

# USGS GeoData

Some of the primary responsibilities of the U.S. Geological Survey (USGS) National Mapping Program (NMP) are to make available maps, images, spatial data, remote sensing data, and related information; provide assistance in selecting, acquiring, and using geographic and cartographic products; and design, print, and distribute maps of the National Atlas. It coordinates Federal topographic mapping and digital cartographic activities and provides leadership in the development and advancement of surveying and mapping technology.

The primary series of standard digital data types created by the NMP is known as USGS GeoData. These data types are as follows:

- Digital Elevation Model (DEM)
- National Elevation Dataset (NED)
- Digital Raster Graphic (DRG)
- Digital Orthophoto Quadrangle (DOQ)
- Digital Line Graph (DLG)
- National Hydrography Dataset (NHD)
- National Land Cover Dataset (NLCD)
- Geographic Names Information System (GNIS)

This booklet shows samples of the data with brief descriptions and applications.

## Digital Elevation Model Data

DEM data are records of terrain information in the form of a sampled array of data at regularly spaced horizontal intervals. The collection methods and sources of DEM data have varied greatly throughout the history of the product. The USGS now uses primarily cartographic sources rather than photogrammetric sources as input to the DEM product. Cartographic sources include contours from DLG hypsography data and scanned contours from USGS topographic maps. Photogrammetric sources include the use of aerial photographs with manual or automated stereoplottting devices to create DEM's.

The USGS currently produces DEM products in the following units of coverage: 7.5-minute DEM, 30-minute DEM, 1-degree DEM, 7.5-minute Alaska DEM, and 15-minute Alaska DEM. The most widely used format is the 7.5-minute DEM, where the area of coverage corresponds directly to the 1:24,000-scale USGS topographic map series. The data are stored in a native (ASCII) file format.

### Applications of DEM Data

DEM data are used in various applications, such as civil engineering (road design, line-of-sight operations, site planning, and volumetric calculations in building dams and reservoirs), earth sciences (hydrological, slope, and aspect studies, terrain modeling, and shaded-relief mapping), and surveying and photogrammetry (source data for digital orthophotos and hypsographic data for topographic mapping).

Additional information about DEM data and the DEM program is available through the Internet at [rockyweb.cr.usgs.gov/elevation/](http://rockyweb.cr.usgs.gov/elevation/).



Shaded-relief map of the contiguous United States created from the National Elevation Dataset. ▶

## National Elevation Dataset

The NED is a new raster product assembled by the USGS. The NED is designed to provide national elevation data in a seamless form with a consistent datum, elevation unit, and projection. Data corrections were made in the NED assembly process to minimize artifacts, permit edge matching, and fill small areas of missing data. The NED has a resolution of 1 arc-second (approximately 30 meters) for the conterminous United States, Hawaii, and Puerto Rico and a resolution of 2 arc-seconds for Alaska.

NED data sources have a variety of elevation units, horizontal datums, and map projections. In the NED assembly process, the elevation values are converted to decimal meters as a consistent unit of measurement, the North American Datum of 1983 (NAD 83) is consistently used as the horizontal datum, and all the data are recast in a geographic projection. Older DEMs have been

filtered during the NED assembly process to minimize artifacts commonly found in data produced by methods that are now obsolete. Artifact removal greatly improves the quality of the data. As higher resolution or higher quality data become available, the NED is updated to incorporate the best available coverage. The USGS 7.5-minute and 15-minute digital elevation products are nearing completion for the conterminous United States and Alaska respectively, and the NED will soon incorporate these sources. For the small areas that are not yet covered, the lower resolution 30-minute and 1-degree USGS DEM's were interpolated to obtain values used in the NED. A customer can identify the requested area graphically through the Internet browser. That area of interest will be extracted from the NED and from the spatially referenced metadata and formatted for delivery. The data will be available to download from the Internet in the Spatial Data Transfer Standard (SDTS) format, using file transfer protocol (ftp), and it will also be available on standard distribution media.



