Congressional Research Service
Informing the legislative debate since 1914

U.S. Geological Survey: Background, Appropriations, and Issues for Congress

-name redacted-
Specialist in Natural Resources Policy

-name redacted-
Specialist in Energy and Natural Resources Policy

November 5, 2014

Congressional Research Service
7-....
www.crs.gov
R43777

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

The U.S. Geological Survey (USGS) aims to provide unbiased scientific information to describe and understand the geological processes of the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the nation's quality of life. The USGS is a scientific agency that is housed within the Department of the Interior. Its primary mission is conducting science; it has no regulatory authority, nor does it manage any significant federal lands. The USGS also collects and stores scientific information that is compiled into long-term continuous data sets. These data sets range from satellite imagery of land and ecosystem features to streamflow data on major rivers and streams.

The USGS conducts scientific activities under seven interdisciplinary mission areas: (1) water resources; (2) climate and land use change; (3) energy and minerals; (4) natural hazards; (5) core science systems; (6) ecosystems; and (7) environmental health. The agency is funded through Interior, Environment, and Related Agencies appropriations laws. The FY2015 budget request for the USGS was $1.07 billion, which is $41.3 million more than the FY2014 enacted level of $1.03 billion.

Congressional interest in the USGS is high because many USGS activities have nationwide and regional policy implications. USGS partners with several stakeholders in its monitoring and scientific endeavors and contributes scientific knowledge to seminal policy decisions such as the listing of species under the Endangered Species Act, the management of water supplies, and the placement of emergency response resources following major storm events or hurricanes.

Some potential congressional concerns about the USGS involve the scope of its mission. For example, some in Congress contend that the mission of the USGS has expanded beyond the scope of its Organic Act, to the detriment of its work on geological issues. In contrast, some others note that the USGS has expanded its scope in response to congressional authorizations and that its mission has changed over time to reflect the needs of the country. Some specific USGS programs—for example, the agency's role in assessing the nation's mineral, oil, and natural gas resources—have also been of interest to Congress. Often, the results of these studies and assessments have led to congressional decision-making regarding resource development and federal land use. Other USGS activities that have generated congressional interest and debate include the National Streamflow Information Program, which deploys streamgages across the country to measure water flows and quality; the Landsat Program, which collects remotely sensed data from satellites and distributes it to stakeholders; and the Natural Hazards Program, which is involved in evaluating, observing, studying, and contributing to the mitigation of natural hazards such as earthquakes, volcanoes, landslides, and coastal storms, among others.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

The mission of the U.S. Geological Survey (USGS) is to serve the United States by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the nation's quality of life.[1] The USGS is housed in the Department of the Interior (DOI), and part of its mission is to provide scientific information to other agencies and bureaus within DOI. This information is used to manage land, fish, and wildlife resources under the supervision of DOI. More broadly, the USGS conducts domestic as well as international scientific activities related to global scientific and natural resource issues. The aim of these activities is to improve the effectiveness of the U.S. government to carry out domestic missions, address U.S. foreign policy and national security interests, and increase the competitiveness of the U.S. private sector in the global economy.[2]

The USGS conducts scientific activities under seven interdisciplinary mission areas: (1) water resources; (2) climate and land use change; (3) energy and minerals; (4) natural hazards; (5) core science systems; (6) ecosystems; and (7) environmental health. In the USGS accounts for appropriations, environmental health is combined with the Energy and Minerals mission area, and there is a Science Support and Facilities account. (See descriptions later in the report for more detail.)[3] Within these program areas, the USGS relies on geologists, geophysicists, hydrologists, biologists, volcanologists, and cartographers, among others, to conduct research, monitoring, and data collection. USGS researchers often work in cooperation with other federal and state agencies, and in some cases with local cooperators, through agreements.[4] Unlike other agencies within DOI, the USGS does not have authority to manage large tracts of public lands, nor does it have authority to construct infrastructure or modify waterways or habitat. Further, the USGS does not have regulatory authority under any statute.[5]

Congress has a broad interest in the activities of the USGS. Many scientific studies conducted by the agency affect areas of congressional interest. For example, the USGS conducts oil, gas, and mineral resource assessments that help Congress evaluate federal land use policy and provide broad-scale information for private-sector resource development. The USGS also collects data from large-scale ecosystems (e.g., Chesapeake Bay and the Great Lakes) that are used to inform ecosystem restoration initiatives. The agency also conducts large- and small-scale studies of water resources throughout the country, addressing both water quality and quantity, which assist decision makers at all levels of government that manage water use.

Congress has been involved in the direction and oversight of the USGS since its inception and has enacted several laws that authorize its activities. The USGS has evolved to be one of the primary scientific agencies of the U.S. government, covering a broad range of scientific topics for

[1] U.S. Geological Survey Mission as noted at http://www.usgs.gov/aboutusgs/.

[2] U.S. Geological Survey International Programs at http://international.usgs.gov/mission.htm.

[3] U.S. Department of the Interior, *Budget Justifications and Performance Information, FY2015, U.S. Geological Survey*, 2014. Hereinafter *USGS FY2015 Budget Justification*.

[4] This includes reimbursable work, which is often funded through appropriations provided to other federal agencies and is a significant component of USGS activities.

