USGS
science for a changing world

The U.S. Geological Survey Recent Highlights—Natural Resources

Introduction

The U.S. Geological Survey (USGS) provides relevant, objective scientific studies and information that are used to help address issues and solve problems dealing with natural resources. As the primary science bureau in the Department of the Interior, the USGS strives to help meet the high priority needs of the Nation for natural resources science (land, water, biota, energy, and mineral) by working closely with State, local, private, and Federal Government organizations; industry; academia; and the general public.

Using Geophysics to Help Identify Ground-Water Flow in the Middle Rio Grande Basin, New Mexico

The rapidly growing Albuquerque-Santa Fe urban corridor is facing serious problems of ground-water and surface-water depletion and compaction of the water-bearing sediments (which leads to land subsidence in many areas). New water supplies are urgently needed. The USGS is integrating sophisticated geophysical techniques with ground-water flow models to help determine the available ground-water supply in the Middle Rio Grande basin and Albuquerque areas of New Mexico. The results are being used by the City of Albuquerque, State of New Mexico, Native American Pueblos, National Park Service, and Bureau of Land Management to determine ground-water resources and water-use policy for the future.

Why use geophysics? It allows geologists and hydrologists to detect the location of faults (fig. 1) throughout the basin faster and more cost-effectively than they could with traditional methods. Faults are known to control the thickness of aquifer units in the subsurface and are potential barriers to ground-water flow. The high-resolution aeromagnetic geophysical methods used in the middle Rio Grande basin, coupled with drilling and geologic mapping, help geologists and hydrologists create a valid three-dimensional picture of the factors affecting the volume, direction, and rate of ground-water flow in the basin.

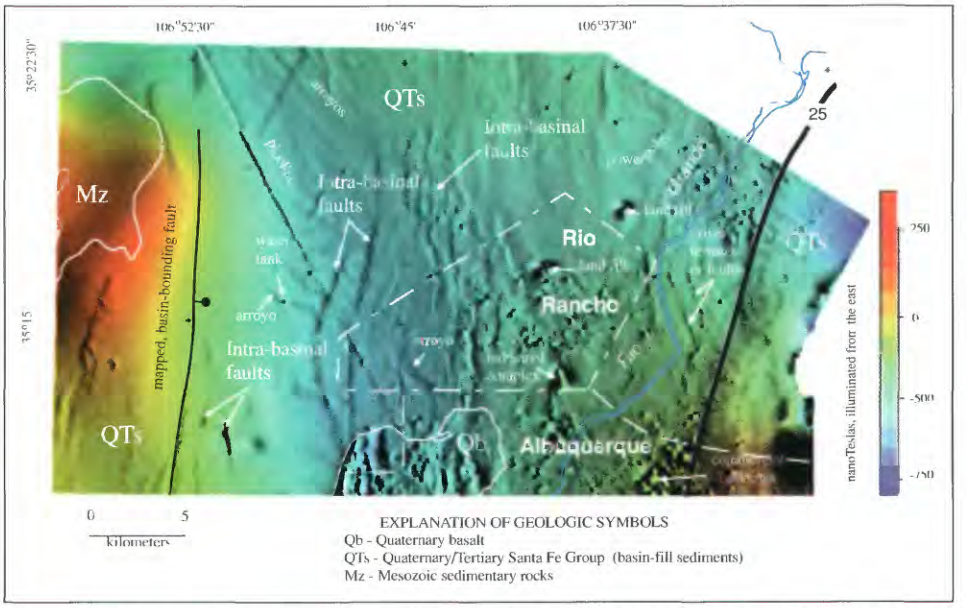

Figure 1.—High-resolution aeromagnetic map for the northern part of the Middle Rio Grande basin, N. Mex.

With a more accurate picture of the subsurface, USGS scientists will be able to develop and apply computer models that will enable water managers to simulate (predict) the effects of future water development on existing ground-water and surface-water resources.

Want to learn more? Check out the Middle Rio Grande basin study home page at <URL: http://rmmcweb.cr.usgs.gov/public/mrgb/mrgbhome.html>.

