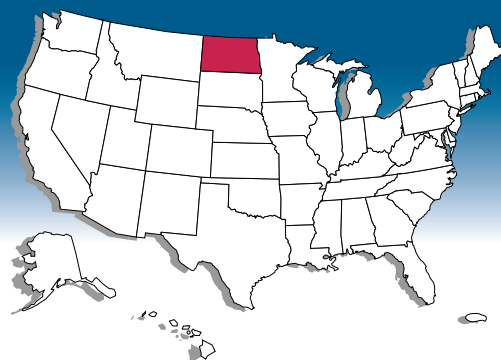




U.S. Geological Survey Programs in North Dakota

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



The U.S. Geological Survey (USGS) provides the Nation with reliable, impartial earth science information to describe and understand the Earth. In North Dakota, the USGS collects data and conducts interpretive investigations in cooperation with more than 30 local, State, and Federal agencies and Indian Tribes. These basic data and issue-relevant investigations provide the types of information on water, biological, energy, and mineral resources that are needed on a continuing basis by those who are responsible for managing the State's natural resources.

Water Levels in Devils Lake

Devils Lake Basin is a 3,810-square-mile closed drainage basin. (A closed drainage basin has no outlet to the ocean.) About 3,320 square miles of the drainage area is tributary to Devils Lake. Lake levels were recorded sporadically from 1867 to 1901, when the USGS established a gaging station. For the period of record, the maximum lake level was 1,438 feet above sea level in 1867, and the minimum lake level was 1,400.9 feet above sea level in 1940. On June 30, 1996, the lake level was at 1,437.7 feet above sea level. In response to the rising water levels, the Devils Lake Basin Interagency Task Force, which comprises many State and Federal agencies, was formed in May 1995 to find and propose intermediate (5 years or less) solutions to reduce the impacts of high lake levels (fig. 1). Analyses of future lake-level probabilities and associated economic damage estimates are required to evaluate the benefits and costs of proposed flood-control or lake-stabilization projects.

The USGS, in cooperation with the North Dakota State Water Commission (NDSWC), conducted a study to estimate future lake-level probabilities. Probability data were used by the U.S. Army Corps of Engineers (USACE) to develop damage-frequency relations for Devils Lake. Periodically updating the model to reflect the most

recent hydrologic conditions for Devils Lake allows the Task Force to base decisions on the most up-to-date hydrologic information. The USGS is helping the USACE and the NDSWC in their Devils Lake Stabilization Feasibility study to understand how various outlet options affect future lake levels and water quality of Devils Lake. The study also will help determine how the various outlet options could affect the hydrology and water quality of receiving streams.

For the flood-control and lake-stabilization studies, many map products recently have been produced for the Devils Lake Basin. In addition, 19 1:24,000-scale topographic maps were revised. High-resolution digital elevation models are being developed to assist State and Federal agencies in making critical management decisions.

Topographic Mapping

Among the most popular and versatile products of the USGS are its 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground).

Index of Subjects

- Water Levels in Devils Lake
- Topographic Mapping
- National Water-Quality Assessment Program
- National Coal Assessment
- Geologic Mapping
- Earth Science Information
- Water-Resources Data
- Water-Resources Appraisals
- Water Quality of E.A. Patterson Lake Basin
- Simulation of Water Quality Under Ice Cover
- Grassland Fire Danger Assessment
- Grassland Ecosystems in the Northern Great Plains

These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. North Dakota is covered by 1,464 maps at this scale, which are useful for civil engineering, land-use planning, natural-resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.



Figure 1. Home being flooded by the rising water levels of Devils Lake.

The USGS has been working with State and Federal representatives to coordinate and produce standard products and digital cartographic data in North Dakota to meet a variety of user needs. Its geographic location in the Northern Great Plains, mixture of mineral resources and agriculture, and segmented population distribution are important factors that affect natural-resource and habitat-management issues. The availability of basic categories of digital cartographic data, such as elevation, hydrologic, and transportation data sets, will allow for improved natural-resource management, hydrographic investigations, and modeling of various physical processes by using geographic information system (GIS) technology. These activities in North Dakota exemplify how government agencies can work together to reduce duplication of effort and resources used, while increasing efficiency in managing their respective responsibilities.

