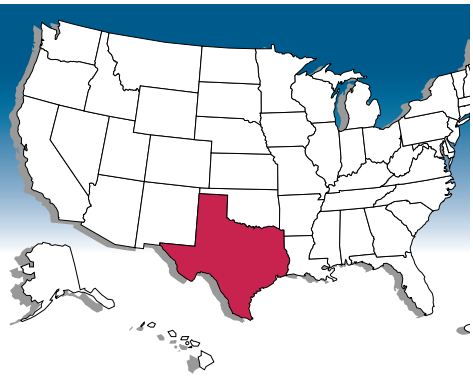
U.S. Geological Survey Programs in Texas



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

The U.S. Geological Survey (USGS) is the Federal Government's primary source of data on the quantity and quality of the Nation's water resources, its principal civilian map making agency, and its primary provider of information on natural hazards and mineral, energy, and biological resources. The USGS makes unbiased scientific information available equally to all interested parties.

Most USGS work in Texas involves the appraisal of the State's water resources in cooperation with more than 80 local, State, and Federal agencies. The foundation of a wide range of hydrologic data-collection and interpretive programs is the stream-gaging program. The Texas network of streamflow-gaging stations, which provides water data for water-resources planning and design, hydrologic research, and operation of water-resources projects, is part of a nationwide aggregation of networks that is unique because of nationally consistent, prescribed standards by which the data are collected and processed.

The USGS continues to expand collection of data for paper and digital maps. The best-known products of the USGS in Texas are its 1:24,000-scale topographic maps. These maps depict basic natural and cultural features of the landscape. Maps at this scale (1 inch on the map represents 2,000 feet on the ground) are useful for civil engineering, land-use planning, and natural-resource monitoring, and have long been favorites with the general public for a wide variety of outdoor uses.

The USGS also continues to monitor geologic conditions in Texas associated with rare but potentially dangerous earthquakes. Recently, the Nation Biological Service (now the Biological Resources Division) joined the USGS to continue their appraisal of the nation's biological resources.

Monitoring Floods, Droughts, and Earthquakes

In fall 1994, the USGS measured major floods in the Houston area. The 100-year flood (the peak streamflow that has a 1-percent chance of being equaled or exceeded in any given year) was equaled or exceeded at 16 of the 43 stream sites monitored. By 1996, the opposite extreme—drought, severe in places and moderate in others—gripped the entire State (fig. 1). USGS monitoring of drought conditions is as meticulous and intense as the monitoring of flood conditions. For the first 6 months of 1996 for each of 16 long-term streamflow-gaging stations distributed throughout the State, streamflow volumes, which are a common indicator of hydrologic conditions, ranged from 0.2 to 44 percent of the mean volume. Streamflow volumes for the first 6 months of 1996 set record lows for 3 of the 16 stations.

Figure 1. Severe drought in Central Texas is reflected by the dry, cracked streambed of the Pedernales River, July 1996. Mean annual flow of the Pedernales near the site of this photograph is about 200 cubic feet per second.

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In recent years, the USGS, in cooperation with local, State, and Federal agencies in Texas, has made a concerted effort to replace outdated monitoring equipment with state-of-the-art Data Collection Platforms (DCP's). The USGS operates about 320 DCP's at stream sites throughout the State. The DCP's transmit stream elevations or water-quality data to a satellite, which, in turn, transmits the data back to a local ground station and into the USGS computer system. These data generally are transmitted at 4-hour intervals, but all DCP's are being programed to transmit data more frequently on a "storm-event" basis—a feature that allows streamflow data during floods to reach users of the data almost instantly. DCP technology, together with the Internet-based World Wide Web (WWW; see p. 3), is bringing the USGS to its goal of making realtime hydrologic data available to water managers and the public.

In 1995, a magnitude 5.3 earthquake struck the Alpine–Marathon area of Texas. The largest historical earthquake, magnitude 6.4, to strike this region occurred in 1931 near Valentine. Both earthquakes caused damage; however, neither was large enough to rupture the ground surface. Large, surface-rupturing earthquakes (magnitude greater than 6.5) have not occurred in west Texas in historic times, but geologic

evidence suggests that they might have in prehistoric times. The USGS, in cooperation with the Bureau of Economic Geology, has recently completed a compilation of data on potentially active faults in west Texas and adjacent Mexico. The compilation includes a conventional map (1:500,000 scale) and fully documents published information on 24 faults with evidence of surface rupture within the last 1.6 million years. The compilation is particularly useful for seismic hazard evaluation of regions, such as west Texas, that have low seismicity. The compilation is the first of many similar State and regional compilations that are planned for the United States.

