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### Unlimited Resource or Looming Roadblock?

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# UNLIMITED RESOURCE OR LOOMING ROADBLOCK?

Conflicting needs for water put pressure on state's water supply.

BY AARON E. PRICE

**T**he Nebraska Sand Hills is cowboy country, where cattle thrive in a sea of grass. Because most of the sandy soil here is unsuited for growing irrigated corn, the Sand Hills is one of the few areas of the state that have not seen large decreases in groundwater levels. The water supply here seems as abundant as the prairie grasses covering the Ogallala Aquifer — one of Nebraska's most treasured resources.

Despite the absence of corn in the area, Bruce Switzer, who ranches and farms about 23 miles northwest of Burwell in Loup County, worries about the pressure that a booming ethanol industry can place on the aquifer.

"It isn't just the water they're using in the ethanol plant. It's producers putting in more wells, farming more ground that hasn't been farmed for years and pumping more groundwater," Switzer said.

Growing one bushel of corn in Nebraska can require as much as 2,000 gallons of water. But Nebraska's ethanol industry relies heavily on groundwater to supply not only the water needs of corn crops, but also of factories that use the corn to make ethanol. Meanwhile, drought, well moratoriums, growing cities, wildlife needs and disputes with Kansas over water put additional pressure on Nebraska's water supply.

PHOTOGRAPH BY KOSUKE KOIWAI

A stream runs through Bruce Switzer's Sand Hills ranch northwest of Burwell, Neb.

# WATER



**B**ecause each of these competing forces stands to benefit from using the water, pressure will continue to increase. Even Switzer, who seems to be far from the conflict, has a vested interest.

In a cowboy hat, Wrangler jeans and work boots, Switzer is a real cowboy. He runs cows and calves on 12,000 acres of ranchland and farms 130 acres of grass, including sudan, rye, orchard, red-tip and timothy. Depending on the year, the grasses are grazed or cut for hay and fed to his cattle.

Although Switzer ranches, he benefits from the ethanol boom, which is typically seen as a boon to farmers. During the winter, Switzer feeds his cattle the distillers grain byproduct from the ethanol plant in Ord.

From his front porch, Switzer sees the Calamus Reservoir with 127,400 acre feet of water dammed for irrigation and not a single corn plant in any direction. According to the Nebraska Corn Board, Loup County farmers harvested only 1.2 million bushels of corn in 2007. In contrast, 60 miles to the south, Dawson County farmers produced 38.5 million bushels on heavily irrigated land.

Ten years ago, Switzer quit growing corn to conserve water and now makes water conservation a habit. He plants crops that need less water and irrigates his grass only during dry weather in spring and fall. A corn crop in Switzer's central Sand Hill location would require irrigation all summer long.

"I hope with our technology we can use something other than corn [to make ethanol] that doesn't use so much water," he said.

Yet, many farmers elsewhere in the state are planting corn to feed ethanol factories. The U.S. Department of Agriculture's statistics show that 9.4 million acres of Nebraska land was used for corn production in 2007, including 5.8 million irrigated acres.

According to "Water Implications of Biofuels Production in the United States," an October 2007 report by the National Academy of Sciences, "Growing and processing biofuel crops to meet America's energy needs will alter how the nation's water resources are used. However, the water implications of biofuels production are complex, difficult to monitor, and will vary greatly by region."

Congress mandated production of 36 billion gal-

lons of ethanol from many sources by 2022; the mandate included a cap of 15 billion gallons from corn. Will there be enough water for all this expected production?

"Do I worry about the impact on water supplies? Yes, I do," said Ann Bleed, former head of Nebraska's Department of Natural Resources, which oversees the management of the state's surface water. "And we need to be very careful, I think, that in siting these plants we get them in areas where there is a good water supply and that we do not adversely affect existing water users in the process."

**P**ersonal interviews and government documents show that the water demands of a growing ethanol industry could conflict with the demands of existing water users. Specifically:

**IRRIGATION OF CORN** uses vast amounts of groundwater and surface water.

**ETHANOL PLANTS** use water to process corn into ethanol.

**GROWING METROPOLITAN** areas of Lincoln and Omaha demand water.

**NEBRASKA STRUGGLES** to comply with interstate water obligations to Kansas.

**FEDERALLY PROTECTED** wildlife on the central Platte River need water.

To meet ethanol-production goals, Nebraskans must navigate existing water issues within an atmosphere complicated by economic, environmental and social issues.

