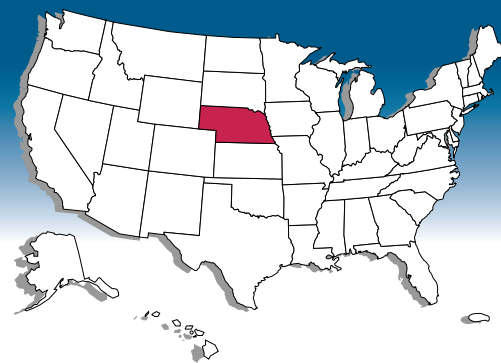




# U.S. Geological Survey Programs in Nebraska

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



The U.S. Geological Survey (USGS) collects, compiles, and disseminates data on water, energy, biological resources, and mineral resources in Nebraska. The USGS is known for its unbiased data collection and research—gathering, interpreting, and presenting data that enable resource planners and others to make decisions that are based on objective information. As the Nation’s leading earth science agency, the USGS works cooperatively with Federal, State, and local agencies to address issues related to Nebraska’s earth resources. Today’s issues are more pressing than ever—the continuing need for resource development, describing and predicting the fate of contaminants, and understanding the effects of human activities on resources.

ment. The USGS works closely with scientists at the Conservation and Survey Division of the Institute of Agriculture and Natural Resources (CSD), the Department of Geology, and the High Plains Climate Center, all located at the University of Nebraska–Lincoln (UNL).

## Grassland Fire Danger Assessment

Grassland fires pose a serious threat to agricultural and urban areas when grasses become dry owing to hot, dry, and windy weather conditions. In response to a need for timely information on grassland conditions, the USGS provides weekly vegetation condition, or “greenness,” information derived from satellite data to the Nebraska Forestry Service. Vegetation conditions vary by county on a weekly basis, from high (green tones) to low (yellow and red tones). Given specific weather conditions (hot, dry, and windy), the grassland fire danger can reach the severe and extreme category where vegetation conditions are in the low category (fig. 1). The greenness information is sent to the National Weather Service in Omaha where it is combined with daily weather information to forecast fire danger conditions. When severe conditions exist, information is provided to emergency monitoring centers and the news media for broadcast to the public.

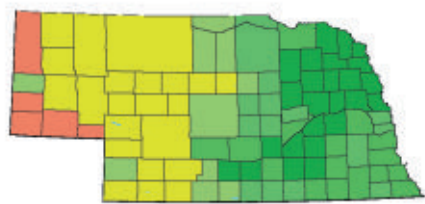


Figure 1. Vegetation conditions in Nebraska. Green represents high vegetation, yellow and red are associated with low vegetation.

## Desertification

The Sand Hills region, which covers nearly the western one-third of the State, is the largest dune field, stabilized or active, in the Western Hemisphere. Studies indicate that in this region, there may be a potential for “desertification,” a term that refers to productive land changing to non-productive land as a result of natural processes or human activities. In the Sand Hills, vegetation is the principal factor that contributes to stability of the dunes. Without soil and vegetative cover, stable and productive sand dunes may become mobile and nonproductive. If the sand dunes are reactivated, then potential consequences include destruction of important grazing land; movement of dune sand onto productive cultivated land and (or) major transportation routes, such as U.S. Interstate 80 and railroads; interference with commuter aircraft departures and arrivals; and destruction of wetlands, which would have severe effects on wildlife.

The USGS is mapping the region and determining the ages of the dunes, particularly the most recent episodes of dune activity; the origin of the sand; and the climatic conditions at the time of dune move-

## Index of Subjects

- Desertification
- Grassland Fire Danger Assessment
- Flood Frequency
- Earthquake Hazards Studies in Southern Nebraska
- Ground-Water-Quality Investigations
- Topographic Mapping
- Geologic Mapping
- Geology in Urban Areas
- Stream-Channel Stability
- Collection of Hydrologic Data
- National Water-Quality Assessment Program
- Digital Mapping
- Sharing Spatial Data
- Earth Science Information
- Outreach
- Studies in National Parks and the Great Plains of Nebraska

## Flood Frequency

Statewide information on the magnitude and frequency of flooding is required by bridge designers, flood-plain managers, and others to ensure public safety and to enable cost-effective bridge design. The USGS, in cooperation with the Nebraska Department of Roads (DOR) and the Federal Highway Administration (FHWA), is updating the techniques for estimating maximum streamflows throughout the State by using flood data through 1993. Characteristics, which include drainage basin size and shape, soils, topography, drainage network, and climate, are being compiled for drainage basins upstream from the gaging stations by using a geographic information system, improved analytical procedures, and a computer program developed by the USGS. Regional and State flood frequency equations, which are based on traditional and nontraditional techniques, are being developed or updated to relate flood discharges to basin characteristics. These equations can be used to estimate the flood potential within ungaged basins throughout the State that have similar basin characteristics. In addition, a network analysis of the flood-gaging network is being conducted to determine where additional data

collection could most improve future flood-frequency estimates.