### Applications of the NED

Elevation data are an essential part of many earth science applications. They are used for such diverse purposes as providing shaded-relief backgrounds, establishing stratification in land cover classification, doing geometric and radiometric correction of remotely sensed data, indicating landform characteristics such as slope and aspect, and analyzing synthetic drainage networks and watershed delineations through the use of geographic information systems (GIS). More information on the NED is available through the Internet at [edcnts12.cr.usgs.gov/ned](http://edcnts12.cr.usgs.gov/ned).



Example of a shaded-relief digital raster graphic showing a part of the Juneau, Alaska, 1:63,360-scale DRG combined with digital elevation model data. This image is intended

## Digital Raster Graphic Data

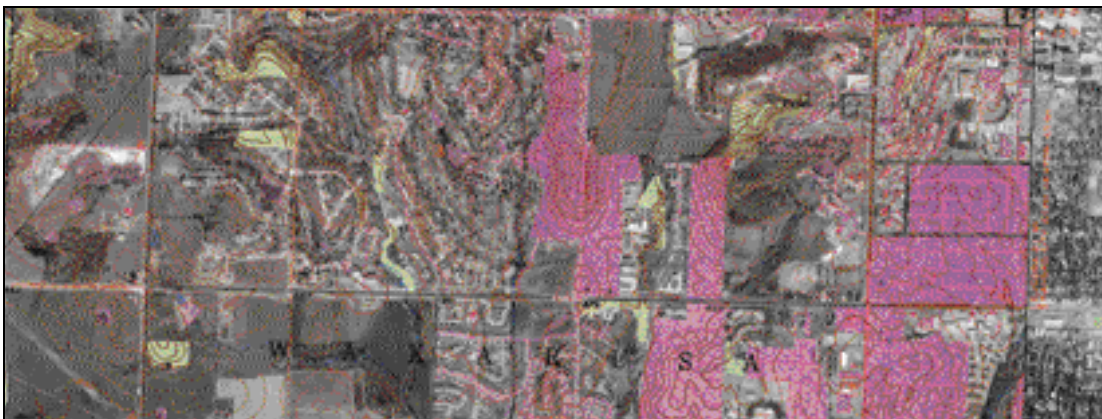
A DRG is a scanned image of a USGS topographic map. The resolution of the resulting image is 250 dots per inch. Standard color values are maintained for all files, and a total of 13 colors can be incorporated in any given file. The file is formatted in the Georeferenced Tagged Image File Format (GeoTIFF), which is easily manipulated by most imaging software. The scanned image includes all of the original map collar information. The image inside the map neatline is referenced to the Universal Transverse Mercator (UTM) projection. The datum for the file will be the same as it was for the source map (NAD 27 or NAD 83). File sizes are typically between 4 and 25 megabytes, depending on the density of information within the respective map.

### Applications of DRG Data

The DRG is an effective mapping tool, but its full potential for digital applications is realized when it is used in combination with other data, such as DOQ and DLG data, for digital map revision. The DRG can also be combined with a DEM for creating shaded-relief products. In addition, the DRG can be used with a global positioning system (GPS) for determining the location of way points in preparation for field work. The UTM or geographic coordinates can be determined for select locations from the DRG and stored in the GPS unit for future use. Additional information about DRG data is available through the Internet at [mcmcweb.er.usgs.gov/drg/](http://mcmcweb.er.usgs.gov/drg/).



A digital raster graphic image depicting a portion of the Montpelier, Vermont, 1:24,000-scale quadrangle.



A combined digital raster graphic and digital orthophoto quadrangle image of a part of the Lawrence, Kansas, 1:24,000-scale quadrangle. Each data type has been displayed as 50 percent of the total image. Applications such as this are used in data revision processes.