USGS is a Partner in Flight

Partners in Flight (PIF) is harnessing energy and resources across the Western Hemisphere to conserve birds (fig. 2) and their habitats. This alliance includes Federal agencies like the USGS, State wildlife agencies, nongovernmental organizations (such as the American Bird Conservancy and the National Audubon Society), universities, and industry, and is coordinated by a network of local, regional, and national working groups. Partners in Flight activities include (1) evaluating status of and threats to landbirds and their habitats; (2) developing conservation plans that identify priority species and habitats, conservation goals, and management recommendations; (3) sponsoring International Migratory Bird Day; and (4) developing educational materials. Information from USGS scientists is crucial to the PIF conservation-planning process. For example:

- Along the Mississippi River corridor, USGS scientists, in partnership with others, are providing technical information to assist with implementing and evaluating a PIF bird conservation plan. Satellite images are used to inventory forested habitat and define bird conservation areas, where large contiguous patches of forest

Figure 2.—Yellow Warbler. Photograph by Mike Hopiak, Cornell Lab of Ornithology.

remain or can be restored. Research is under way to improve reforestation methods, evaluate bird use of reforested areas, and examine the impacts of forest-management practices on bird productivity. The Mississippi Alluvial Valley bird conservation plan, because of the progress it already shows in implementation and partnerships to conserve birds and direct future research, serves as a model for PIF conservation planning across the country.

• USGS scientists are involved in a cooperative effort to review and synthesize literature on the effects of management practices on grassland birds. PIF and the North American Waterfowl Management Plan identified this information as critical for the conservation of declining grassland species. It will produce a bibliography, annotations and critical evaluations of this literature, and synthesized counts of grassland bird species. This information is currently in great demand by managers who must make decisions about burning, harvesting, and grazing their land and have little information about how their decisions will affect this poorly understood group of birds.

• In addition to administering the Breeding Bird Survey, USGS scientists, working with the PIF Monitoring Working Group and others, are developing a prototype data base to house point-count data collected by PIF partners. Currently no central repository exists for this information. The pilot project will explore the feasibility of importing, storing, and delivering data on bird counts and locations, and related information on habitat and vegetation. It will also identify costs and problems involved in possibly expanding the prototype to encompass all PIF point-count data. Consolidating, analyzing, and presenting these data will improve understanding of bird population status and trends and direct bird conservation efforts and future research.

• USGS scientists are collaborating in a review of all existing avian monitoring programs sponsored by the PIF Monitoring Working Group. This evaluation will define gaps in our ability to monitor species of concern and focus efforts to improve monitoring capabilities. The USGS Avian Research and Monitoring Support Program also provides technical assistance to bird conservation projects, such as the development of a PIF riparian conservation plan for the Northwest.