## Earthquake Hazards Studies in Southern Nebraska

The interior parts of continents are usually considered to be tectonically and seismically stable. However, recent surface-rupturing earthquakes in the United States, as well as in other parts of the world, raise concern for many States, including Nebraska, that are normally considered to be aseismic. The long-term behavior of faults in such areas is poorly known despite the potential threat that these faults may pose to populated regions. Additional studies of the history of Quaternary age faulting in stable continental regions are needed to characterize their short- and long-term behavior and to improve earthquake-hazard assessments in these largely aseismic areas.

The USGS is studying several suspected faults in Nebraska. One is exposed on the south shore of the Harlan County reservoir, southeast of Alma, and the second is just northeast of Ord. This study is one of many supported by the Nuclear Regulatory Commission. The objective of these studies is to provide paleoseismic data on suspected but unstudied faults in the stable central interior of the United States. Preliminary results from these studies show that faults can remain dormant for thousands of years, and then fail with little or no precursory seismic warning. Many of these faults are reactivated structures commonly associated with ancient rifts or suture zones that are within regionally uniform stress fields, driven by plate tectonic forces.

## Ground-Water-Quality Investigations

Nebraska has some of the most intensively cultivated and irrigated land in the Nation. As a result, ground water has become contaminated by agricultural chemicals in some areas. As part of their ground-water-management plans, each of Nebraska's 23 Natural Resources Districts (NRD's) is required to identify locations and concentrations of ground-water contamination and to monitor levels of selected contaminants. Many NRD's have established "ground-water management areas" where nonpoint-source contamination problems can be managed through the reg-

ulation of chemical and water applications or through other appropriate best-management practices. The establishment of such areas is underway in several additional NRD's as well.

In 1990, the USGS began a cooperative program to conduct a water-quality reconnaissance in selected NRD's. The resulting data help the NRD's to fulfill their responsibilities. The USGS either has completed or is conducting ground-water-quality investigations in the Nemaha, the North Platte, the Papio-Missouri River, and the Lower Platte South NRD's (fig. 2).

Under an alternative procedure, the State has designated some areas that are particularly susceptible to nitrate contamination of ground water as Special Protection Areas (SPA's). As part of this designation, NRD's are required to establish ground-water-quality-monitoring networks within the SPA's. These networks can be used to determine water-quality changes that result from alternative land-management practices. The USGS has completed or is currently involved in three SPA water-quality investigations in the Superior, the Upper Big Blue, and the Red Willow-Hitchcock areas (fig. 2).

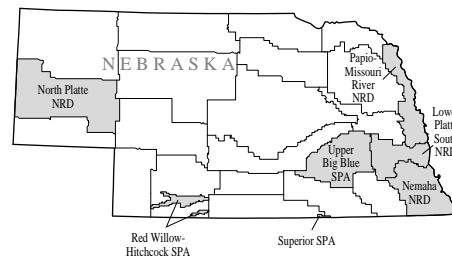


Figure 2. Special Protection Areas and Natural Resource District cooperative project study areas in Nebraska.

## 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 equals 2,000 feet on the ground). 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. Nebraska is covered by 1,427 maps at this scale, which are useful for civil engineering, land-use planning, natural-resource monitoring, and many other technical applications. These maps have long

been favorites with the general public for outdoor recreational uses, including hiking, camping, hunting, exploring, and back-country fishing expeditions.

## Geologic Mapping

STATEMAP is one of the external funding opportunities offered by the USGS National Geologic Mapping Program; agreements are open to all 50 State Geological Surveys. Typically, the Program focuses on such issues as ground-water quality and geologic hazards. The Program also addresses a range of resource issues, such as oil and gas assessments, coal quantity, sand and gravel resources, and economic mineral development. Geologic map data generated are archived at the State Geological Survey and within the National Geologic Map Data Base.

Work is currently continuing on the Alliance and the O'Neill 1:250,000-geologic maps. Preliminary geologic mapping in urban areas in eastern Nebraska is beginning.

## Geology in Urban Areas

The State Geological Surveys of Nebraska, Iowa, Kansas, and Missouri and the USGS have formed a partnership to conduct geologic studies that concern land-use issues in the Middle Missouri Basin. These studies are being conducted in a corridor that encompasses Omaha and Lincoln, Nebraska, Council Bluffs, Iowa, Kansas City, Missouri, and Kansas and Topeka, Kansas. Most of the areas between the cities consist of smaller urban centers and intervening rural areas that support intensive agricultural activities.