Water-Quality Trends

The USGS has been using age-dated bottom-sediment cores from reservoirs, wetlands, and estuaries in Texas to evaluate historic water-quality trends in upstream watersheds. The technique, which was developed as a part of the National Water-Quality Assessment Program and subsequently applied in other USGS studies in Texas, is particularly useful because appropriate historic water-quality data are lacking for long-term trends assessment.

One of the first sites where the USGS applied the technique is White Rock Lake, which is a 2-square-mile reservoir in northeastern Dallas. Soils from the watershed have been eroding from the land surface into streams and subsequently accumulating on the bottom of the reservoir since its construction in 1912. By analyzing discrete sections of age-dated sediment cores, scientists are able to reconstruct water-quality conditions associated with the change from agricultural to urban land use and with the implementation of more stringent environmental controls.

For example, a concentration-depth profile of the insecticide DDT in bottom sediments from White Rock Lake with a history of deposition indicated (fig. 2) shows that DDT was first detected in sediments deposited in about 1942. Concentrations peak in sediments deposited in about 1963 and decrease by a factor of more than 25 from 1963 to 1994. Production of DDT in the United States began in 1939, peaked in the early 1960's, and declined from the early 1960's until 1972 when its use was banned. (The U.S. Environmental Protection Agency banned all uses of DDT primarily because amounts were building up in the environment and some cancer tests in laboratory animals showed positive results.)

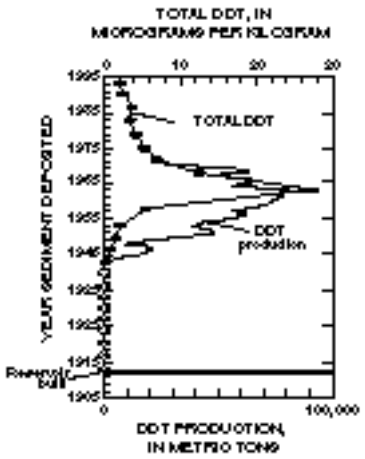

Figure 2. Concentration of total DDT in bottom sediments of White Rock Lake in Dallas, Texas.

Detection of DDT in the upper parts of the core indicates that DDT continues to enter White Rock Lake, presumably in streams that carry soils eroded from the watershed.

U.S.–Mexico Border Activities

With the adoption of the North American Free Trade Agreement, interest in environmental issues associated with economic development has increased on both sides of the U.S.–Mexico border. Texas is one of four States involved in environmental and mapping activities in the area along the border (fig. 3). The USGS has several relevant initiatives. For example:

- Within the Rio Grande/Rio Bravo international watershed, the USGS is using age-dated bottom-sediment cores from reservoirs to define historic trends in water quality. This approach is being applied to Cochiti Lake and Elephant Butte Reservoir, New Mexico, International Amistad Reservoir, Texas/Coahuila State, Mexico, International Falcon Reservoir, Texas/Tamaulipas State, Mexico, and Laguna Madre, Texas. Occurrence and trends in radioactive elements in the upper Rio Grande Basin and pesticides and trace metals in the middle and lower parts of the Basin are of particular interest. The study is a cooperative effort with the Texas Natural Resource Conservation Commission, the El Paso County Water Conservation and Improvement District No. 1, the U.S. Bureau of Reclamation, and the Pueblo de Cochiti Tribe, in consultation with the International Boundary and Water Commission, the New Mexico Environment Department, and the U.S. Department of Energy.
- The USGS is acquiring data needed in the border region of Texas to address surface-water quality issues that could arise as the region continues to develop.