"It's going to be challenging to figure out how to share it [water], and we don't have a policy or tradition of public policy that really makes sharing very easy," said Susan Seacrest, former director of the Groundwater Foundation.

In particular, ethanol production will compete with other water users in areas where the state and natural resources districts have already limited water use.

"I am certainly concerned that if these plants are going to go in water-short areas, that there is a way of making sure that the water supplies are going to



"When you add it all up, I wonder what we would rather have: would we rather be out of oil or water?"

**Bruce Switzer**

Nebraska rancher

PHOTOGRAPH BY AARON E. PRICE

continue to be available for the plant into the future as well as to the local area in general,” said Bleed. “I would be surprised if there isn’t some ethanol plant out there who didn’t do their homework as well as they should have, and is going to run out of water at sometime in the future.”

In a 2007 report titled “Biofuels and Global Water Challenges,” the Institute for Agriculture and Trade Policy — a non-profit based in Minneapolis — warned, “water could be the Achilles heel” of the United States’ ethanol industry. Minnesota alone uses two billion gallons of water a year to support its ethanol industry.

Minnesota officials were alarmed in 2007 when a Granite Falls ethanol plant had to start using water from the Minnesota River in place of the groundwater previously allotted to the plant. The alarm caused by the rapid drawdown of the aquifer in Granite Falls prompted the state’s Environmental Quality Board to review the sustainability of the state’s water resources in view of all the competing needs.

In Tampa, Fla., the state’s first ethanol plant will become a Top 10 water user in its area, requiring 400,000 gallons of water a day. The United States EnviroFuels factory in Tampa plans to double its size, though widespread drought has residents asking where the additional water will come from.

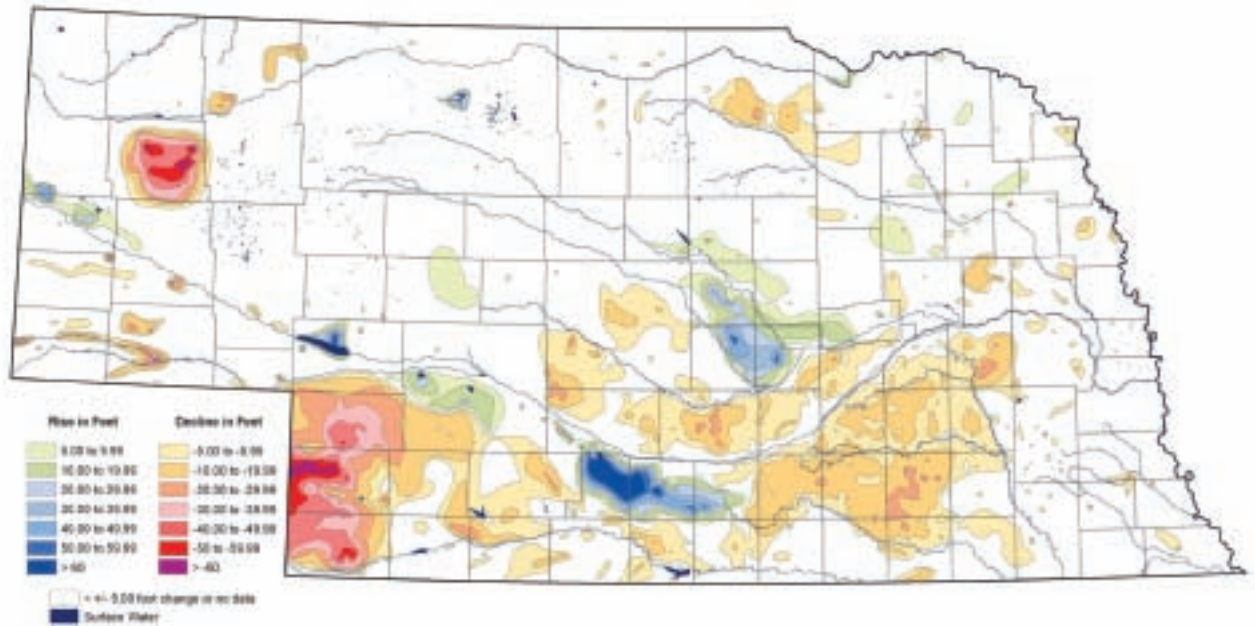
Vast water supplies have made corn king in Nebraska, and a large part of the state’s economy depends on corn and the livestock industry it supports. But corn is a thirsty plant. According to the Nebraska Corn Board, on average, 70 percent of Nebraska’s corn crop is irrigated.