[5] Under a 1954 court decree, the USGS serves as River Master on the Delaware River and is responsible for coordinating discharge rates among the decree parties.

multiple audiences in the federal, state, local, and private sectors. The expanded role of the USGS since its Organic Act, however, has caused some in Congress to question if study areas such as ecosystem science and coastal stewardship, among others, represent the best direction and best allocation of resources for the USGS. They note that the USGS Organic Act specifically addresses classifying public lands and examining geologic structures and mineral resources, but that current USGS mission areas are much broader.[6] Others praise the USGS for being one of the foremost scientific agencies of the U.S. government, and note that conducting research in each of its mission areas (e.g., energy and mineral resources, water resources, climate change, and others) addresses many issues of broad importance to the United States.[7] The broadened nature of the USGS mission since it was established may be a direct result of Congress diversifying USGS activities by expanding its authority in legislation. The **Appendix** of this report provides a chronology of authorizing legislation affecting the USGS.

Because of recent congressional interest in the scope of the USGS mission, how it has changed since its inception, and how the agency is currently structured and funded, this report explores the evolution of the USGS since the USGS Organic Act in 1879 and its present structure. **Table 1** provides a snapshot of current USGS appropriations, and **Table 2** provides a chronology of some of the key developments in USGS history since 1879.

Origin of the USGS

The roots of the USGS existed before it was officially created and authorized as a federal agency in 1879. The Louisiana Purchase in 1803 and subsequent territorial acquisitions necessitated that mapping and surveying land in the United States be a priority of the federal government. Mapping was critical for classifying lands, organizing the distribution of lands, and securing the frontier.[8] Various government entities participated in mapping throughout the 19th century, and these efforts were later integrated, in part, within the USGS. State and federal involvement in geology also contributed to the creation of the USGS. States created geological surveys to foster internal improvements and develop natural resources. Some note that the state-run geological surveys resulted from an interest in mining for gold and other precious metals.[9] The creation of the USGS was prompted in part by a report by the National Academy of Sciences that provided recommendations for surveying various topographical and geological aspects of the United States.[10] Among other things, the report called for the creation of three new bureaus under DOI,

[6] Opening Statement of Hon. Doug Lamborn, at U.S. Congress, House Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Effect of President's FY2013 Budget for the U.S. Geological Survey on Private Sector Job Creation, Hazard Protection, Mineral Resources and Deficit Reduction*, oversight hearing, 112th Cong., 2nd sess., March 22, 2012.

[7] Testimony of Dr. Craig Schiffries, Director for Geoscience Policy, Geological Society of America. U.S. Congress, House Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Spending Priorities and Missions of the U.S. Geological Survey and the President's FY2012 Budget Proposal*, H.Hrg. 112-8, 112th Cong., 1st sess., March 9, 2011 (Washington: GPO, 2011), p. 36. Hereinafter Schiffries Testimony.

[8] Mary C. Rabbitt, *Minerals, Lands, and Geology for the Common Defense and General Welfare: Volume 1, Before 1879, The United States Geological Survey*, U.S. Department of the Interior, 1979, pp. 2-3.

[9] Mary C. Rabbitt, "The United States Geological Survey 1879-1989," US Geological Survey Circular 1050, March 1989, http://pubs.usgs.gov/circ/c1050/index.htm.

[10] U.S. Congress, House, *Surveys of the Territories: Letter from the Acting President of the National Academy of Sciences*, Miscellaneous Documents, prepared by National Academy of Sciences, 45th Cong., 3rd sess., November 26, 1878, Mis.Doc. 5 (Washington: GPO, 1878), pp. 1-5.

of which one was the USGS. The primary purpose of the USGS, according to the report, would be to study the geological structure and economic resources of the United States. Largely based on this report, Congress authorized the creation of the USGS in an appropriations bill, named the Sundry Civil Expenses bill, passed on March 3, 1879, which became known as the USGS Organic Act.[11] The act established the USGS to classify the public lands and examine the geological structure, mineral resources, and products within the national domain. A key excerpt from the act stating the authority of the Director of the USGS states:

> The Director of the United States Geological Survey, which office is established, under the Interior Department, shall be appointed by the President by and with the advice and consent of the Senate. This officer shall have the direction of the United States Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain. The Director and members of the United States Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations.[12]

The USGS Organic Act specifically authorized the examination of the geological structure and mineral resources of the nation, but did not specifically address water resources, ecosystem resources, natural hazards, and climate change, all of which are current mission areas in the USGS. Some have argued that "products of the national domain" could include water and ecosystem resources, but the intent behind the definition and scope of the word "product" was not specified in the authorizing language. The first Director of the USGS, Clarence King (1879-1881), apparently sensed that the mandate for the USGS was broad and established a framework for USGS activities.[13] He stated that Congress intended the agency's mission to include a classification of all public domain lands, and later attempted to expand the scope of the USGS from a western focus to include the entire United States.[14] King also led USGS efforts to establish and implement a mining geology program to collect mineral statistics in the western states.

