sress1@unl.edu.

"Controlling Nitrate Leaching in Irrigated Agriculture," Roy F. Spalding, Darrell G. Watts, James S. Schepers, Mark E. Burbach, Mary E. Exner, Robert J. Poreda and Glen E. Martin, *Journal of Environmental Quality*, vol. 30, no. 4, July-Aug. 2001, pp. 1185-1194.

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WATER CENTER
103 Natural Resources Hall
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