The State of North Dakota established a Geographic Information System Technical Committee (GISTC) and the State Mapping Advisory Committee (SMAC) by Executive Order in May 1995. These committees will work with the USGS and other Federal agencies to coordinate state GIS and mapping activities, which include digital spatial data holding and clearinghouse activities. The GISTC will keep governmental agencies and the public informed with respect to GIS technologies and GIS projects, standards, and digital spatial data availability, and the SMAC will coordinate and prioritize mapping requirements in the State.

National Water-Quality Assessment Program

Nationally consistent and comparable information is needed to make valid regional and national statements about water-quality conditions now and in the future. The USGS's National Water-Quality Assessment (NAWQA) Program was established to address these needs. The goals of the NAWQA Program are to describe the status and trends in the quality of a representative part of the Nation's surface- and groundwater resources and to provide scientific understanding of the natural and human factors that affect water quality.

The Red River of the North (Red River) study unit was started in 1991 (fig. 2) to assess the water-quality issues of nutrients and pesticides from nonpoint sources. Local and regional issues also were identified through a study-unit liaison committee

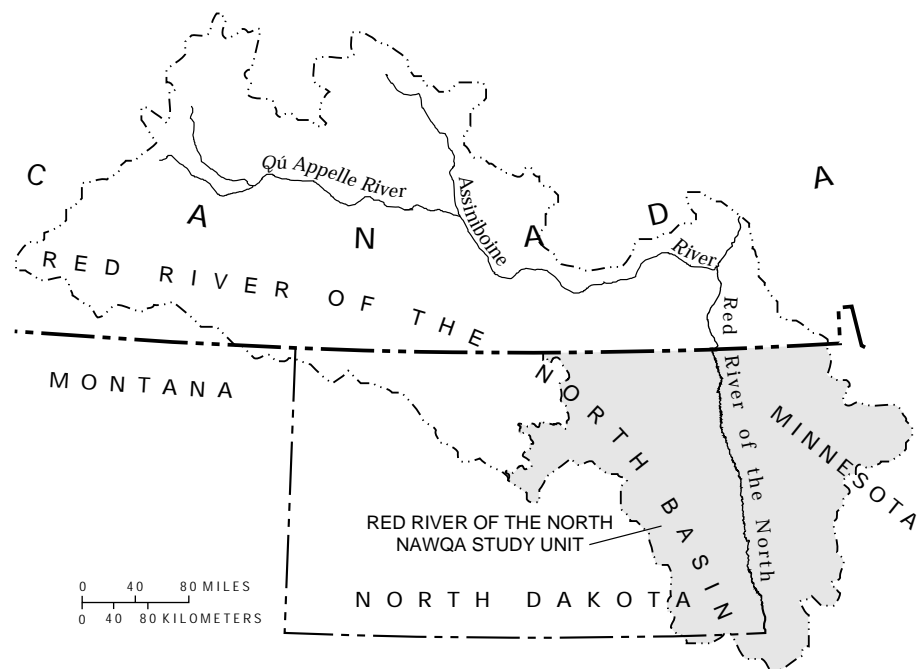


Figure 2. Red River of the North National Water-Quality Assessment (NAWQA) Program study unit.

and considered in the Red River study unit assessment. These included soil erosion, sedimentation, natural salinity from ground water, and contamination from point sources, particularly to the Red River. Intensive data collection included water chemistry in streams and shallow aquifers; suspended sediment and bottom sediment in streams; the variety and number of fish, aquatic insects, and algae in streams; and contaminants in fish tissues was completed in 1995.

The Red River study is producing water-quality information that is useful to policy-makers and water managers at all government levels. For example, the amount and types of pesticides and nutrients measured in streams and surficial aquifers are compared with estimates of land applications of these compounds for various landscapes, seasons, and weather conditions within the study area. The NAWQA study has fostered cooperation among State agencies in North Dakota and Minnesota and various Provincial and Federal Canadian agencies.

National Coal Assessment

As the United States emerges into the next century, coal will continue to be a major source of energy. Coal usage accounts for one-third of the total energy and more than one-half of the electricity generated in the United States. Even with substantial increases in energy conservation and in the use of natural gas to meet increased demand