Geologic constraints, such as collapsing or expanding soils, landslides, subsidence, and flooding, affect land use and present other problems, especially in urban areas. Disposal of municipal and industrial wastes, which include hazardous waste, is of concern in terms of past practices and future needs. Erosion, sedimentation, and contamination from nonpoint sources are major issues in areas of agricultural and urban development. Geologic information obtained in these studies is essential to understanding the carrying capacity of the land, identifying potential consequences of land uses on the natural system, and determining methods to reduce or mitigate these consequences.

## Stream-Channel Stability

Many stream channels in eastern Nebraska were altered in the early 1900's to help alleviate flooding. Channel straightening has long been recognized as a cause of channel-stability problems, such as downstream deposition and upstream degradation and widening of the channel, which pose hazards to roads and bridges. In addition, the channel banks, which comprise highly erodible soils, were severely eroded by the floods of 1993. Many small county bridges failed or were closed as a result of the floods.

The USGS, in cooperation with the Pappo-Missouri River and the Lower Platte South NRD's, the DOR, the Nebraska Natural Resources Commission (NRC), the FHWA, the UNL, the Agricultural Research Service, and the U.S. Army Corps of Engineers, is examining the effects of channel instabilities on bridge structures and flood-plain resources in a 23-county area of eastern Nebraska.

Improved methods for anticipating future channel stability and geometry and the identification of possible types of remediation measures to stabilize the channels will benefit planners, structural designers, and resource managers by helping them make optimal economic use of resources in and near flood plains.

## Collection of Hydrologic Data

Flood and drought conditions may adversely affect wildlife habitat, human activity, and crop production. The USGS, in cooperation with more than 25 Federal, State, and local agencies, collects stream-flow data at numerous sites throughout the State. These data are critical for administering and managing water resources, determining the extent and severity of droughts, characterizing and predicting conditions during floods, and monitoring the effects of human activities on streamflow. In addition, the USGS collects water-quality information at surface- and ground-water sites throughout Nebraska as part of its cooperative program. Water-resource managers use these data to evaluate the suitability of water as a source of supply for specific uses and to monitor the effects of human activities on water quality. The USGS also compiles and reviews ground-water level data collected annually or semiannually by State or local agencies from more than 4,000

wells and from about 100 wells monitored continuously. These data are used to monitor changes in ground-water quantity and to provide a basis for sound ground-water management decisions in the State.

## National Water-Quality Assessment Program

The National Water-Quality Assessment (NAWQA) Program was established by the USGS to provide a hydrologically based, long-term method of assessing the quality of a large representative part of the Nation's water resources. A multidisciplinary approach to data collection (physical, chemical, and biological) is used to provide an integrated assessment of water quality within selected environmental settings, to assess trends in water quality, and to investigate the influence of natural and human factors on water quality over time. Water-quality information produced through the NAWQA Program will be useful to policymakers and water managers at Federal, State, and local levels. Two NAWQA Program studies are underway in Nebraska—the Central Nebraska and the South Platte Basins.

Selected results from the Central Nebraska Basins study (fig. 3) relate to water quality. Herbicides (atrazine and cyanazine) widely used in the production of row crops, especially corn, are found in many streams in concentrations large enough to exceed the U.S. Environmental Protection Agency (USEPA) drinking

water standard. Concentrations decrease significantly as the growing season progresses. These herbicides also are found in ground water but at concentrations that are much smaller than in surface water and seldom if ever exceed the drinking water standards. Nitrate is commonly found at concentrations that exceed the USEPA drinking water standard in shallow ground water in the Platte Valley (fig. 3), where large quantities of fertilizer are applied. Nitrate also is found in area streams. Most public water supplies derived from ground water in the Platte Valley are obtained from deeper wells that have smaller nitrate concentrations or from wells close enough to the Platte River that concentrations are diluted by infiltration of river water into the ground water.

