# Water Quality in a Wet Meadow, Platte River Valley, Central Nebraska

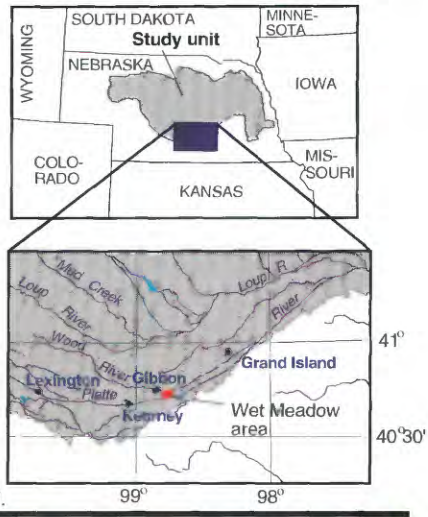
U.S. Department of the Interior–U.S. Geological Survey

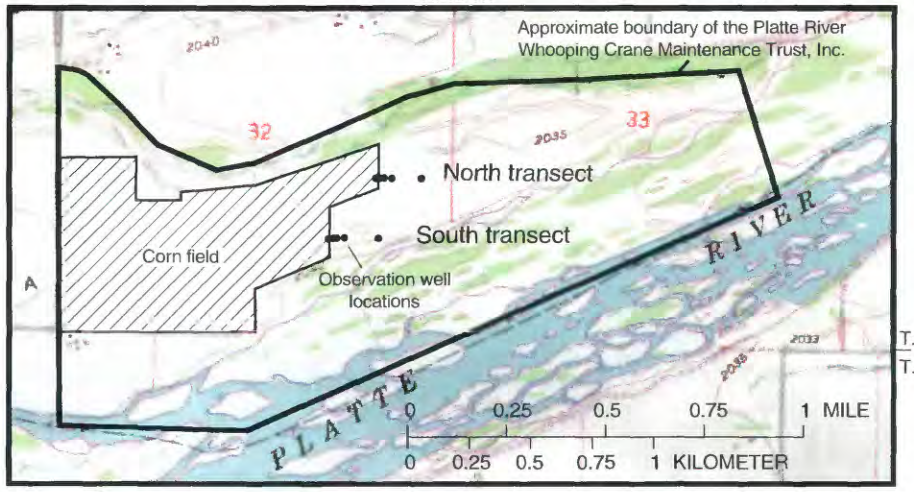
**Wet meadows along the Platte River in central Nebraska are a part of an important habitat for migratory birds in North America.**

The Platte River Valley in Nebraska, and in particular the reach from Lexington to Grand Island, is an extremely important natural habitat. Over 300 migratory bird species, including several threatened and endangered species, have been observed along the Platte River. In the spring, nearly 500,000 sandhill cranes (80 percent of the North American population) along with millions of ducks and geese use this reach as a staging and feeding area during their northerly migration. Wet meadows, grasslands that have waterlogged soils much of the year, are a critical part of this migratory-bird habitat. The area of wet meadows between Lexington and Grand Island has declined as much as 45 percent since 1938 due to human activities (Sidle and others, 1989). As a result of this decline, the condition of the remaining wet meadows is of vital importance.

Courtesy of the Platte River Whooping Crane Maintenance Trust, Inc.

The U.S. Geological Survey's (USGS) National Water-Quality Assessment (NAWQA) Program is designed to describe the status and trends in the quality of the Nation's water resources and to provide a sound understanding of the natural and human factors that affect the quality of these resources. The Central Nebraska Basins (CNB) is one of 60 study units in the Program. Assessment of the occurrence of agricultural chemicals in the ground water is one aspect of the study.

