

United States Geological Survey

Programs in Nebraska



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

The U.S. Geological Survey (USGS) collects, compiles, and disseminates data on water, energy, and mineral resources in Nebraska. The USGS is known for its impartial data-collection and research mission—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 State, local, and Federal 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 man's activities on resources.

Management Systems Evaluation Area Research

Since 1991, the USGS has been participating in research with the U.S. Department of Agriculture and the University of Nebraska–Lincoln at the Management Systems Evaluation Area site near Shelton. The goal of this research is to develop best-management practices that reduce or reverse the gradual degradation of water quality in the uppermost aquifer resulting from agricultural practices. The USGS describes and defines the hydrogeologic system of the research area by use of data from a network of observation wells, aquifer tests, and a ground-water-flow model.

The model provides a better understanding of the hydrogeologic factors that affect the movement of nitrates and pesticides in the ground water at and near the study site. Information derived from the model will enable researchers to gain new insights and interpretations from the water-quality data and to determine the

effectiveness of management practices in reducing the effects of agriculture on water quality.

Desertification

The Sand Hills region, which is the largest dune field, stabilized or active, in the Western Hemisphere, covers nearly one-third of the State. Studies indicate that in this region, there may be a potential for “desertification,” a term that refers to productive land changing to nonproductive land whether from natural or human processes. One way this may occur is by the conversion of the sand

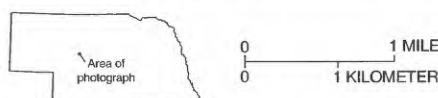
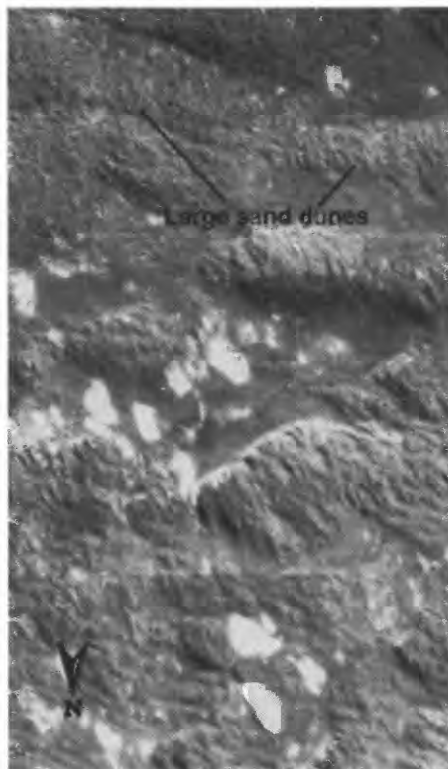


Figure 1. Part of the Nebraska Sand Hills. Bright areas depict active sand dune areas. (Aerial photograph, 1:80,000.)

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dunes from nonactive to active. In the Sand Hills, vegetation is the principal factor that contributes to stability of the dunes. Without soil and vegetative cover, these sand dunes may become mobile. An aerial photograph of part of the Nebraska Sand Hills is shown in figure 1.

If the sand dunes are reactivated, then the 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 movement. The USGS works closely with scientists at the Conservation and Survey Division of the Institute of Agriculture and Natural Resources (also known as the Nebraska Geological Survey), the Department of Geology, and the High Plains Climate Center, all located at the University of Nebraska–Lincoln.

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 local, State, and national levels.

Two NAWQA Program studies are underway in Nebraska—the Central Nebraska and the South Platte Basins. Three additional studies—the North Platte, the Kansas, and the Cheyenne–Belle Fourche River Basins—are scheduled to begin in 1997 (fig. 2). Communication and coordination among the USGS and water-management, and other water-resource agencies are key components of the NAWQA Program in the State. The results of the projects are distributed in a variety of reports to local, State, and Federal agencies and the public as results become available. The NAWQA Program also focuses on integrating results from several projects to provide information at regional and national scales.

Midwest Floods of 1993

In response to extensive flooding in the Midwest during summer 1993, the White House Interagency Floodplain Management Task Force directed seven Federal agencies to establish the Scientific Assessment and Strategy Team to determine the immediate effects of flooding

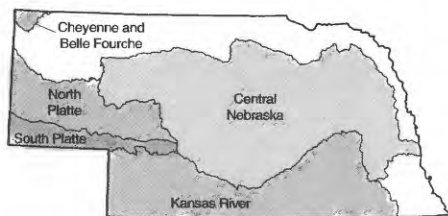


Figure 2. NAWQA study areas in Nebraska.

and longer term implications for floodplain management within the region. The team was hosted by the USGS because of its extensive computer-based technological capabilities, multidisciplinary staff, and experience in the development, scientific application, and management of large amounts of geographically referenced information. One of the team's initial objectives was to develop an interactive data base that contains various types of flood-relevant information for the affected nine-State region. The data base includes graphically referenced information on manmade structures, hazardous and toxic waste sites, and water-treatment facilities, land cover and land use, fish and wildlife habitats, rainfall, topography, surficial geology and soils, stream and river hydrology and hydrography, demography, and economic bases. Digital data bases for large geographic areas were compiled, and data for flood-related land-management and environmental research have been consolidated and made available through Internet-accessible programs for State planning officials and natural-resource investigators.