## Digital Mapping

The USGS produces digital cartographic data in cooperation with the NRC. The data are useful for geographic information systems (GIS) analyses and applications that address land-use, natural-resource management, and environmental impact issues throughout the State. The USGS and the NRC cooperatively produced new digital elevation models (DEM's) and digital orthophotoquads (DOQ's) for Lancaster County in a recent pilot project. DOQ's are prepared by scanning aerial photographs and processing to correct for camera and relief distortion. DEM's portray the Earth's terrain as a sampled array of elevation values and are used

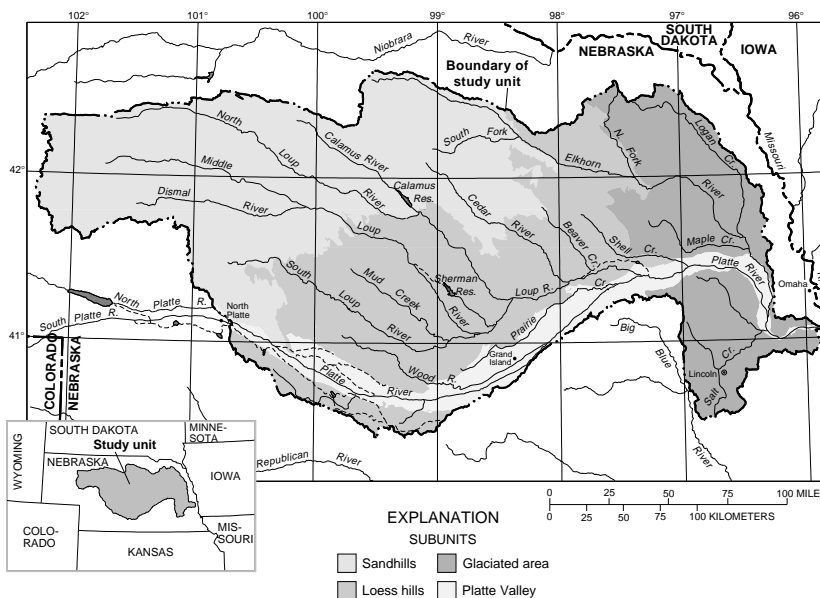


Figure 3. Subunits of the Central Nebraska Basin's study unit, National Water-Quality Assessment Program.

to correct for relief distortion in the DOQ source photographs. They also are used as a major data element in GIS analyses. The Lancaster County pilot project served as the model for implementing a partnership agreement between the two agencies to prepare new DEM's by using state-of-the-art production techniques and to produce DOQ's for the entire State.

## Sharing Spatial Data

The Competitive Cooperative Agreements Program was established by the Federal Geographic Data Committee (FGDC) through the USGS to help form partnerships with the non-Federal sector that will assist in the evolution of the National Spatial Data Infrastructure. This program provides funding to State and local government agencies, academia, and the private sector to encourage resource-sharing projects through the use of technology, networking, and interagency coordination. A variety of agencies in Nebraska, which include the Nebraska Library Commission and the Nebraska Geographic Information Systems Steering Committee, are participating in the Nebraska National Spatial Data Infrastructure Clearinghouse and Geospatial Metadata Initiative Project. It was designed to establish and manage a National Spatial Data Infrastructure clearinghouse node on the Internet, to enhance the compatibility of existing geospatial data in Nebraska with FGDC data standards; and to increase the awareness and use of the National Spatial Data Infrastructure clearinghouse network and FGDC standards among Nebraska's geospatial data users.

## Earth Science Information

The Earth Science Information Centers (ESIC's) provide information about USGS programs, products, and technological developments to the public. The ESIC in Lincoln was established under a cooperative agreement between the USGS and the CSD. As part of the national ESIC network, this office provides information on such earth science topics as cartography, geography, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geo-hydrology, aerial photography, and land use. It is supported by the USGS with reference materials, technical assistance, training and outreach activities, as well as access to USGS data bases.

## Outreach

Outreach is a USGS priority in Nebraska. It can be found in many forms, such as participation in festivals (Children's Groundwater Festival, Earth Wellness Festival, Earth Day), area grade/high school visits, visits to classes at UNL, and participation in Women in Science activities. The USGS works closely with The Groundwater Foundation; employees serve on its National Review Board and committees and as mentors in its Groundwater University Program.

Many educational materials are available for educators and the public. The USGS District Office in Lincoln has created a coloring book that describes the hydrologic cycle, which is displayed on the District's home page on the World Wide Web. Poster sets, pamphlets, and other educational materials may be obtained from the ESIC in Lincoln.

## Studies in National Parks and the Great Plains of Nebraska

The USGS Biological Resources Division (BRD; 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 central Great Plains. BRD research activities include documenting the wildlife values of the Conservation Reserve Program, which removed about 36 million acres of marginal farmland nationally from agricultural production and enhanced its value as food and cover for wildlife. BRD also works with other USGS Divisions on the development and implementation of a study of wetlands and water quality in the North and South Platte Rivers and their tributaries, which are critically important in the State for migratory birds and endangered species. Another significant project is coordinating vegetation mapping work at Scotts Bluff and Agate Fossil Beds National Monuments for the National Park Service Inventory and Monitoring Vegetation Mapping Program, which is a comprehensive project to map vegetation in 250 units of the National Park System to provide information for natural resource managers.

## For More Information

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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  
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