Changes to the Authority of the USGS and Scope of Its Activities

The interpretation and application of the authorities in the USGS Organic Act were molded by subsequent actions of its directors and by Congress. Further, the scope of the USGS was expanded by administrative decisions and laws that directly or indirectly authorized many current activities.[15] (See **Figure 1** for an illustration of key authorities and transitions for the USGS since 1879; see **Table 2** for a chronology of specific events.) Starting with its first Director, discussed above, the USGS defined and changed the scope of the agency beyond its initial implementation of the 1879 Organic Act. For example, under its second Director, John Wesley Powell (1881-1894), the USGS broadened its work to include topographical mapping, paleontological studies,

[11] 43 U.S.C. §31.

[12] 43 U.S.C. §31(a).

[13] U.S. Congress, Senate Committee on Interior and Insular Affairs, *The U.S. Geological Survey*, committee print, prepared by Congressional Research Service, 94th Cong., 1st sess., December 1975, S442-39, p. 27. Hereinafter USGS Committee Print.

[14] This expansion was acknowledged by Congress in 1882 under 22 Stat. 329.

[15] See **Appendix** of this report.

and stratigraphic studies to support the geological mapping program. The shift toward topography at this time was short-lived, however, as the budgets of the USGS and other federal science agencies were reduced substantially in the early 1890s.[16] The USGS subsequently broadened its role to aid any industry (not just the mineral industry) in the knowledge and application of geology under its next director, Charles Walcott (1894-1907).[17] USGS involvement in water resources, including the deployment and monitoring of streamgages, was also initiated under Wolcott's Administration.

In addition to actions of the USGS Directors, Congress authorized and appropriated funds for certain projects and initiatives that defined and changed the scope of the USGS. Further, Congress passed laws that directly amended the Organic Act to expand the scope of the USGS. For example, the Organic Act was amended in 1986 to authorize the USGS to conduct projects in cooperation with other federal, state, and private entities.[18] Congress also authorized specific projects, which later expanded into program areas within the USGS. For example, efforts to study water resources by the USGS began in 1888 with an authorization by Congress to study the irrigation capacity of arid regions of the United States. This study identified areas where irrigation was necessary for agriculture; investigated water storage behind dams; measured streamflow; and designated sites that had the potential for reservoirs, canals, and ditches for irrigation purposes. This congressional authorization marked the beginning of USGS involvement in water resource studies of the United States.

Ecosystem studies in the USGS derived from the incorporation of biological studies into the USGS mission in 1996. In 1994, all of the biological research functions from all of the bureaus within DOI were consolidated into a new bureau, the National Biological Survey (NBS).[19] The intent behind the NBS was to have an independent science agency to conduct research in a manner that insulates the science from those who manage federal lands and draft government regulations. Scientists from DOI agencies were transferred to this new bureau, mostly coming from the Fish and Wildlife Service (FWS). Some argued that the NBS would distance scientists from the political pressures facing DOI agencies, and that the NBS would give visibility to research being conducted within DOI and reduce overlap of DOI research.[20] However, in 1996 this bureau (then called the National Biological Service) was moved into the USGS and named the Biological Resources Division (BRD).[21] The transfer of NBS to the USGS was intended to encourage the independent nature of scientific research. Further, according to the conference report for P.L. 104-134, the BRD was to pay attention to "wildlife resources entrusted to the stewardship of the Department; fisheries, including restoration of depleted stocks; fish propagation and riverine studies; aquatic resources; nonindigenous nuisances that affect aquatic ecosystems; impacts and epidemiology of disease on fish and wildlife populations; chemical drug registration for aquatic species; and effective transfer of information to natural resources

[16] The USGS in 1892 received $705,000 in appropriations. This was reduced to $488,000 in 1893 and increased slightly to $495,000 in 1894.

[17] Mary C. Rabbitt, *Minerals, Lands, and Geology for the Common Defence and General Welfare: Volume 2, 1879-1904, the United States Geological Survey*, U.S. Department of the Interior, 1980, p. 13.

[18] 43 U.S.C. §36(c).

[19] Secretarial Order 3173, "Establishment of the National Biological Survey, Department of the Interior," September 29, 1994.

[20] Fredric H. Wagner, "Whatever Happened to the National Biological Survey," *BioScience*, vol. 49, no. 3 (March 1999), pp. 219-222.

[21] P.L. 104-134.

managers."[22] The BRD was transformed during a 2011 reorganization and became part of the Ecosystem program area. The general framework of independent scientific research stayed in place.

The scope of USGS activities also has expanded in response to domestic and worldwide events. During both world wars, USGS activities broadened to include searching for strategic minerals and improving topographic maps. In the 1920s, energy shortages prompted Congress to direct the USGS to determine the known geological structure of producing oil and gas fields so that leases could be issued. This activity followed the enactment of the Mineral Leasing Act of 1920, which authorized the federal government to issue mining leases on federal lands.[23] In 1964, a 9.2 magnitude earthquake in Alaska prompted USGS scientists to participate in a task force that guided rebuilding efforts. Consequently, the USGS Center for Earthquake Research was established in Menlo Park, CA, during that same year.

The scope of scientific work done by the USGS expanded beyond U.S. borders several times during its history. Amendments to the Organic Act in 1962 stated that the Secretary of the Interior is authorized, through the USGS, to conduct scientific activities outside of the national domain, when it is determined by the Secretary to be of the national interest.[24] For example, international work currently conducted by the USGS includes addressing scientific and technological issues associated with climate variation, providing global petroleum and mineral resource assessments, and monitoring natural disasters such as volcanic eruptions, flooding, and earthquakes.