Partnership for the Missouri Basin Study

The State Geological Surveys of Nebraska, Iowa, Kansas, and Missouri and the USGS have formed a partnership to conduct geologic studies concerning 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, including 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. The identification, protection, and extraction

of construction materials present a continuing problem, as does reclamation of the mining areas. 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.

Mineral-Resource and Environmental Investigations of the Elk Creek Carbonatite

The Elk Creek carbonatite, located south of Lincoln, has the potential to be one of the largest global resources of niobium and rare-earth elements (REE). These REE's have many important applications in industry, including petroleum-cracking catalysis, steel alloying, and glass polishing, and as sources of permanent magnets and phosphorus for television and lighting.

The Elk Creek carbonatite is buried beneath about 500 feet of overlying rock and is known only from drill cores, which, until recently, have remained proprietary. Scientists from the USGS and the Conservation and Survey Division (CSD) of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln have studied drill cores. This study is providing baseline information regarding an assessment of the total geologic resources likely to be in the carbonatite unit and the identification, distribution, and abundance of potentially hazardous materials that may be associated with development of this unit.

Stream Channel Stability

Many stream channels in southeastern Nebraska were altered in the early 1900's to help alleviate flooding. Channel straightening has been recognized as a cause of channel-stability problems, such as deposition, erosion, or widening of the channel, which pose hazards to roads and bridges. In addition, the channels, which comprise highly erodible loess 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 is working with the Omaha District of the U.S. Army Corps of Engi-

neers, the Nebraska Natural Resources Commission, and the Federal Highway Administration to identify hydraulic and geomorphic factors that affect erosional processes at many stream sites in a six-county area of southeastern Nebraska. Assessment and prediction of adjustment trends in channel morphology are necessary to protect bridges and farmland and will provide a basis for decisionmaking in mitigation efforts.

Landslide Hazards

Since the mid-1980's, the USGS, in cooperation with the CSD has been assessing landslide hazards in the State. Determining the existence and potential for landslides is a necessary first step in planning cost-effective transportation routes and developing strategies for mitigation or reduction of damage. The USGS, in cooperation with the CSD and the Nebraska Department of Roads, has documented and developed methods for predicting the potential for landslides along the major transportation corridors in the State. Subsequent work by the CSD has been broadened to include the assessment of potential landslides beyond the major transportation corridors and the development of statewide maps useful for identifying areas of potential hazards.

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. Each of Nebraska's 23 Natural Resources Districts (NRD's), which were created as part of the State's ground-water-management plans, is required to identify locations and concentrations of ground-water contamination and to monitor levels of selected contaminants.

The State also has designated some areas that are particularly susceptible to nitrate contamination of the 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 to determine water-quality changes that result from alternative land-management

practices. The USGS has completed or is currently involved in three SPA investigations in the Superior, the Upper Big Blue, and the Red Willow-Hitchcock areas (fig. 3). The objectives of these investigations are to establish a ground-water-monitoring network within the SPA's, to determine the seasonal variability of nitrate concentrations in ground water, and to determine baseline concentrations of nitrates in the unsaturated zone above the aquifer. This information is needed to establish the movement rates of nitrogen from the land surface through the unsaturated zone to the aquifer.

In 1990, the USGS began a cooperative program with selected NRD's to perform a water-quality reconnaissance of each District with the following objectives: to determine the general chemical character of water, including concentrations of agricultural chemicals, major ions, radionuclides, organic chemicals, and trace elements in principal aquifers; to assess the principal factors that affect ground-water quality; and to establish a monitoring network to assess future changes in water quality. Currently (1995), the USGS either has completed or is involved in ground-water-quality investigations with four NRD's—the Nemaha, the North Platte, the Papio-Missouri River, and the Lower Platte South (fig. 3).

National Mapping Program

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). 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 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.

Earth Observation Data

Through its Earth Resources Observation System (EROS) Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite-image data products that cover Nebraska. Mapping photographs of some sites go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes. USGS scientists have been providing technical support in the use of a statewide block of Landsat satellite image data acquired recently. State resource-management agencies use the satellite data as a cost-effective means for interpreting land-cover characteristics.