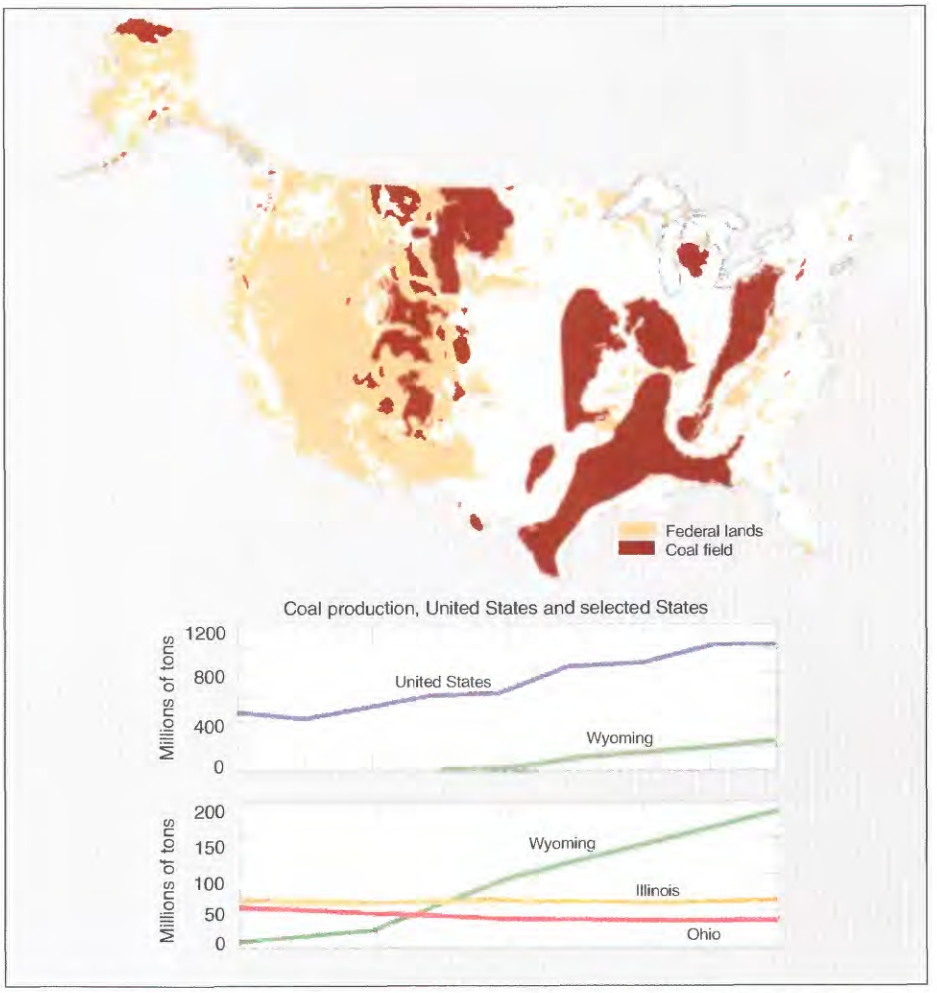

Figure 3.—Coal fields of the United States, with coal production for the United States, Wyoming, Illinois, and Ohio.

• The USGS in Alaska has played a key role in developing and testing methods for monitoring landbirds breeding in extensive, remote habitats that present challenges in logistics and expenses. Annually they organize Federal and State agencies, nongovernmental organizations, and Alaska Native corporations to conduct monitoring and then compile and analyze these data. Future plans include providing resulting graphs, tables, and maps on a website. This effort provides much-needed information from a part of the continent with large tracts of relatively undisturbed habitat and offers unique comparisons with temperate breeding areas in the rest of the United States.

Want to learn more about Partners in Flight? Contact their home page at <URL: http://www.pif.nbs.gov/pif>, or contact:

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National Coal Resource Assessment

The USGS Energy Resources Program, in partnership with State geological surveys, is assessing the major coal beds that are likely to be mined during the first quarter of the 21st century (fig. 3). The USGS National Coal Resource Assess-ment is an intensive, multiyear assessment of coal quantity, quality, availability, and recoverability, involving the development of digital data bases and a geographic information system (GIS) that helps scientists quantify estimates of coal resources. The results and digital products of the assessment will be used by Federal and State land managers, regulators, and economists, as well as by industry and electric utilities.

For example:

• A digital (GIS) map of the Pittsburgh coal bed in the northern Appalachians, released by the USGS in February 1997 (fig.4), suggests that this important energy resource may be exhausted within three