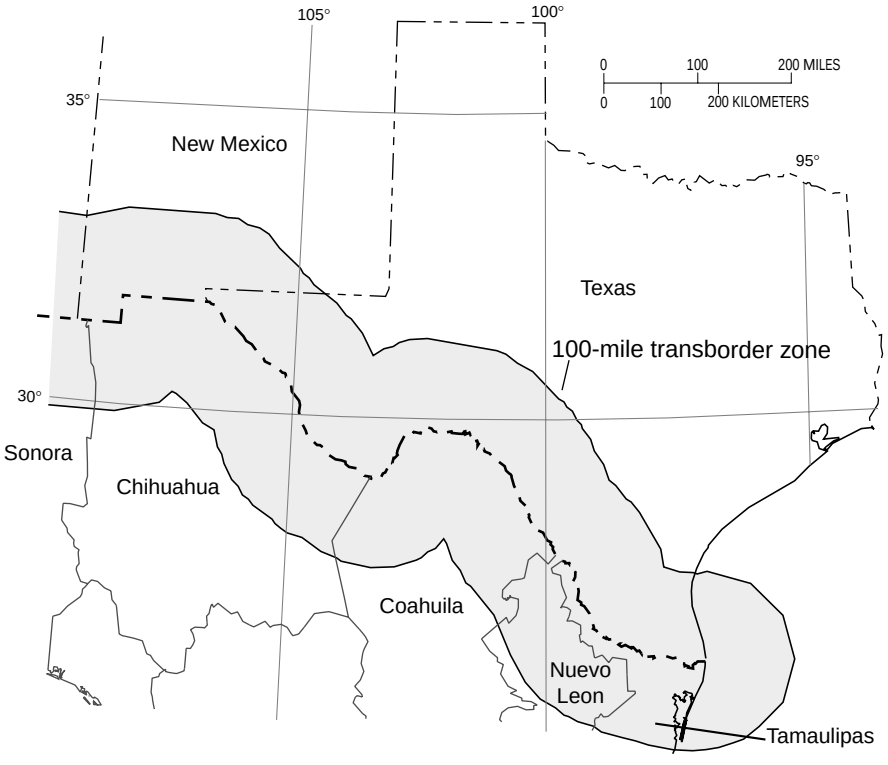

Figure 3. USGS environmental and mapping activities in the Rio Grande /Rio Bravo border region are increasing as a result of the North American Free Trade Agreement.

- Data for future constituent trend analyses and studies of constituent transport and of processes, such as storage and remobilization of sediments and associated contaminants, are being collected. Data-collection sites are on the mainstem of the Rio Grande (six sites), at the Pecos River near Langtry, and at the Arroyo Colorado near Harlingen. The new water-quality initiative in the basin is associated with the USGS National Stream Quality Accounting Network, the focus of which is on the quantity and quality of water that moves within and from large river basins.

- Ground water is becoming increasingly important in parts of the border region, particularly in the El Paso area where freshwater resources are scarce, and the Laredo area, one of the fastest-growing urban areas in the United States. In the El Paso area, withdrawals of ground water at rates exceeding those of natural recharge have reduced supplies; a related effect is land subsidence from compaction of the aquifer system. The USGS is cooperating with the City of El Paso to construct a regional computerized hydrologic model to simulate the flow of fresh and saline water and compaction in the aquifer system. The model will help the City evaluate future water-management schemes. Increasing demand for water associated with industrial development and population growth in Laredo is causing that city to consider ground water as a source of additional public supply. Currently (1996) the Rio Grande supplies all of the municipal water for Laredo. The USGS is cooperating with the City in a multi-year study of the water-yielding potential and the quality of water of selected aquifers in the Laredo area.

- The USGS is cooperating with local, State, and Federal agencies and other organizations in the United States and Mexico to develop digital map data for the border area. These data support a wide range of studies by scientists of environmental and resource-management agencies on both sides of the border. Cartographic data are being collected within a 100-mile zone on each side of the border (fig. 3). In 1996, the USGS acquired color-infrared aerial photographs for the 100-mile zone on the U.S. side of the border. The USGS is producing digital orthophotoquads from the color-infrared aerial photographs. A digital orthophotoquad combines the image characteristics of a photograph with the geometric qualities of a map. The digital orthophotoquads are useful for revising and upgrading various maps, which include the popular USGS 1:24,000-scale topographic maps, along the border.

New Maps for Texas

The USGS is preparing 485 digital orthophotoquads that cover the Texas Gulf Coast through a partnership between the Texas Natural Resource Conservation Commission, the General Land Office, and the USGS. The Texas Natural Resource Conservation Commission uses digital orthophotoquads for various purposes which include watershed delineation and building hydrologic models. The General Land Office uses digital orthophotoquads to support oil-spill prevention and mitigation, to locate sensitive wildlife habitat areas, and to depict current shorelines and land-water contacts.

Digital orthophotoquads are being prepared for much of east and central Texas as a result of a partnership between the Texas Department of Information Resources and the USGS. The Natural Resources Conservation Service, the Consolidated Farm Services Agency, and the USGS are providing funding and source materials. The digital orthophotoquad data are being held by the Texas Natural Resources Information System and also are being archived by the USGS for public distribution.