The EROS Data Center also receives earth-observation images from sensors on board orbiting weather satellites to determine vegetation conditions, or relative "dryness" or "greenness" of vegetation

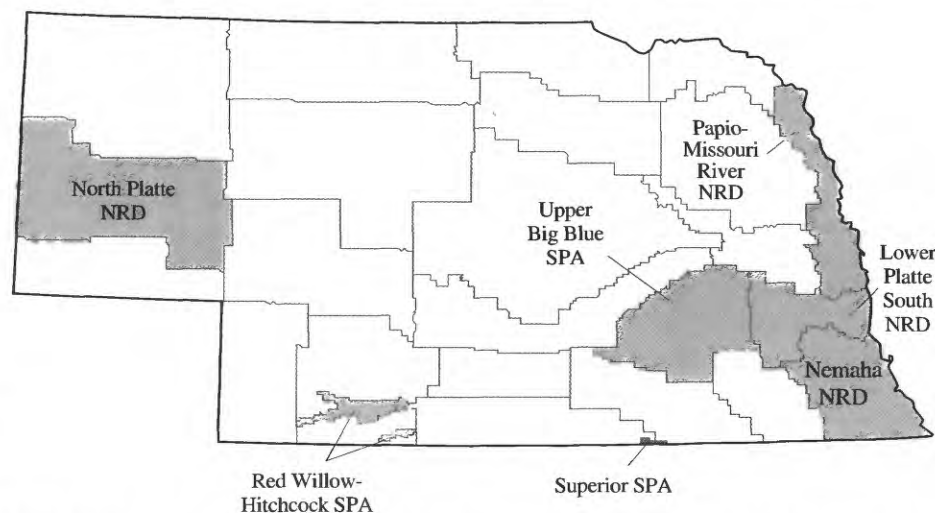


Figure 3. Special Protection Areas (SPA's) and Natural Resource Districts (NRD's) cooperative project study areas in Nebraska.

cover, over the conterminous United States. Weekly updates of greenness or dryness of vegetation condition are produced for use in the National Fire Danger Assessment Program. The information is transmitted electronically to the U.S. Department of Agriculture's National Computing Center in Kansas City, Missouri, where it is distributed nationally over computer networks to Federal and State fire-management agencies, which use the information to determine local fire danger conditions and, where appropriate, to issue safety advisories to the populace. Comparisons with historical data are made to measure current conditions against normal conditions and to construct computer models that use vegetation conditions and weather information to forecast fire-danger conditions. These forecasts are used in the allocation of regional firefighting resources.

Digital Map Data

The USGS, in cooperation with Nebraska Natural Resources Commission (NRC), jointly produce computerized (digital) spatial data. The data are useful for geographic information system analyses and applications that address various land-use and environmental issues in selected areas of the State.

The USGS also is cooperating with the NRC to produce digital elevation models and digital photographs for Lancaster County. This project will be the model for producing statewide coverage. The digital photographic data sets are being developed from statewide aerial photographic coverage completed in 1993–94.

Collection of Hydrologic Data

Periods of drought may adversely affect crops and wildlife habitat. During flood periods, loss of life and substantial property damage may occur. The USGS, in cooperation with more than 25 local, State, and Federal agencies, collects streamflow 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 numerous cooperative programs with Federal, State, and local agencies. Locations of current and historical water-quality data-collection sites are shown in figure 4. These data are used 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 collects or compiles and

reviews ground-water-level data collected by local or State agencies from more than 4,000 wells that are measured on an annual or semiannual basis and from about 100 wells that are 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.

Cooperative Programs

Work is pursued in partnership with many State and local agencies. A few examples of cooperators not previously mentioned are the Nebraska Department of Environmental Quality, The Nebraska Department of Water Resources, the City of Lincoln, and the following Natural Resources Districts: Central Platte, Upper Republican, and Twin Platte.

The USGS also provides support to the Nebraska Water Resources Center, which conducts a program of research, education, and information and technology transfer in the State.

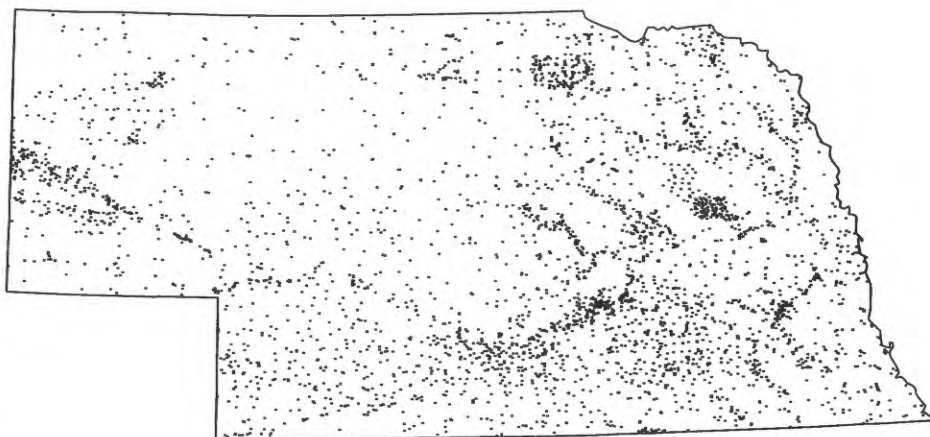


Figure 4. Water-quality data-collection sites in Nebraska.

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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.