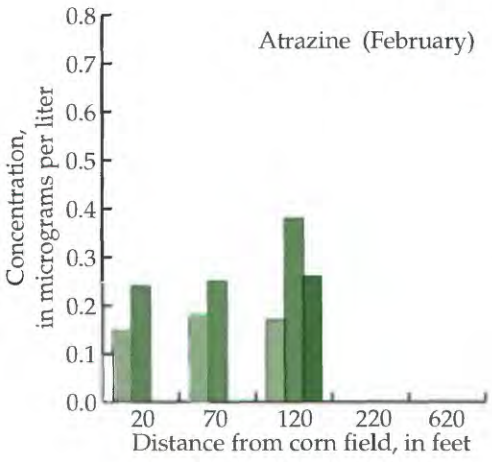


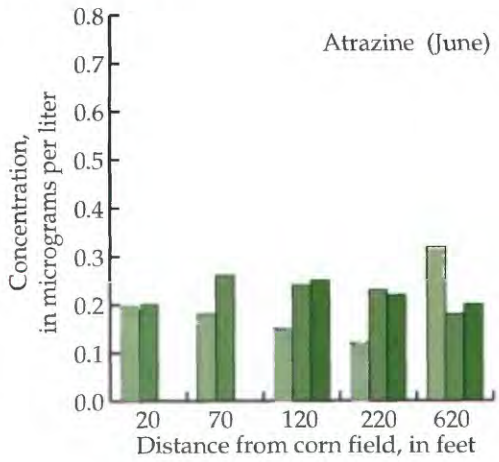



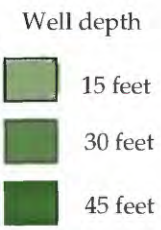

A study of ground-water quality was conducted beneath a wet meadow, located adjacent to the Platte River near Gibbon in central Nebraska. This Fact Sheet is based on the water-quality data collected in 1994.

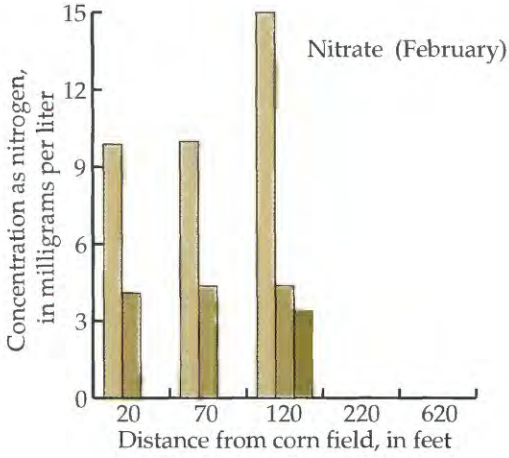
Observation wells were installed in the wet meadow along two transects at distances of about 20, 70, 120, 220, and 620 or 680 feet downgradient from the edge of a field that has been planted to corn for more than 10 years. The number