“Corn is a good plant precisely because it uses a lot of water, but it uses it more efficiently at converting it into product—grain and biomass than almost any other crop plant we have,” said Ken Cassman, University of Nebraska–Lincoln agronomist.

Cassman said 1,800 to 2,000 gallons of water is required to grow a bushel of corn in Nebraska. Looking at corn production nationwide, the National Corn Growers Association came up with a much higher figure; the NCGA says 4,000 gallons of water is needed to grow each bushel of corn. In contrast, one bushel of wheat requires 11,000 gallons of

# LEVELS

Since the 1950s, groundwater levels have declined in heavily irrigated areas of the state. One major exception is in south central Nebraska, where leaking irrigation canals have raised the groundwater level by more than 50 feet.



GRAPHIC BY ALEX HAUTER

SOURCE UNL CONSERVATION AND SURVEY DIVISION

water. The U. S. Geological Survey says the average household uses 107,000 gallons each year.

About 1.4 billion bushels of corn was grown in Nebraska in 2007, according to the Corn Board. Under Cassman’s most conservative estimate, 2.5 trillion gallons of water, some of it from rain, went in to growing the 2007 Nebraska corn crop.

Some of this water recharges the aquifer, and some flows back into rivers and streams. But water is also lost through evaporation from the soil surface or by transpiration from the leaf surfaces of plants.

Groundwater irrigation began in Nebraska around the end of World War II. As of May 8, 2008, the Nebraska Department of Natural Resources reported 104,903 registered irrigation wells in the state.

A U.S. Geological Survey circular titled “Estimated Use of Water in the United States in 2000” reported that 94 percent of the groundwater withdrawals in Nebraska were for irrigation in 2000; nationwide, irrigation accounted for 137 billion gallons per day, the largest use of freshwater in the U.S.

Environmental Defense, a conservation group, predicts the ethanol industry will increase demand on the Ogallala Aquifer by 900 percent, largely because of increased irrigation for corn.

“I really don’t know how many gallons of ethanol is realistic,” Bleed said. “A lot of that depends on how much other types of water uses people are willing to give up to produce ethanol.”

Processing corn into ethanol requires additional water.

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Bob Lundeen, CEO of Standard Ethanol in Madrid, Neb., said his plant pulls 175 million gallons of groundwater annually from the Republican River Basin and returns about one third of it to the river. The wells supplying water to the plant pump 350 gallons a minute while returning 100 gallons a minute to the river.

“We think our water use is on the lower end because we have newer technology and a newer plant and our technology has a record of using less water than other technologies,” Lundeen said. “Some plants use as high as 800 gallons a minute.”

The water not returned to the Republican River leaves as steam or in distillers grain.

Using water from old wells retired by the city of Cambridge, the Madrid ethanol factory produces

48 million gallons of ethanol every year.

Lundeen figured his facility uses 2.7 gallons of water for every gallon of ethanol produced.

The Renewable Fuels Association says three gallons of water is needed to produce every gallon of ethanol. The National Corn Growers Association agrees, saying a typical factory producing 40 million gallons of ethanol per year uses 330,000 gallons of water per day — equivalent to the daily water use of an 18-hole golf course.

“When you look at the geographic area, I think we’re very insignificant,” Lundeen said. “One ethanol plant is a minor water user. We’re taking over old city wells that can’t be used anymore for the city of Cambridge. We’re about as green as you can get.”

Officials at Chief Ethanol in Hastings, Nebraska’s oldest ethanol plant, declined to give information about the plant’s water use, calling it a “trade secret.” But a 2007 report from the Upper Big Blue Natural Resources District states Chief Ethanol’s two groundwater wells pump a combined total of 477.7 million gallons annually. Considering the plant’s own reported annual production of 60 million gallons of ethanol, the plant uses about eight gallons of water for every one gallon of ethanol produced.

“As recently as five years ago, it typically took about eight gallons of water to process a gallon of ethanol,” said Todd Sneller, administrator of the Nebraska Ethanol Board. “Today, it takes about three gallons of water to process a gallon of ethanol. And in the most modern plants being designed today, it takes about a gallon and a half of water.”