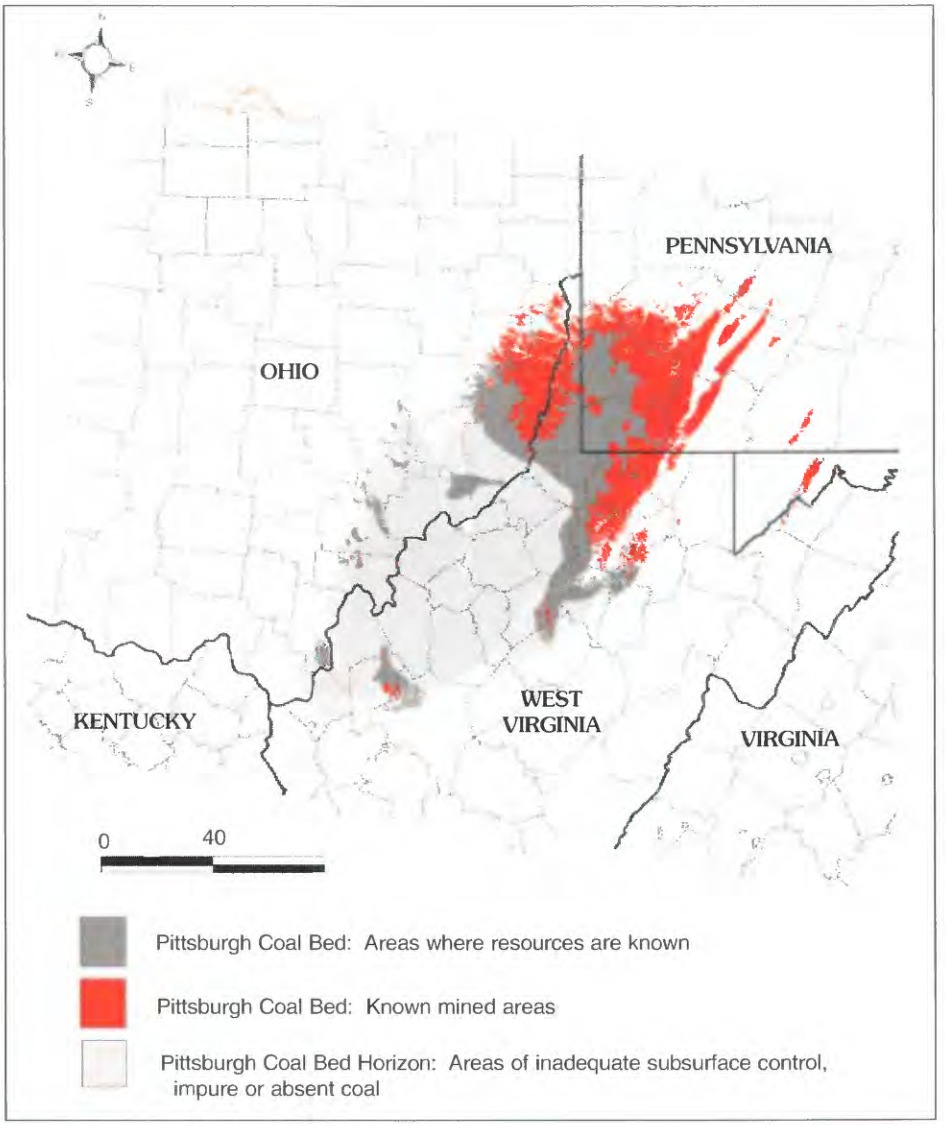

Figure 4.—Aerial extent of the Pittsburgh Coal Bed horizon and mined areas of the Pittsburgh Coal Bed.

decades and that significant potential exists for acid mine drainage as mines are closed. The map and related data have become the focus of economic and environmental analyses being conducted by a spectrum of State, local, Federal, and private organizations.

• A USGS coal resource assessment of the Kaiparowits Plateau, southern Utah, was released in the fall of 1996, within days of the establishment of the Grand Staircase-Escalante National Monument in the same area. The USGS assessment, prepared in cooperation with the State of Utah, is being used by the U.S. Bureau of Land Management as a basis for developing a management plan for the Monument, at the direction of the Administration.

Why is coal so important? Coal fuels over half of the electricity produced in the United States and is also used for residential and commercial heating and for the production of coke for the steel industry. In spite of the growing demand for energy, much of the Nation's extensive coal resources may never be mined because of environmental, technological, and economic constraints on the production and use of those coal resources. Major changes in the coal industry and the economy of the coal-producing regions of the United States are expected as production rates decline in the coming decades because of decreasing quality, availability, and recoverability of the coal. Currently, production from eastern coalfields is steady or declining, and production from western coal-producing regions is increasing rapidly in response to the demand for low-sulfur coal for steam production.

Want to learn more? Visit the Energy Resources Program home page at <URL: http://energy.usgs.gov/>, or call Dave Houseknecht, Program Coordinator, at 703-648-6470.

Submerged Aquatic Vegetation in the Chesapeake Bay

USGS studies of submerged aquatic vegetation are providing scientific information needed by local and regional seafood industries, environmental groups, and recreational fishing interests. Submerged aquatic vegetation is an indicator of water quality and an important component of the Chesapeake Bay ecosystem because it provides critical habitat for shellfish and fin fish, as well as food for waterfowl. The USGS is mapping submerged vegetation species to show their distribution, quantity, and change. It is also conducting nutrient studies above and below dense aquatic beds in the bay area to determine if plants take up nutrients and to see if they filter algae and suspended sediments out of the water as it moves through these beds.