Despite an increase in the scope of its authority and activities, on several occasions the USGS has shed some responsibilities and activities. In some cases, departments within the USGS have splintered off to form separate federal agencies and bureaus. For example, the U.S. Reclamation Service was originally established within the USGS under the authority of the Reclamation Act of 1902.[25] The Reclamation Service studied potential water development projects in each western state with federal lands. The Service became the Bureau of Reclamation in 1907 when work under the Reclamation Act progressed from planning to construction. Other examples include the U.S. Bureau of Mines and the U.S. Forest Service, which were both derived from USGS functions.[26] In 1982, part of the USGS staff and operating budget were reorganized and formed the separate Minerals Management Service (MMS), reorganized again following the Deepwater Horizon oil spill to become the Bureau of Ocean Energy Management (BOEM), the Office of Natural Resources Revenue (ONRR), and the Bureau of Safety Environment and Enforcement (BSEE).[27]

[22] H.Rept. 104-402.

[23] 30 U.S.C. §181 et seq.

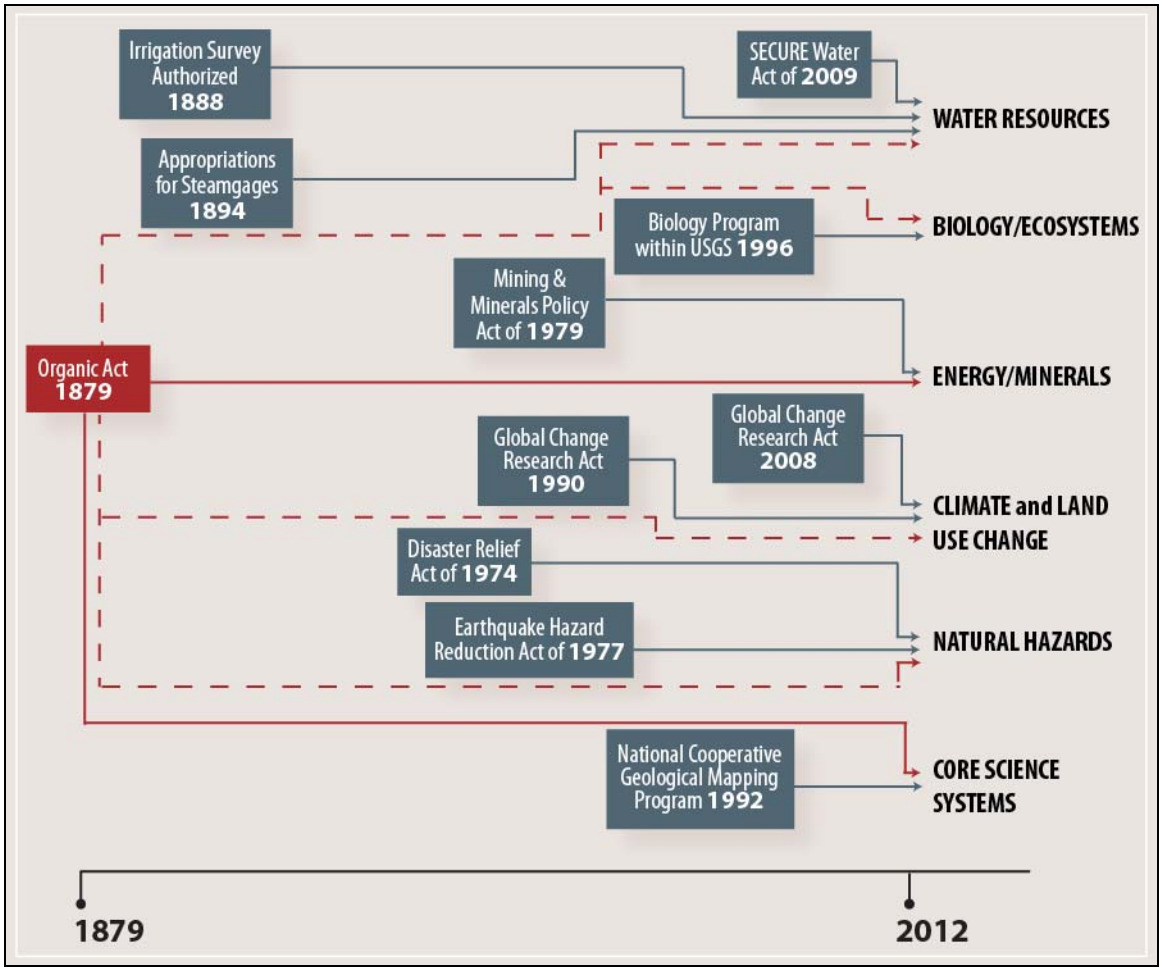
[24] 43 U.S.C. §31.

[25] P.L. 57-161; 43 U.S.C. §371.

[26] The Bureau of Mines was abolished in 1996; see http://www.doi.gov/library/internet/doi-info.cfm.

[27] MMS was renamed the Bureau of Ocean Energy Management, Regulation, and Enforcement under Department of the Interior, Secretarial Order 3302, June 18, 2010. The current structure includes three entities: BOEM, ONRR, and BSEE.