According to the 2008 winter issue of *Cornstalk*, a Nebraska Corn Board publication, new technologies may enable future ethanol plants to cut their water requirements by about a third.

The Nebraska Corn Board, University of Nebraska agronomists and other water professionals in the state point out the water use of ethanol factories is small compared to that of cities and corn irrigation.

Bruce Switzer, the Sand Hills rancher, also considers the water used by ethanol factories as a drop in the bucket compared to irrigation.

“When you add it all up, I wonder what we would rather have: Would we rather be out of oil or water?” Switzer said.

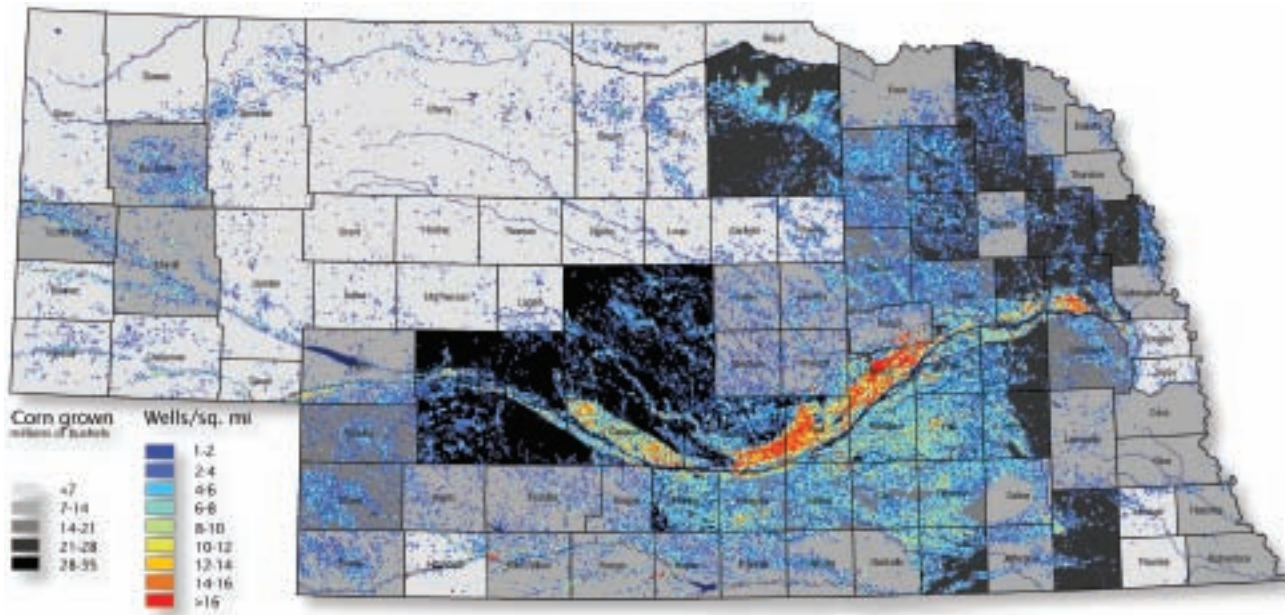
Switzer’s groundwater in the Sand Hills has a hydrologic connection to Lincoln and Omaha’s water supplies. The gradual movement of groundwater from the Sand Hills toward the east and into the Elkhorn and Lower Loup Rivers slowly provides both surface water and groundwater to the Platte River, which in time supplies water to Lincoln and Omaha.

Joel Christensen, the vice president of water operations for the Metropolitan Utilities District of Omaha, doesn’t think the ethanol boom poses a threat to water supplies in Lincoln and Omaha.

“Those river systems make Lincoln and Omaha’s

## WELLS

Irrigation wells in Nebraska are most heavily concentrated along the Platte River and in the state’s major corn-growing counties.



GRAPHIC BY ALEX HAUTER

SOURCE U.S. GEOLOGICAL SURVEY

water supply very reliable,” Christensen said.

Christensen helps oversee Omaha’s annual water use of 100 million gallons per day. Half of this supply comes from the Platte; the other half comes from the Missouri River.

In contrast with Christensen, Cecil Steward, president of the Joslyn Castle Institute and a UNL architecture professor emeritus, believes the water demands of ethanol will eventually compete with Lincoln and Omaha’s water needs. Steward said that, in the 60-mile radius around Omaha, three growth conditions are developing that will challenge the use of water in ethanol production.