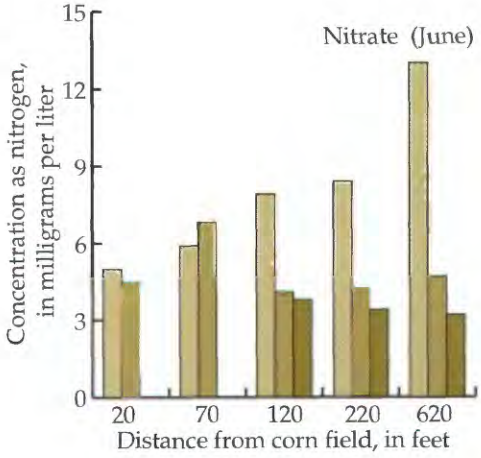
# North Transect



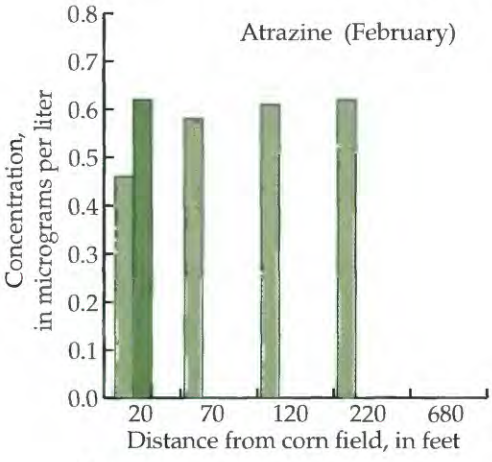



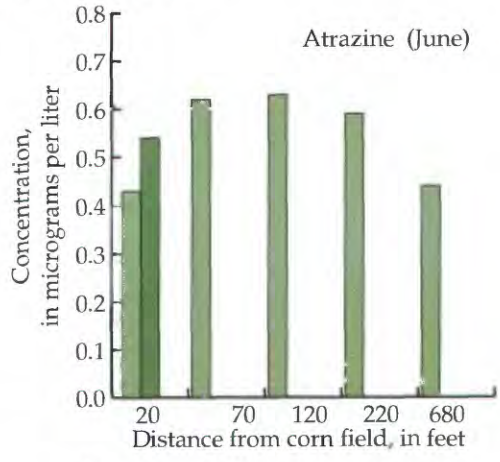



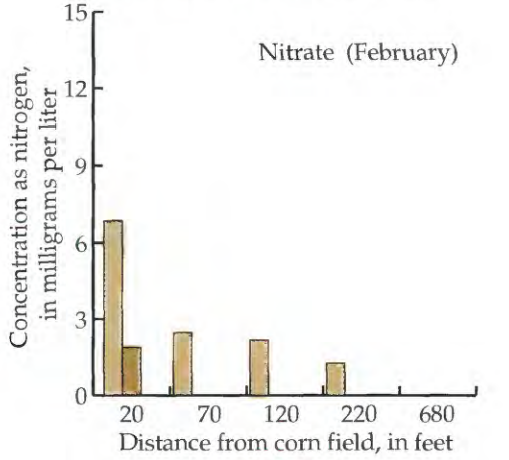


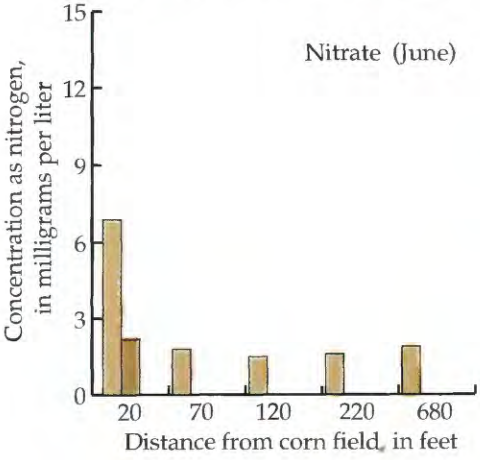
# South Transect

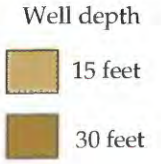






of wells at each distance ranges from one to five, completed at depths of about 15, 30, 50, 80, and 100 feet. The wells were completed with either 2.5- or 5.0-foot screens. All but one of the wells were completed in the approximately 75-foot-thick, unconsolidated Platte River alluvial sand and gravel. The 100-foot well was completed in the underlying Ogallala Formation (semi-consolidated silt and sand). The depth to the water table in the wet meadow ranges from 0 to about 5 feet below land surface. The general direction of ground-water flow is parallel to flow in the Platte River (down stream is toward the east). Selected observation wells were sampled in February, March, June, and December 1994 for major ions, nutrients, and organonitrogen herbicides.

**Pesticides and fertilizers are used extensively in Nebraska to increase row-crop production and some of these compounds have migrated into the water.**

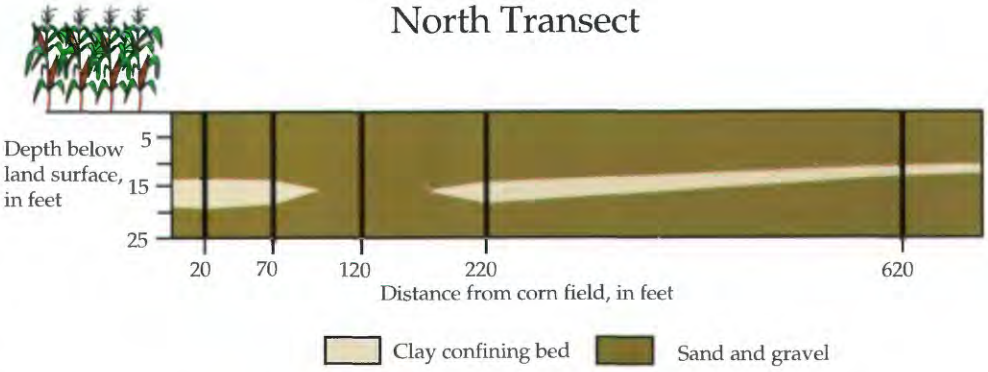
The most extensively applied pesticides are herbicides used to control weeds in corn. The four most commonly applied herbicides in Nebraska were alachlor, atrazine, cyanazine, and metolachlor.

The U. S. Environmental Protection Agency (USEPA) drinking-water regulation for atrazine is an annual average concentration of 3.0 micrograms per liter (µg/L). The median concentration of atrazine in water from the Platte River near Grand Island from April 1993 through May 1995 was 0.6 µg/L with the concentrations ranging from 0.1 to 14.7 µg/L. The Platte River is hydraulically connected with its adjacent alluvium. Atrazine was detected in 13.4 percent of wells randomly sampled in Nebraska in 1987. Although some concentrations exceeding 3.0 µg/L were detected in the ground water, most concentrations were 1.0 µg/L or less. Most of the atrazine detected occurred in ground water in the Platte River Valley (Exner and Spalding, 1990).

The median concentration of nitrate as nitrogen in ground water from selected shallow wells (less than 82 feet deep) in the Platte River Valley was 6.5 milligrams per liter (mg/L). The USEPA drinking-water regulation for nitrate is 10 mg/L as nitrogen.

**Small concentrations of pesticides were detected in all wells completed in the alluvium beneath the wet meadow. Nitrate concentrations in some wells approached or exceeded the drinking-water regulation.**

A discontinuous clay confining bed as thick as 7 feet is present in the alluvium beneath the wet meadow, as illustrated on the schematic section. Fine-grained material in this layer vertically separates the water at the 15- and 30-foot depths. This layer does not appear, however, to affect the vertical distribution of chemical compounds detected in the ground water.