for energy, coal continues to be a major contributor. New technologies that use coal will require resources that fulfill defined quality parameters. The Clean Air Act with its amendments of 1990 has placed renewed interest on coals that are low in ash, sulfur, and hazardous air pollutants (HAP's). The location, quantity, and quality of the Nation's coal resources that will be consumed over the next 20 years, classified particularly by the best end use, will be necessary information for national and regional planners. The Tertiary age coals of North Dakota, Montana, and Wyoming are known for being low in sulfur and ash, but detailed studies of the distribution of HAP's have only recently been undertaken. The USGS has developed models for HAP distribution on the basis of coal depositional environments and tectonic controls that influence coal-forming basins in these States and, in cooperation with scientists from State and other Federal agencies, is evaluating the viability of these models in anticipation of increased demand for compliant coals over the next two decades. This is an important step because most of the coals in North Dakota, Montana, and Wyoming are publicly owned. As part of the National Coal Assessment, the USGS is working closely with the North Dakota Geological Survey (NDGS) to identify coal resources, which include those resources potentially suitable for export, on public and private lands within the State. These coal resources are being identified and characterized with regard to quantity and quality. Products that

result from the National Coal Assessment will be useful to all levels of government, which include regulatory, information, and management agencies, as well as industrial and academic research teams.

Geologic Mapping

North Dakota faces long-term challenges related to land-use and land-management practices and engineering construction. Use of the land contributes to environmental changes (erosion, reservoir siltation) and natural hazards (floods, landslides, swelling and collapsing soils). The USGS, in cooperation with the NDGS, is involved in studies to provide information about the distribution of geologic resources and to identify potential consequences of land-use and land-management practices. The distribution, thickness, and chemical, physical, and engineering characteristics of surficial geologic deposits are being mapped as part of the compilation of the *Quaternary Atlas of the United States*. Bedrock geology, areas of active surface processes (erosion, deposition), areas of geologic hazards, and other aspects of geology and hydrology that affect or are affected by continued development of the land surface in parts of North Dakota are being mapped in detail as part of a regional study of environmental change in the Missouri River drainage basin.

STATEMAP is one of the external funding opportunities offered by USGS National Cooperative Geologic Mapping Program. Agreements are open to the State Geologic Surveys. Proposals focus on such issues as ground-water quality, geologic hazards, landfill siting and management, oil and gas assessments, coal quantity, sand and gravel resources, and economic mineral development. For example, STATEMAP funds detailed geologic and paleontologic mapping that is needed to make land-use decisions in Theodore Roosevelt National Park, and that is being used to develop visitor programs and interpretive materials on the geology of the area.

Earth Science Information

The Earth Science Information Centers (ESIC) provide information about USGS programs, products, and technological developments to the public. The ESIC in Bismarck was established under a cooperative agreement between the USGS and the NDGS. As part of the national ESIC network, this office provides information on

such earth-science topics as cartography, hydrology, geohydrology, aerial photography, and land use. It is supported by the USGS with reference materials, technical assistance, training and outreach activities, and access to USGS data bases.

Water-Resources Data

The USGS, in cooperation with about 30 local, State, and Federal agencies, operates an extensive hydrologic data-collection program. During 1996, the program provided for the collection of data at 173 streamflow and lake-level stations, 141 ground-water observation wells, 185 water-quality and sediment stations, and 2 atmospheric-deposition stations. Current-year data, which are published annually, are critical for daily administrating and managing of water resources, determining the extent and severity of droughts, characterizing and predicting conditions during floods, and monitoring the effects of human activities on streamflow, ground water, and water quality. The data also are essential to interpretive studies that provide information for making decisions about water issues that potentially affect all North Dakotans. Locations where surface-water data have been collected over the years by the USGS are shown in figure 3.

Data at 38 streamflow stations and 3 reservoir sites are being relayed on a real-time basis to the USGS computer in Bismarck. These data can be accessed immediately on the North Dakota District Home Page on the World Wide Web at:

<http://srv1dndbmk.cr.usgs.gov/public/>
Streamflow and stage information for the last 7 days is provided in graphic form along with such information as station location and length of record. The importance of the streamflow network was demonstrated during the floods of July and August 1993 and April 1996, when streamflow data transmitted by satellite telemetry were used by several agencies to manage storage and releases from reservoirs and to forecast floods.

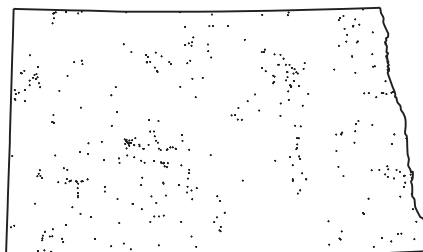


Figure 3. Surface-water data -collection sites in North Dakota.