“One, is there water and at what expense? Another is, is it quality for domestic drinking and household use? And third, who’s competing for it on the highest order?” Steward said. “The ethanol industry and the growth characteristics of both Omaha and Lincoln and the increase in growth of acres along with this population, are all putting huge pressure in this region on a very limited and undependable resource.”

Through the Republican River Compact, Kansas, another competitor for water, claims the right to use a share of water from the Republican River, which flows from Colorado, through southern Nebraska and into Kansas. The compact, which allots a share of the river’s water to each state, essentially reduces the amount of water that Nebraska farmers can use to irrigate corn.

Tracy Zack, a Department of Natural Resources attorney representing Nebraska in the dispute with Kansas, said, “It’s up in the air. The legal side is clear. The numbers are not.”

In the years-long dispute over the numbers — that is, the acre-feet of water flowing from Nebraska to Kansas — Kansas has threatened a lawsuit to force Nebraska to allow more water to flow across the border.

**W**idespread drought in the Great Plains has complicated the dispute. Groundwater and surface water are hydrologically connected, so Nebraska farmers in the Republican River Valley who compensate for drought by irrigating their

crops with groundwater also decrease flows in the river. These combined factors increase the difficulty of meeting Kansas’s water requirements.

Back in the Sand Hills, Bruce Switzer watches the conflict unfold.

“I guess if they can get low on water in the Republican, why can’t we?” Switzer asked. “I just don’t think we can keep using, keep using and keep using.”

The federal Endangered Species Act requires some Platte River water to be allocated for four species of wildlife: two endangered birds (the whooping crane and interior least tern), one threatened bird (the piping plover) and one endangered fish (the pallid sturgeon). This requirement has helped to create a moratorium on new wells in much of the river valley, limiting irrigation for corn.

UNL agronomist Ken Cassman says 1,800 to 2,000 gallons of water is required to grow a bushel of corn in Nebraska. Other experts say 4,000 gallons of water is needed to grow each bushel of corn.

# OGALLALA

## THE HIGH PLAINS AQUIFER

The High Plains – or Ogallala – Aquifer lies beneath about 175,000 square miles of land in eight states: South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, New Mexico and Texas. About 30 percent of the groundwater used for irrigation in the U.S. is pumped from the aquifer. In 2000, irrigation accounted for 17 billion gallons of withdrawal per day. The aquifer is estimated to hold about three billion acre feet of water (an acre-foot equals 326,000 gallons). Two-thirds of that amount – or two billion acre feet – lies beneath Nebraska.



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SOURCE U.S. GEOLOGICAL SURVEY

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Finding the right water balance for the imperiled species is a unique challenge, said Mary Bomberger Brown, program coordinator of the Tern and Plover Conservation Partnership at UNL. The fish need water, and the birds need sandbar habitat near the water.

“Anything that influences the flow for creating the proper habitat is a concern for them,” Brown said.

One concern is the heavy demand that irrigating corn and producing ethanol are making on the state’s water resources. Worries about the sustainability of those resources lead many to question the long-term sustainability of corn-ethanol production.

Nebraska’s vast groundwater resource, the Ogallala or High Plains Aquifer, is believed to hold two billion acre-feet of water, enough to cover the state to a depth of 40 feet.

“Hopefully, our underground water table will remain at a stable level and we’ll be able to pump the underground water,” said Alan Songster, who farms near York in east central Nebraska.

Yet, in much of Nebraska, the water table, which is the distance to groundwater, has fallen because of decades of heavy irrigation and more recent drought. In the southwest and the northern panhandle, for example, the water table has dropped by at least 50 feet, putting it out of reach for some irrigators and resulting in well-drilling moratoriums.

The National Academy of Sciences predicts that in the next five to 10 years, the increase in agricultural production will not alter the “national aggregate” supply of water, but will change select areas’ water supply if stress already exists on the water systems.

And yet, the drumbeat for more ethanol production continues among policymakers.

“Because the science, the technology, the efficiency of the farmer, the water management, the weed management — all of that just continues to improve year after year,” said Nebraska U.S. Senate candidate and ex-Secretary of Agriculture Mike Johanns in the fall of 2007. “And it will. That’s the one promise I can make. We’re just going to get better at this year after year.”



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