National Coal Assessment

Texas ranks sixth in coal production in the United States. Most coal in the Gulf Coast area is used as fuel for electric power-generating plants. In the National Coal Assessment in Texas, the USGS is working with the Bureau of Economic Geology and the Railroad Commission of Texas to provide high-quality, organized information and interpretations on the location, quality, and quantity of the coal to be mined during the next several decades. Particular attention is being given to the characterization of hazardous air pollutants identified by the 1990 Clean Air Act Amendments.

Potential for Desertification of the Texas High Plains

Desertification is the loss of productive land. A cooperative study by the USGS, the Museum of Texas Tech University, and the University of Wisconsin suggests that stabilized sand dunes on the Texas High Plains could become active with only slight changes in climate. Sand dunes presently stabilized by sparse vegetation occur over much of the Texas Panhandle and adjacent States. Radiocarbon dating and soils studies indicate that more than 1 million acres of these dunes have been active in the past 1,000 years. Historical observations and examination of archival aerial photographs indicate appreciable areas of dune activity in the 19th century and during the 1930's drought. In a 21st century "greenhouse" climate or even under natural climatic cycles, the potential for reactivation of these dunes is high. Activation of presently stabilized sand dunes would significantly impact grazing, agriculture, and transportation routes in the Texas Panhandle.

Texas Earth Science Information on the World Wide Web

The WWW, together with DCP technology, is allowing public Internet access to up-to-the-day, if not up-to-the-minute, hydrologic data. The USGS has placed a vast amount of hydrologic data and information for Texas on the WWW. By using any Internet browser, people can locate, view, and retrieve data, text, and graphical information generated by the USGS. Public access to the data and information is through the Texas USGS website at:

http://txwww.cr.usgs.gov/

The Texas USGS website is continually evolving and improving. Currently (1996), available data include realtime and historic streamflow data, water-quality and groundwater data, peak-discharge information, and monthly precipitation data (obtained from the National Weather Service). For example, a canoeist interested in current streamflow conditions on the Guadalupe River in central Texas can access and retrieve an up-to-date hydrograph (or tabular data) of flow at the USGS streamflow-gaging station at Comfort. Each of the online data bases allows searching for information by county, hydrologic basin, or keyword search.

The Texas USGS website also contains regularly updated information about ongoing activities, staff directories, brief descriptions of current projects in Texas in easily retrievable formats, and links to other online sources of natural-resources information. The USGS library in Texas maintains reference material online, which includes bibliographic references, report abstracts, and the entire contents of selected recent publications.

The USGS also is assisting local and State government agencies, universities, and private firms to develop and make accessible on the WWW spatial data that incorporate Federal Geographic Data Committee (FGDC) policies and standards. This assistance comes through the National Spatial Data Infrastructure (NSDI) Competitive Cooperative Agreements Program (CCAP), which was established by the FGDC through the USGS. One of three recent CCAP grants awarded to Texas will enable the University of Texas at Dallas, Bruton Center for Development Studies, to establish a NSDI website with procedures in place to make its data holdings consistent with FGDC standards.

Earth Science Information Centers

Earth Science Information Centers (ESIC's) and their affiliates nationwide provide information to the public about USGS programs, products, and technological developments. The Texas Natural Resources Information System in Austin is an ESIC affiliate. As part of the national ESIC network, this office provides information on cartography, geography, digital data, remote sensing, geology, geophysics, geochemistry, 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.

A New USGS Division—Biological Resources

The USGS in Texas is working with others to provide the scientific understanding and technologies needed to support the sound management and conservation of the State's biological resources. For example:

- The USGS is cooperating with government agencies and private entities on long-term research at Padre Island National Seashore to increase understanding of five species of threatened or endangered sea turtles of the northwestern Gulf of Mexico. Data are being gathered to help scientists determine ways to protect, manage, and recover sea turtle populations (fig. 4).
- A series of studies in partnership with State and Federal agencies is ongoing at Caddo Lake, which is a unique wetland in northeastern Texas and a critical resting site during migration for two declining warbler species.
- USGS scientists serve on technical advisory committees for several oil companies that fund major research projects in the Gulf of Mexico.
- USGS toxicologists contribute to oil-spill contingency planning in Galveston Bay and other critical areas.

Figure 4. Research Biologist Donna Shaver, aided by National Park Service personnel and beach visitors, investigate one of the first two confirmed returnees associated with an international, multi-agency, experimental project to establish a secondary nesting colony of Kemp's Ridley sea turtles at Padre Island National Seashore, May 1996. The only remaining nesting ground for this turtle is in Mexico. The turtles stay at sea about 12 years before returning to their nesting ground to reproduce. (Photograph by Carolyn Gorman, National Park Service.)

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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