Figure 1. Selected Authorities and Transitions for USGS Programs: 1879 to 2012



Source: U.S. Geological Survey, *United States Geological Survey Authorizations*, U.S. Geological Survey, 2012.

Notes: Red line indicates a direct connection to the Organic Act of the USGS. The Organic Act indirectly authorizes other program areas (dashed line connections) by authorizing the USGS to study products of the national domain. Products could indicate water and biological resources and their status after the effects of natural hazards and climate and land use change. Some program areas are not listed in the diagram.

2011 Reorganization of the USGS

Most organizational changes to the USGS throughout the 20th and 21st centuries have been confined to specific departments and programs.[28] However, in 2011 the USGS reorganized its science programs into interdisciplinary program areas related to those outlined in the USGS 2007-2017 Strategic Plan.[29] The USGS shifted to interdisciplinary mission areas, including Ecosystems; Climate Variability and Land-use Change; Energy and Minerals; Environmental Health; Natural Hazards and Risk Resilience Assessments; Water Resources; and Informatics and

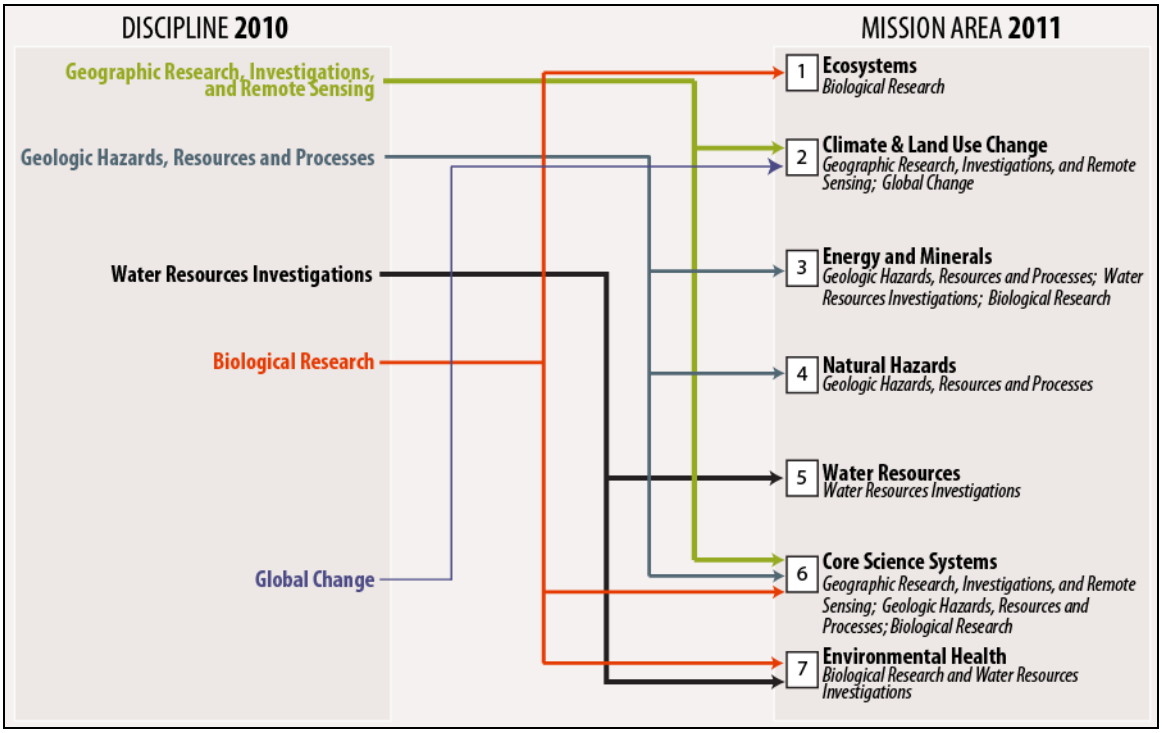
[28] For example, in 1996 a Biological Resources Division was created within USGS when the National Biological Service was abolished.

[29] U.S. Geological Survey, *Facing Tomorrow's Challenges: U.S. Geological Science in the Decade 2007-2017*, Circular 1309, 2007. Hereafter called USGS 2007-2017 Strategic Plan.

Data Integration. In addition, the USGS created an office for science quality and integrity. (See **Figure 2**.)

The justification for realignment was to reduce barriers in the budget and management structure of the USGS that hindered the interdisciplinary nature of problem solving. The realigned program areas represent interdisciplinary entities that are intended to reflect the best structure for solving current natural science challenges, according to the USGS.[30] Further, the realignment was intended to facilitate collaboration among various departments and programs within the USGS and increase collaboration across geographic boundaries among management.

Figure 2. Crosswalk of USGS Disciplines and Mission Areas under the 2011 Reorganization



Source: Based on the U.S. Department of the Interior, Budget Justifications and Performance Information, FY2012, U.S. Geological Survey, Budget Justification, 2011, as modified through discussions with the USGS.

