



News Release

U.S. Department of the Interior
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Address

Upper Mississippi River NAWQA
2280 Woodale Drive
Mounds View MN 55112

E-mail

stark@usgs.gov

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Contact

James Stark

Phone

(763) 783-3230

Fax

(612) 783-3103

Look at Surrounding Land, Soil, and Geology for Water Resource Quality

Water resources are affected by land use, soils, and geology in the Upper Mississippi River Basin, according to a recently published report by the U. S. Geological Survey (USGS). Urban, agricultural, and forested land use in combination with geology and soil type result in different degrees of water-resource quality. Surface-water quality was better in forested watersheds than in urban or agricultural watersheds. Ground-water quality was better in aquifers with overlying soils that reduced direct infiltration.

The study of the Upper Mississippi River Basin, conducted from 1995-98, as part of the USGS National Water-Quality Assessment Program, found that streams in forested watersheds like the St. Croix River Basin had less nutrients, sediment, and organic contaminants than streams in agricultural watersheds like the Minnesota River Basin or urban areas like the Twin Cities Metropolitan Area. "Land use a major factor affecting water quality in streams and ground water. However, the type of soils in the watershed or overlying shallow aquifers could have a significant effect", said Jim Stark, the project chief. The findings indicate that agriculture, urbanization, and natural land uses continue to affect water quality.

The quality of urban streams has been affected more than streams in agricultural or forested areas. One component of the study examined biological communities and habitat. Urban streams had reduced fish and invertebrate species richness (numbers of species) and biological diversity compared to agricultural and forested streams. Several factors may be responsible for the comparatively poor condition of aquatic resources in urban streams, including contaminants in the water and sediment, and reduced habitat.

Reduced habitat in urban streams was associated with loss of riparian vegetation, channelization, impoundments, and changes in the pattern of streamflow. The rise and fall of the water in urban streams after rainstorms or snowmelt are much more rapid than streams in other land-use settings. Impervious surfaces such as parking lots, roads, and building roofs do not allow precipitation to soak into the ground; therefore, runoff reaches the streams more quickly and streamflow increases and decreases rapidly. Higher flows scour the stream bottom, reducing habitat.

Agricultural streams in the study were found to receive nonpoint-source inputs of nutrients and sediment. Nitrate concentrations in streams in artificially drained agricultural areas exceeded the U.S. Environmental Protection Agency's (USEPA) drinking water standard of 10 milligrams per liter in about 20 percent of the samples. Stream channels and habitat were also affected by channelization and loss of riparian buffers. The importance of riparian buffers for agricultural streams was shown with a special study. This study found that streams with more trees and shrubs along the banks in riparian buffer zones had more fish and invertebrate species and better ecological integrity than streams without riparian buffer zones.

Streams in forested basins like those in the northern part of the study area were relatively unaffected except by localized activities such as minor wastewater effluent discharges, pesticide applications at tree farms, leaks from septic systems. Nutrients and pesticides did not exceed drinking water standards or criteria to protect aquatic life. Concentrations of nutrients and pesticides were

small compared to urban and agricultural streams.

Ground water supplies about 75 percent of the public and industrial water supply. The major source for this water is the Prairie du Chien-Jordan aquifer. The local quality of the water in the aquifer depends on land use and the type of bedrock or glacial deposits above it. In areas where water can readily seep through the overlying soils to the aquifer, 8 percent of the nitrate samples exceeded the USEPA drinking water standards. In areas where water could not readily reach the aquifer due to low-permeability glacial tills, nitrate standards were not exceeded. Some pesticides were detected in ground water. In areas overlain by till, atrazine (a herbicide used with corn) was detected in 36 percent of the wells, whereas in areas without a low-permeability layer, it was detected in 52 percent of the wells.

The USGS report, "Water Quality in the Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, and North Dakota, 1995-1998", published as USGS Circular 1211, is available on the World Wide Web as downloadable portable document files (PDF) at <http://water.usgs.gov/nawqa> or in printed form (single copies of the report are at no cost) from Branch of Information Services, P.O. Box 25286, Denver, CO 80225, or by fax request to 303-202-4693. Please specify USGS report C-1211.

The USGS assessment is part of a national program, currently releasing results on surface and ground water in 15 additional major river basins. Check the status and availability of the individual basin reports on the NAWQA website, as well as accessibility to other NAWQA publications and national data sets and maps.

As the nation's largest water, earth and biological science and civilian mapping agency, the USGS works in cooperation with more than 2,000 organizations across the country to provide reliable, impartial, scientific information to resource managers, planners, and other customers. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disaster, contribute to the sound conservation, economic and physical development of the nation's natural resources, and enhance the quality of life by monitoring water, biological, energy, and mineral resources.