The availability of nutrients influences the severity of algae blooms in the tributaries. USGS scientists looked for a way to efficiently map and effectively display the submerged vegetation and nutrient areas that were identified in their field studies. Because submerged vegetation is not easily displayed and viewed on a paper map, researchers looked to computer mapping technology for an efficient way to portray the data. They have developed techniques that combine the features from existing aerial photographs and topographic maps. Areas where submerged vegetation and nutrients were identified in the field can be displayed on these maps (fig. 5) and stored in the computer. By mapping the locations of submersed vegetation over time, USGS scientists can begin to assess and link the rates of vegetation growth and recession with the effects of pollution or storms.

Figure 5.—A computer-readable aerial photograph (digital orthophoto) of a section of the Potomac River, Va.

Although two-dimensional maps or computer displays traditionally have been used in this type of study, USGS scientists at the Mapping Applications Center took the next step and used innovative cartographic methods to view the terrain along the Potomac River in a dynamic three-dimensional display. This three-dimensional display, also known as an interactive flyover, makes it possible to look at the river and shoreline terrain from any angle, as if flying over the area in a helicopter (fig. 6.)

These newly applied methods are also being used by the U.S. Forest Service to identify riparian forest buffers along the Potomac River. The National Park Service will also use these image data to view the Chesapeake and Ohio Canal, which runs along the river in this study area. Through the use of innovative computer technology, USGS researchers are able to more efficiently map submersed aquatic vegetation in the Potomac River. The three-dimensional displays give scientists and managers tools they can use to improve the natural resources of the Chesapeake Bay ecosystem.

Want to know more? Contact the Mapping Applications Center home page at <URL: http://mapping.usgs.gov/mac/>.

Figure 6.—A frame from an animation of an interactive "flyover" of the Potomac River, Va.

USGS Cooperative Water Program helps Carson City, Nevada, in a Water Rights Issue

In fiscal year 1994, the USGS Nevada District entered into a Cooperative Agreement with the Public Utilities Department of Carson City, Nev., to re-evaluate several components of the water budget for the Eagle Valley, which contains most of the city's urban area. Carson City, the State capital, is about 35 miles south of Reno, Nev., and is one of the most rapidly urbanizing areas of the country. The city uses both surface water and ground water (fig. 7) for water supply. Water rights for both have been fully allocated, leading the city to develop ground-water recharge and other conjunctive use projects to meet increasing water demands. During periods of drought, ground water provides as much as 80 percent of the city's water. Ground-water pumpage is limited by the State Engineer to not exceed estimates of annual recharge, which are based on a 1966 study by the USGS. The Washoe Tribe, which has lands irregularly distributed within Eagle Valley and faces water-resource management problems similar to those of Carson City, joined as a cooperator in the study in 1996.

Figure 7.—USGS scientist measuring the temperature of sediments in the Vicee Canyon, Carson City, Nev.

Two significant findings resulted from the USGS studies:

- A previously ignored ground-water component of recharge from the mountains was quantified for three canyons tributary to the basin. This information gave the city a basis for filing for water rights on an additional 3,000 acre-feet-per-year of ground water, which will provide additional ground-water supply during times of drought. The city and the tribe have continued to fund additional phases of this study to complete evaluation of the entire hydrographic area.

- USGS researchers discovered and documented a strong relationship between the temperature of surface water and its rate of infiltration into the ground for conjunctive use. This information will help the city maximize ground-water recharge through its infiltration basins by controlling the timing of water delivery to those sites.

The Federal-State Cooperative Program, a partnership between the USGS and more than 12,000 State and local agencies, provides information that forms the foundation for many of the Nation's water resources management and planning activities. In addition, the information may function as an early warning of emerging water problems. The fundamental characteristic of the program is that local and State agencies provide at least one-half of the funds, but the USGS does most of the work. Having the USGS do the work results in consistent techniques of data collection and archiving, with the information stored in a common data base readily available to all. The knowledge gained in the studies is published and added to the growing body of information about the hydrology of the region or area.

Want to know more about cooperative work in your State? Visit the home page at <URL: http://water.usgs.gov/public/yourstate.html>.

Information

For information on these and other USGS products and services, call 1-800-USA-MAPS, or use the EARTHFAX fax-on-demand system, which is available 24 hours a day at 703-648-4888.

Please visit the USGS home page at <URL: http://www.usgs.gov/>.

The address for the Natural Resources Theme home page is <URL: http//www.usgs.gov/themes/resource.html>.