Organizational Structure of the USGS

USGS activities are organized under seven interdisciplinary mission areas that cover (1) water resources; (2) climate and land use change; (3) energy and minerals; (4) natural hazards; (5) core science systems; (6) ecosystems; and (7) environmental health. In its budget request, USGS also includes Science Support and Facilities under its mission areas. The following sections provide an

[30] U.S. Geological Survey, *Aligning USGS Senior Leadership Structure with the USGS Science Strategy*, Fact Sheet 2010-3066, November 23, 2010.

overview of the responsibilities for each mission area, as well as the Science Support and Facilities program areas.[31]

- **Ecosystems**—Under this mission area, scientists investigate how ecological and geological processes affect the structure, function, and resilience of ecosystems. Many studies are regionally based in ecosystems such as the Chesapeake Bay, Great Lakes, and Florida Everglades. Other studies are national in scope. Authority for conducting activities under the Ecosystem program area is derived largely from laws that authorize the Secretary of the Interior to conduct research on recreation, and fish and wildlife issues.
- **Water Resources**—This mission area covers scientific activities that involve collecting, assessing, and disseminating hydrological data; and analysis and research on hydrological systems and methods for water conservation. This program contains the National Streamflow Information sub-program and the Cooperative Water sub-program, both of which fund streamgages throughout the nation.
- **Climate and Land Use Change**—This mission area is split into several components that collectively provide science to inform policy makers and stakeholders on the effect of climate and landuse change on natural resources within the United States. The mission area covers five sectors including National Climate Change and Wildlife Science Center and DOI Climate Science Centers; climate research and development; carbon sequestration science; land remote sensing; and land change science. Work in this area reflects the DOI Strategic Plan goal for providing science to address ecosystem, landuse, and climate effects on resources. The Land Use Change subprogram enables users to access and use Earth observation imagery collected via satellites.
- **Energy and Minerals**—This mission area includes research and assessments on the nation's mineral and energy resources. There are two components within this program area: mineral resources and energy resources, Within this context, scientific activities address how energy and mineral resources influence landscape, water, climate, ecosystems, and human health.
- **Environmental Health**—This mission area addresses the relationship between environmental and human health and the physical environment. Specifically, contaminant biology and toxic substances hydrology are two sub-programs. The contaminant biology sub-program reflects the goal to understand energy and mineral resources in the context of the life cycle of the energy or mineral commodity. Interactions between ecological processes, geological processes and contaminants and pathogens are studied under this area. Studying the effects of toxic chemicals on fish reproduction and the effect of insecticides on honeybee die-offs are examples of work done under this mission area.
- **Natural Hazards**—This mission area provides scientific information and knowledge necessary to address and mitigate the effects of natural hazards such

[31] Descriptions of mission areas are summarized from descriptions in the *USGS FY2015 Budget Justification* and the USGS Science Strategy. United States Geological Survey, *Facing Tomorrow's Challenges: U.S. Geological Survey Science in the Decade 2007-2017*, United States Geological Survey, Circular 1309, 2007. Hereafter, *USGS Science Strategy*.

as volcanic eruptions, earthquakes, storm surges, and landslides. The Coastal and Marine Geology sub-program addresses the coastal effects of natural hazards, such as the impacts of hurricanes and tsunamis on the coast, and the effects of rising relative sea level on coastal ecosystems and communities.

- **Core Science Systems**—The Core Science Systems program provides data in a geospatial framework for managing resources and planning for natural hazards.
- **Science Support**—This budget area includes funding for administrative activities and information needs. Some examples include education services and the evaluation of science quality and integrity.
- **Facilities**—The Facilities budget area includes funding for sites where USGS activities are housed—offices, laboratories, storage, parking, and more—as well as eight large research vessels.

FY2015 Budget for the USGS

The FY2015 budget request for the USGS was $1.073 billion, which was $41.3 million more than the FY2014 enacted level of $1.032 billion. The House Interior, Environment, and Related Agencies Appropriations Committee reported an Interior, Environment, and Related Agencies Appropriations Bill for FY2015.[32] The USGS would receive $1.036 billion under this reported bill; this would be approximately $3.7 million over the FY2014 enacted amount and $37.6 million less than the Administration's request. (See **Table 1**.)

The Administration requested increases compared to the FY2014 enacted amounts for all USGS programs except for Science Support, which would receive a $2.4 million decrease, and Natural Hazards, which would receive flat funding. For the Ecosystems program area, there was an increase of approximately $10.8 million, including an increase of $4.0 million for the Invasive Species sub-program.[33] Further, there was a requested increase of $18.4 million for the Climate Variability sub-program, including an increase of $11.6 million for Climate Science Centers administered by the USGS. The USGS is charged with implementing and maintaining the National Climate Change and Wildlife Science Center (NCCWSC) and its regional entities—referred to as the DOI Climate Science Centers (CSCs). These centers support research, assessment, and synthesis of global change data for use at regional levels. The CSCs aim to evaluate global climate change models at scales that are appropriate for research managers of species and habitats, and facilitate data integration and outreach to collaborators and stakeholders, including federal agencies. For FY2015, the Administration proposes to use the centers to conduct adaptation planning for issues such as sea level rise and drought, as well as work with tribal communities, and to create a system for facilitating adaptation coordination among agencies.

The House reported bill proposed small increases or flat funding for all USGS programs compared to the FY2014 enacted level except Core Science Systems and Science Support, which would be decreased by $0.5 million and $2.7 million, respectively.

[32] H.Rept. 113-551.