## Digital Orthophoto Quadrangle Data

A DOQ is a computer-generated image of an aerial photograph, in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Standard DOQ's produced by the USGS are either grayscale or color-infrared (CIR) images with a 1-meter ground resolution. The individual files cover an area that is one-quarter of a standard 1:24,000-scale USGS topographic quadrangle, so that the resulting data are at a scale of 1:12,000. Between 50 to 300 meters of overedge are provided to allow smoother paneling to adjacent images. Files are formatted either as a standard USGS DOQ 8-bit binary image or as a GeoTIFF file. File sizes are typically 50 megabytes for the grayscale and 150 megabytes for the CIR images.

The USGS also distributes a limited number of county DOQ data on CD. They consist of individual, Joint Photographic Experts Group (JPEG) compressed DOQ files that cover select counties.

### Applications of DOQ Data

The detail provided by the DOQ allows users to evaluate their data for accuracy and completeness, make real-time modifications to their data, and even generate new files. DOQ data can be incorporated into a GIS as a base layer for displaying, generating, and modifying other digital data. Additional information about DOQ data is available through the Internet at [mapping.usgs.gov/www/ndop/](http://mapping.usgs.gov/www/ndop/).



A color-infrared digital orthophoto quadrangle of a part of the Holder, Florida, 1:12,000-scale quadrangle.

## Digital Line Graph Data

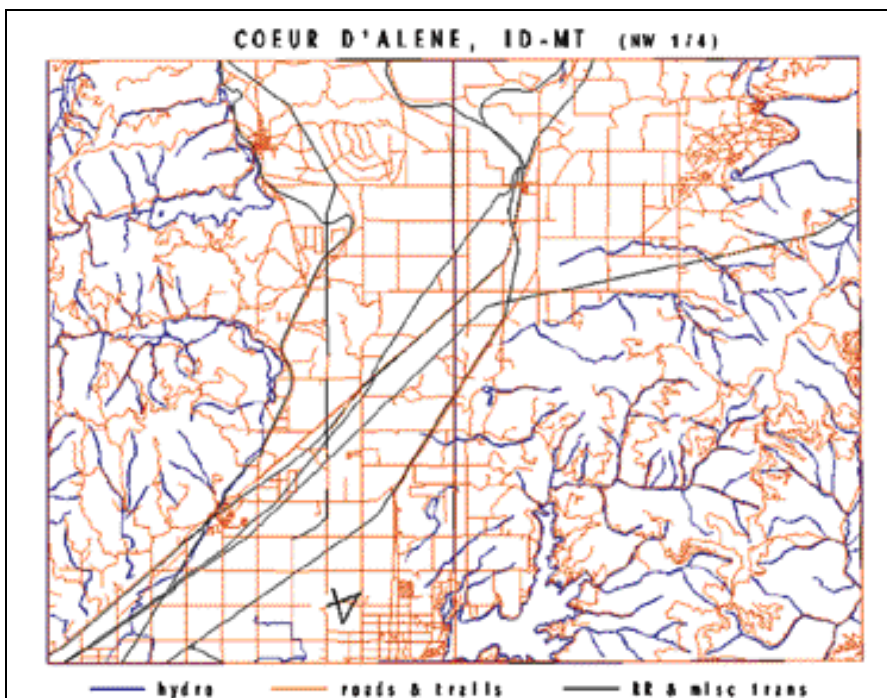
A DLG is a vector representation of the line information found on USGS topographic maps. The data are collected as distinct units, and each unit contains a specific category of data. The vectors are tagged with attribute codes that identify the major category to which the data element belongs. Additional attribute codes can be assigned to a data element when more descriptive information is needed. The data are processed to provide topological structure, which ensures that the spatial relationships inherent in the source map are preserved. The data are stored in the USGS optional file format.

There are nine units or categories of large-scale DLG data, which include (1) Public Land Survey System (PLSS), including township, range, and section line information; (2) boundaries, including State, county, city, and other national and State lands, such as forests and parks; (3) transportation, including roads and trails, railroads, pipelines, and transmission lines; (4) hydrography, including flowing water, standing water, and wetlands; (5) hypsography,

including contours and supplementary spot elevations; (6) nonvegetative features, including lava, sand, and gravel; (7) survey control and markers, including horizontal and vertical positions (third order or better); (8) manmade features, including cultural features not collected in other data categories, such as buildings; and (9) vegetative surface cover, including woods, scrub, orchards, vineyards, and vegetative features associated with wetlands.