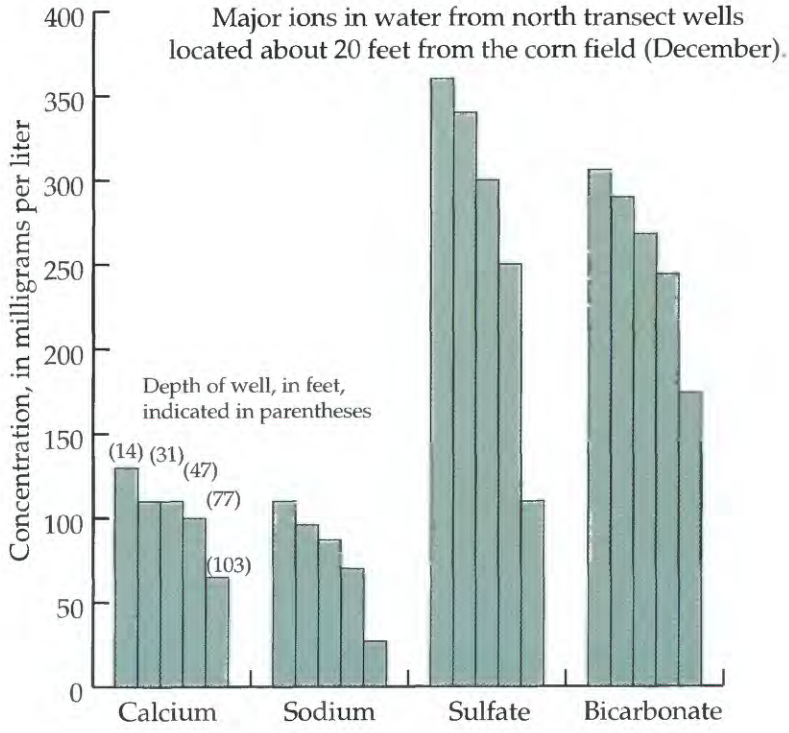

Concentrations of atrazine and nitrate are shown for February and June on bar charts on the preceding page. Atrazine was detected in small concentrations of 0.1 to 0.6 µg/L in water from all of the wells sampled in February and June. Concentrations of the other pesticides analyzed, including alachlor, cyanazine, and metolachlor, were at or below the detection level of 0.05 µg/L. Nitrate as nitrogen concentrations in the shallow wells (about 15 feet deep) in 1994 ranged from 5.0 to 15 mg/L. Concentrations from the shallow wells were generally much larger than the associated deeper wells (30 and 45 feet deep) which had nitrate as nitrogen concentrations ranging from 1.3 to 6.8 mg/L. Nitrate as nitrogen concentrations in many of the shallow wells approached or exceeded the drinking water regulation of 10 mg/L.

**The most pronounced changes in specific conductance occurred with depth--from large values in shallow wells to small values in deep wells.**

Specific conductance is an indicator of the concentration of dissolved minerals in water. The conductance of water sampled from the shallow wells increased slightly downgradient, however no consistent pattern of change in specific conductance with distance from the corn field was observed in the deeper wells. Specific conductance was relatively high (average shallow-well specific conductance for December 1994 was 1,400 microsiemens per centimeter at 25 degrees Celsius (µs/cm at 25°C)) during the winter months and generally decreased (average for June 1994 was 1,280 µs/cm at 25°C) during the summer months. The most pronounced changes in conductance occurred with depth. For example, specific conductance for December 1994 was 1,350 µs/cm at 25°C in the shallow well located closest to the corn field in the north transect, decreased to about 70 percent of that value at the bottom of the alluvium, and to about 40 percent of that value in the Ogallala Formation.

**Major cations were calcium and sodium, and major anions were sulfate and bicarbonate.**

Concentrations of major cations and anions decreased and their ratios change with depth as shown on the bar chart. The major cations were calcium and sodium, and the major anions were sulfate and bicarbonate. Water from the shallowest three wells (north transect, about 20 feet from the corn field) was a calcium sodium sulfate type, whereas water from the 77-foot well was a calcium sulfate type. The water from the Ogallala Formation (103-foot well) was a calcium bicarbonate type. Ground-water quality varies in the wet meadow in response to seasonal changes in recharge to and evapotranspiration from the alluvium and rates of movement and mixing of the water within and between the alluvium and Ogallala Formation.

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Information regarding the NAWQA Program is available on the Internet via the World Wide Web. You may connect to the NAWQA Home Page using the Universal Resource Locator (URL): http://wwwrvares.er.usgs.gov/nawqa/nawqa_home.html



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