[33] According to the USGS, this funding is to be used for research on brown tree snakes in Guam, invasive species in the Everglades, Asian carp in the Great Lakes and Upper Mississippi River Basin, and other invasive species of national concern. See http://www.usgs.gov/newsroom/article.asp?ID=3817#.U8wkIFZN3wI.

The largest difference between the House reported bill and the Administration's request was for the Climate Variability sub-program. The Administration request of $72.0 million for the Climate Variability sub-program is $18.4 million above the FY2014 level; the House reported bill would be $3.0 million above the FY2014 level. (See **Table 1** for more details.)

Table 1. U.S. Geological Survey Appropriations

(FY2014-FY2015, in $ millions)

Program Area	FY2014 Enacted	FY2015 Request	FY2015 House Reported
Ecosystems			
Status and Trends	20.4	21.0	20.8
Fisheries: Aquatic and Endangered Resources	20.9	22.3	19.9
Wildlife: Terrestrial and Endangered Resources	44.7	45.1	43.7
Terrestrial, Freshwater, and Marine Environments	36.2	37.5	34.7
Invasive Species	13.1	17.6	16.8
Cooperative Research Units	17.4	18.5	17.4
Ecosystem Total	152.8	162.0	153.2
Climate and Land Use Change			
Climate Variability			
Climate Science Centers	23.7	35.3	26.7
Climate Research and Development	20.5	25.2	20.5
Carbon Sequestration	9.4	11.4	9.4
Subtotal	53.6	72.0	56.6
Land Use Change subprogram			
Land Remote Sensing	67.9	66.5	66.3
Land Change Science	10.5	10.6	10.5
Subtotal	78.4	77.1	76.8
Climate and Land Use Change Total	132.0	149.1	133.4
Energy, Minerals, and Environmental Health			
Minerals Resources	45.9	46.3	45.9
Energy Resources	26.0	26.9	24.5
Contaminant Biology	9.6	12.0	10.0
Toxic Substances Hydrology	10.0	13.8	11.1
Energy, Minerals, and Environmental Health Total	91.5	99.1	91.5
Natural Hazards			
Earthquake Hazards	53.8	54.1	59.5
Volcano Hazards	23.1	23.3	23.1

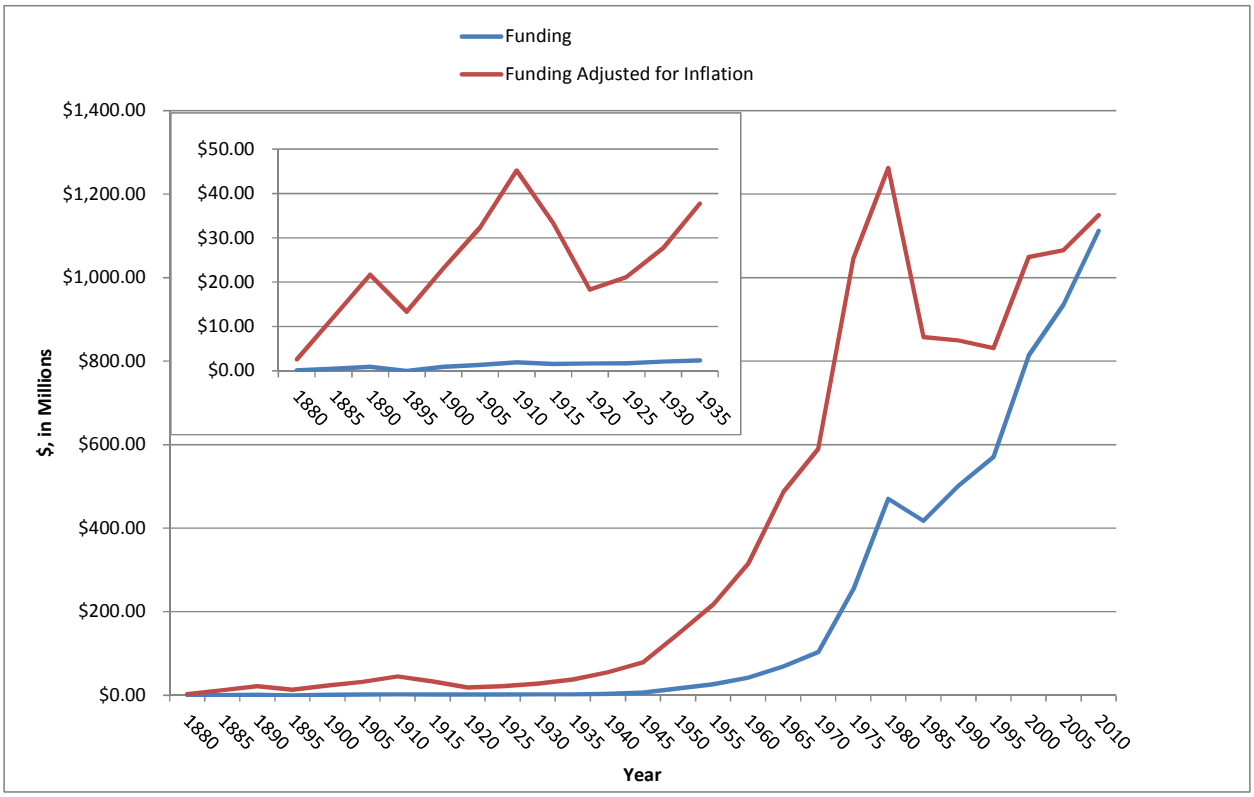
Program Area	FY2014 Enacted	FY2015 Request	FY2015 House Reported
Landslide Hazards	3.5	3.5	3.5
Global Seismographic Network	4.8	4.9	4.8
Geomagnetism	1.9	1.9	1.9
Coastal and Marine Geology	41.3	40.6	40.3
Natural Hazards Total	128.5	128.3	133.2
Water Resources			
Groundwater Resources	8.9	11.4	11.3
National Water Quality Assessment	58.8	59.1	58.5
National Streamflow Information Program	33.7	35.1	34.9
Hydrologic Research and Development	10.9	11.3	10.2
Hydrologic Networks and and Analysis	28.9	30.4	30.1
Cooperative Water Program	59.5	59.6	57.7
Water Resources Research Act Program	6.5	3.5	6.5
Water Resources Total	207.3	210.4	209.3
Core Science Systems			
Science Synthesis, Analysis, and Research	24.3	24.4	24.1
Nation Cooperative Geological Mapping	24.4	24.5	22.4
National Geospatial Program	60.1	60.4	59.6
Core Science Systems Total	108.8	109.4	106.1
Science Support			
Administration and Management	87.0	86.4	84.2
Information Services	23.7	21.9	21.4
Total Science Support	110.7	108.3	105.6
Facilities			
Rental Payments, Operation, and Maintenance	93.1	99.4	96.1
Deferred Maintenance and Capital Improvement	7.3	7.3	7.3
Facilities Total	100.4	106.7	103.3
U.S. Geological Survey TOTAL	1,032.0	1,073.3	1,035.7