### Applications of DLG Data

Large-, intermediate-, and small-scale DLG data are useful in the production of cartographic products (for example, base maps). Also, the data are structured to support GIS technologies. A typical use of base category digital cartographic data is to combine them with other geographically referenced data, thus enabling various automated spatial analyses. Additional information on DLG data is available through the Internet at [edcwww.cr.usgs.gov/nsdi/gendlg.htm](http://edcwww.cr.usgs.gov/nsdi/gendlg.htm).



This graphic shows a part of the Coeur D'Alene, Idaho-Montana, 1:100,000-scale digital line graph. Separate data layers depicting transportation and hydrography have been combined into one data file.

## National Hydrography Dataset

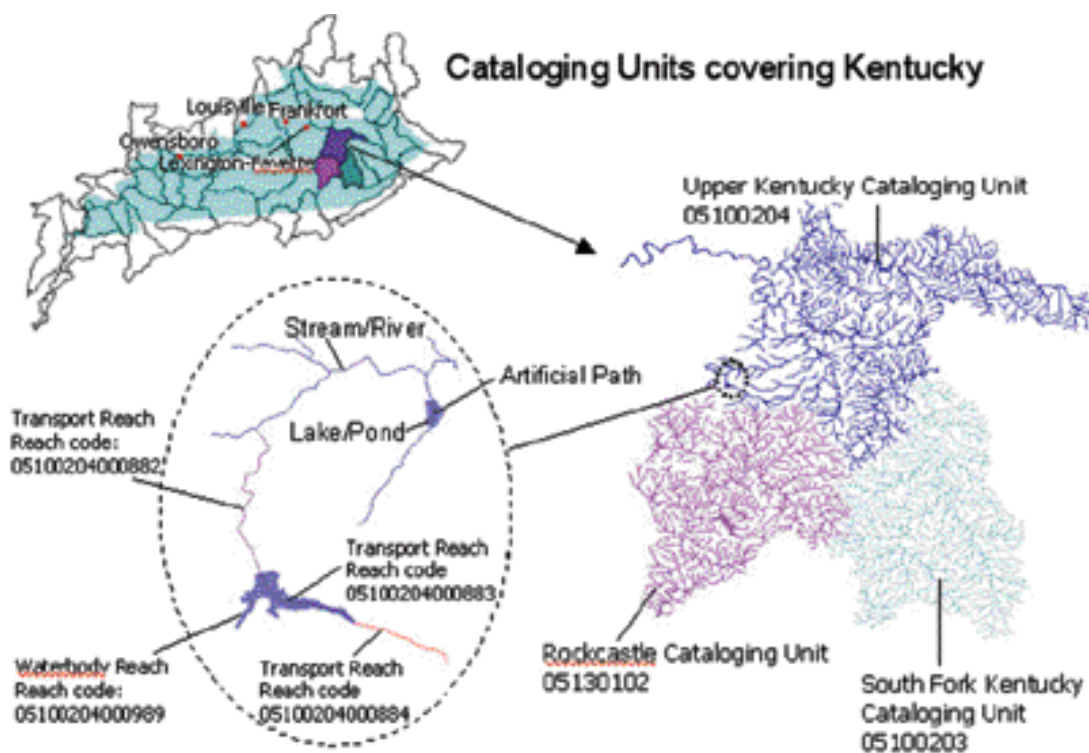
The NHD is a comprehensive set of digital spatial data that contains information about surface water features, such as lakes, ponds, streams, rivers, springs, and wells. Within the NHD, surface water features are combined to form “reaches,” which provide the framework for linking water-related data to the NHD surface water drainage network. These linkages enable the analysis and display of these water-related data in upstream and downstream order.

The NHD is based on the content of USGS DLG hydrography data integrated with reach-related information from the Environmental Protection Agency (EPA) Reach File Version 3 (RF3).