Water-Resources Appraisals

The USGS, in cooperation with the NDSWC and the NDGS, has completed reconnaissances appraisals of ground-water availability and quality in each county in North Dakota. The county ground-water studies determined the availability, movement, recharge, discharge, and quality of water in glacial and bedrock aquifers. Information from the county studies has provided a scientific basis for addressing many ground-water issues, such as water availability and water allocation.

In 1993, the USGS, in cooperation with the NDSWC, began a series of studies to describe the water resources of the State by river basin. The first study, which is being done in the James River Basin, describes the hydrologic system of the Basin and includes analysis of the major rivers and related reservoirs, wetlands, major types of aquifers, soil system, and climate. Study results are useful to water-management officials and the public for making informed decisions about water projects or other issues related to North Dakota's water resources.

Water Quality of E.A. Patterson Lake Basin

Since the construction of E.A. Patterson Lake, which is a reservoir on Heart River near Dickinson, sedimentation and nutrient loading have caused limited success in fish production. Excessive algae blooms have concerned the local citizens as well as local and State officials. The USGS, in cooperation with the city of Dickinson, is conducting a study to understand better the water quality of the Patterson Lake Basin. This study is part of the much larger Patterson Lake Diagnostic/Feasibility Study Plan. Information from this plan is being used by local and State agencies to improve management of the Basin.

Simulation of Water Quality Under Ice Cover

The Clean Water Act requires all States to implement a total maximum daily load (TMDL) process for surface water where water-quality controls are not adequate to achieve in-stream standards. A TMDL process results in an allocation of loads for point and nonpoint sources. As part of this process for a reach of the Red River of the North in the vicinity of Fargo, North Dakota, and Moorhead, Minnesota, the USGS

conducted a cooperative study with the North Dakota Department of Health and the Minnesota Pollution Control Agency. The study used a water-quality model that was calibrated for ice-free conditions and verified the model under ice-cover conditions. On the basis of the agreement between the measured and simulated values or concentrations, the model was found to be capable of simulating water quality for ice-free and ice-cover conditions. The model is being used by State water-resource managers to evaluate loads in the reach.

Grassland Fire Danger Assessment

Grassland fires pose a serious threat to agricultural and urban areas. Grassland fire danger conditions exist when dry grasses are present and hot, dry, and windy weather conditions prevail. In response to a need for timely information on grassland conditions, the USGS provides vegetation condition, or "greenness," information derived from satellite data to the North Dakota Forest Service. The satellite observations from the USGS provide weekly statewide updates of greenness conditions. The greenness information is sent to the National Weather Service in Bismarck where it is combined with daily weather information to forecast fire-danger conditions. Whenever severe conditions exist, information is provided to emergency monitoring centers and the news media for broadcast to the public.

Grassland Ecosystems in the Northern Great Plains

The USGS Biological Resources Division (formerly the National Biological Service) conducts research and provides the scientific data needed for sustained economic benefits from and conservation of the grassland ecosystems of the northern Great Plains. Ongoing research at the Northern Prairie Science Center (NPSC) in Jamestown, includes studies to document the wildlife values of the Conservation Reserve Program, which removed about 36 million acres of marginal farmland from agricultural production and enhanced its value as food and cover for wildlife; to assess impacts of habitat fragmentation on grassland birds, which include waterfowl; to contain the spread of invasive weeds; to assess the ecological functions of natural and restored prairie wetlands; to determine the effect of agricultural practices upon sedimentation and chemical contamination of prairie wetlands (fig. 4); to determine predation rates on grassland birds and to document the ecology of their mammalian predators; to determine survival rates and causes of mortality of waterfowl broods; and to develop methods to inventory amphibians and nocturnal wetland birds. Information that pertains to the biota of the Great Plains are made available on NPSC's Home Page on the World Wide Web at:

<http://www.npsc.nbs.gov/>



Figure 4. Many studies in North Dakota focus on the hydrologic and biological functions and values of prairie wetlands.

For More Information

USGS State representative
821 E. Interstate Ave.
Bismarck, ND 58501
701-250-4601
Fax: 701-250-4252
Email: dc_nd@usgs.gov

Additional earth science information can be found by accessing the USGS Home Page on the World Wide Web at <http://www.usgs.gov/>

For more information on all USGS reports and products (including maps, images, and computerized data), call **1-800-USA-MAPS**

The **USGS** provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, biological, and land resources. We help find the natural resources needed to build tomorrow, and supply the scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by natural and human activities. The results of our efforts touch the daily life of almost every American.

U.S. Geological Survey
Fact Sheet FS-034-96