Although initially based on 1:100,000-scale data, the NHD is designed to incorporate and encourage the development of higher resolution data required by many users. Complete coverage for the United States is expected to be available sometime early in the year 2000. Delivery formats will be available in Arc/Info workspaces and, eventually, in the SDTS format.

### Applications of NHD Data:

The applications of NHD data are similar to those of DLG hydrography data. Information and data files for the NHD are available through the Internet at [nhd.usgs.gov/](http://nhd.usgs.gov/).



This graphic depicts the various levels of hydrologic cataloging units as defined by the National Hydrography Dataset.



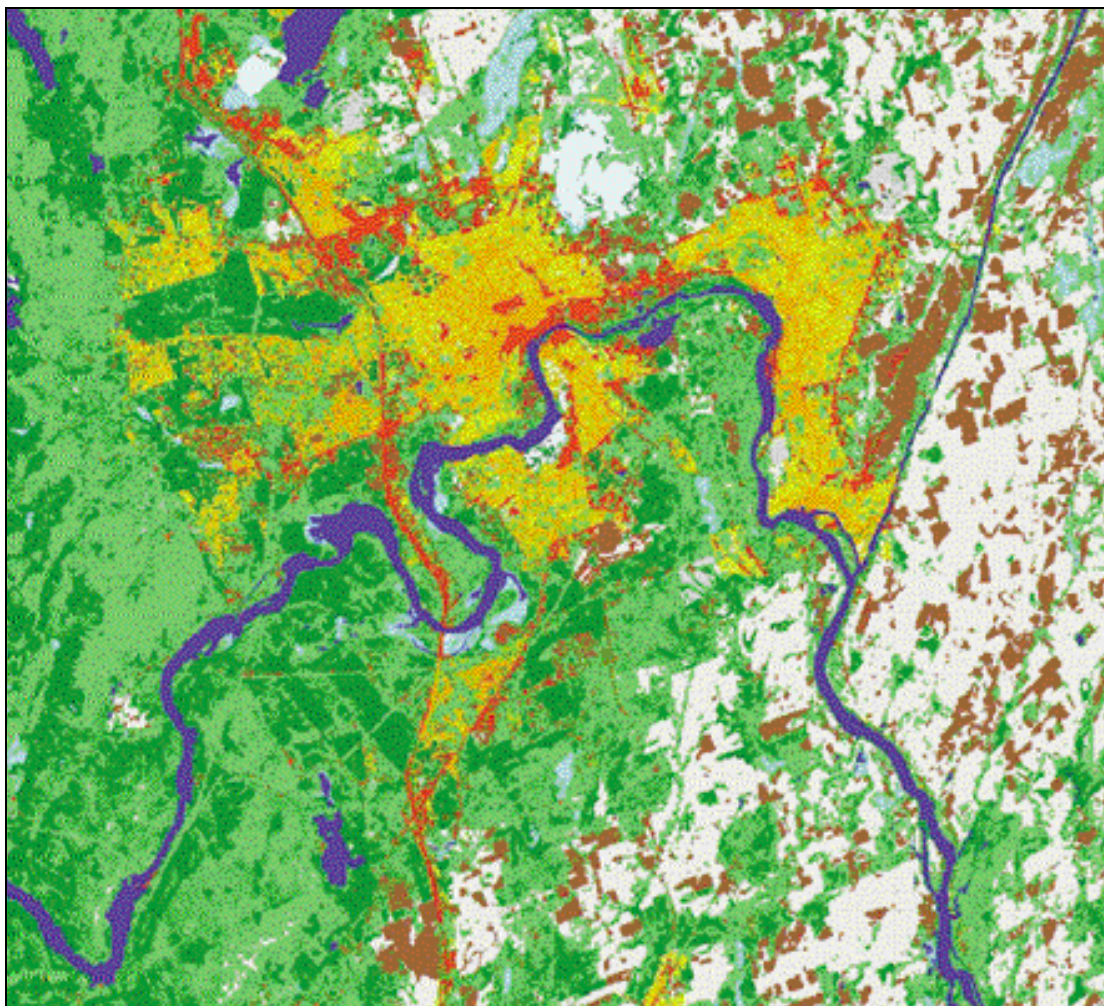
## National Land Cover Dataset

The NLCD project is part of the interagency Multiresolution Land Characterization (MRLC) initiative involving the USGS, the EPA, the National Oceanic and Atmospheric Administration, and the U.S. Forest Service. These agencies need a nationally consistent land cover data set, and in 1993 they combined financial resources to purchase Landsat thematic mapper data covering the entire United States. Besides the satellite data, various supplemental information, including topography, census, agricultural statistics, soil characteristics, other land cover maps, and wetlands data, is used to determine and label the land cover type for each 30-meter pixel. The project delineates 21 classes of land cover

mapped, using consistent procedures for the entire United States. The data are available on CD in the GeoTIFF format.

### Applications of NLCD Data:

The NLCD can be used for many different national and regional applications, including watershed management, environmental inventories, transportation modeling, fire risk assessment, and land management. Information about the NLCD is available through the Internet at [edcwww.cr.usgs.gov/programs/lccp/](http://edcwww.cr.usgs.gov/programs/lccp/).



The land classifications around Glens Falls, New York, area as defined by the National Land Cover Characterization program. Each distinct color represents one of 21 classes of land cover.

## Geographic Names Information System

The GNIS is the Nation's official automated geographic names repository. The GNIS was developed by the USGS in cooperation with the U.S. Board on Geographic Names (BGN). The GNIS consists of four separate data bases, each with unique characteristics and functions. The National Geographic Names Data Base contains entries for almost 2 million physical and cultural geographic features in the United States. The federally recognized name of each feature in the data base is identified, and references are made to a feature's location by State, county, and geographic coordinates and to the appropriate 1:24,000-scale USGS topographic map (cell name) on which it is shown. The Geographic Cell Names Data Base, formerly the Topographic Map Names Data Base, contains the official name for each USGS cell (map series). The Antarctica Geographic Names Data Base contains names approved by the BGN for features in Antarctica and the area extending northward to the Antarctic Convergence. The Reference Data Base defines 63 broad categories of feature types and describes

their properties. It is also the GNIS information depository and contains complete annotated bibliographies of the source materials used in compiling the National Geographic Names Data Base. The National Geographic Names Data Base and the Antarctica Geographic Names Data Base are searchable online at [mapping.usgs.gov/www/gnis](http://mapping.usgs.gov/www/gnis). The standard GNIS State and territory digital data sets are also available through anonymous ftp at [mapping.usgs.gov/www/gnis](http://mapping.usgs.gov/www/gnis). The Digital Gazetteer on CD-ROM contains all four GNIS data bases.

### Applications of the GNIS

The GNIS information has a wide range of applications. The broad categories of use include emergency preparedness, local transportation planning, regional planning, product marketing, site selection and analysis, genealogical research, and toponymic problem solving requiring the use and analysis of geographic names.



This graphic depicts the various types of names and features that are included in the Geographic Names Information System data base.

## Digital Data Formats

In compliance with a Federal mandate to provide spatial digital data in standardized formats and to move away from using native formats for spatial digital products, the USGS uses the SDTS and the GeoTIFF. The SDTS and GeoTIFF formats are offered in addition to the native USGS formats for digital data.

### Spatial Data Transfer Standard

The SDTS is a robust way of transferring digital geospatial data between producers and consumers who may be using different software and computer systems. The SDTS provides a standard way to “package” data and information for transfer among different GIS platforms. It is neutral, modular, growth oriented, extensible, and flexible: all characteristics of an open systems standard. This transfer standard embraces the philosophy of self-contained transfers; for example, spatial data, attributes, georeferencing, data quality report, data dictionary, and other supporting metadata are all included in the transfer. These components are all resident in specified containers or modules that can be customized to fit unique data models, such as raster, vector, and point data. Eventually all USGS data will be available optionally in the SDTS format. Additional information about the

SDTS format is available through the Internet at [mcmcweb.er.usgs.gov/sdts/](http://mcmcweb.er.usgs.gov/sdts/).

### Geographic Tagged-Image File Format

The USGS offers some types of data in a format called GeoTIFF, a georeferenced version of the popular TIFF, which allows users with image-rendering programs, Web browsers, image processing systems, and GIS's to easily read and display data.

Additional information on the GeoTIFF is available through the Internet at [www.remotesensing.org/geotiff/faq.html](http://www.remotesensing.org/geotiff/faq.html).

### Coordinate Systems and Datums

All GeoData are referenced either to the UTM projection or to a geographic coordinate system. Some older data are referenced to the North American datum of 1927 (NAD 27), whereas newer data are referenced to the NAD 83. Customers should verify data projections, coordinate systems, and datums before ordering by calling 1-888-ASK USGS or by accessing the file metadata using the Global Land Information

## USGS GeoData Ordering Information

Data can be obtained from these sources:

### USGS Business Partners

The USGS has a network of authorized data distributors. A list of digital data distributors in the Business Partner program can be accessed through the Internet at [edcwww.cr.usgs.gov/busparkers/digital/currentpart.html](http://edcwww.cr.usgs.gov/busparkers/digital/currentpart.html).

### ESIC Network

USGS GeoData can be ordered by contacting the USGS Earth Science Information Center (ESIC) network. The ESIC network can be contacted through the toll-free number 1-888-ASK-USGS (275-8747). A list of products and services available through the ESIC, as well as information on the locations of ESIC offices, can be accessed at the following Internet address: [mapping.usgs.gov/esic/index.html](http://mapping.usgs.gov/esic/index.html).

### GLIS

USGS GeoData can also be queried for availability and ordered over the Internet by means of the GLIS at [edcwww.cr.usgs.gov/webglis/](http://edcwww.cr.usgs.gov/webglis/). GLIS inventories are reviewed daily to ensure access to the most current information. The system operates 24 hours a day, 7 days a week for worldwide connectivity and availability. GLIS will be replaced by Earth Explorer as a new interface to access USGS GeoData sometime in 2000.

### Product Status Graphics

The availability of many types of USGS GeoData can be determined by accessing online status graphics. The USGS status graphics Web site is maintained at the following Internet address: [mapping.usgs.gov/www/products/status.html](http://mapping.usgs.gov/www/products/status.html).

## GeoData Prices and Media

USGS GeoData are available on CD-ROM and CD-R, on 8-mm tape, or through ftp. Some types of data can be downloaded from the World Wide Web. For more information on prices and delivery media, contact the ESIC network at 1-888-ASK-USGS or access the following Internet address at [mapping.usgs.gov/mac/isb/pubs/pubslists/index.html](http://mapping.usgs.gov/mac/isb/pubs/pubslists/index.html).

## Public Domain Software and Sample Data

The USGS maintains an Internet Web site with access to public domain software for use with GeoData and other products at the address below: [edcwww.cr.usgs.gov/doc/edchome/ndcdb/public.html](http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/public.html).

Sample data in their native formats are useful for determining potential applications and compatibility with user software platforms. Sample data can be assessed at the following address: [edcwww.cr.usgs.gov/doc/edchome/ndcdb/samples.html](http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/samples.html).

The USGS also maintains a GeoData Web site where a wide variety of data types and formats can be downloaded. These data are available for assessment purposes and may not be in a format that can be readily imported into specific operating systems or GIS platforms. The USGS GeoData Web site can be accessed at the following address: [edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html](http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html).

For information on other USGS products and services, call 1-888-ASK-USGS, use the Ask-USGS fax-on-demand system, which is available 24 hours a day at 703-648-4888, or visit the general interest publications Web site on [mapping.usgs.gov/mac/isb/pubs/pubslists/index.html](http://mapping.usgs.gov/mac/isb/pubs/pubslists/index.html).

Please visit the USGS home page at [www.usgs.gov/](http://www.usgs.gov/).