Source: U.S. Congress, House Committee on Appropriations, *Department of Interior, Environment, and Related Agencies Appropriations Bill, 2015*, committee print, 113th Congress, 2nd session, July 23, 2014.

Historically, appropriations for the USGS rose dramatically after the Second World War, and peaked in inflation-adjusted dollars in the late 1970s (**Figure 3**). Funding for the agency rose again in the 1990s, but has yet to reach its peak funding level (inflation-adjusted).

Figure 3. Historical Record of USGS Appropriations, 1880-2010

(in $ millions, in five-year intervals)



Source: Personal communication from U.S. Geological Survey, September 17, 2012. Data are also taken from U.S. Geological Survey, *U.S. Geological Survey Budget Justification*, FY1997 – FY2013. U.S. Geological Survey, Budget Justification, http://www.usgs.gov/budget/fiscal_year.asp; and Office of Management and Budget, *Appendix, The Budget of the United States Government*, Office of Management and Budget, FY1958 to present.

Notes: The embedded chart is a blow-up of the primary chart from 1880 to 1935. The funding adjusted for inflation in both charts is calculated in 2011 dollars. The pre-1975 data are the Consumer Price Index statistics from *Historical Statistics of the United States,* see http://hsus.cambridge.org/HSUSWeb/HSUSEntryServlet. All data since then are from the annual *Statistical Abstracts of the United States*, see http://www.census.gov/compendia/statab/.

Issues for Congress

This section reviews some selected issues related to the USGS that have been of interest to Congress.

Mission of USGS

Some in Congress contend that the mission of the USGS has expanded beyond the scope of its organic act to the detriment of its original focus on geology and resources.[34] They note that with

[34] Opening Statement of Hon. Doug Lamborn, at U.S. Congress, House Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Effect of President's FY2013 Budget for the U.S. Geological Survey on Private Sector Job Creation, Hazard Protection, Mineral Resources and Deficit Reduction*, Oversight Hearing, (continued...)

competing interests, such as ecosystem research, potentially less funding and effort is devoted to traditional USGS endeavors such as assessing energy supplies.[35] In contrast, some others note that the USGS has expanded its scope due to congressional direction in terms of authorities and allocation of funding. Further, they note, the mission of the USGS has changed over time to reflect the needs of the country. For example, Ecosystems Program Area, created in the 2011 reorganization within USGS is targeted toward integrating the cross-disciplinary nature of USGS ecosystem related studies into one mission area to serve the scientific needs of large-scale ecosystem restoration initiatives, some of which have been authorized by Congress. However, critics of this expanded USGS mission contend that ecosystem based research should not be a focus of USGS; rather, research on fish and wildlife and their habitat should be the responsibility of other agencies such as the U.S. Fish and Wildlife Service (FWS).

The USGS role as the scientific agency within DOI was partly defined by the need to separate scientific inquiry from regulatory responsibility. Stakeholders did not want scientific results to come from the same agency that has regulatory responsibilities. The USGS role as the primary scientific agency has continued to evolve. Ecosystem level scientific studies that relate to restoration, habitat assessment, and species survival that are integral to DOI's mission, some contend, should continue to be the responsibility of the USGS. Another distinction between research at USGS and other government entities is that USGS conducts science in *support* of natural resource management versus managing natural resources, a priority for FWS and other DOI agencies.

Some contend that the role of USGS as the scientific agency of DOI might be eroding due to the expansion of scientific expertise and programs within other DOI agencies. For example, FWS has a science support program area that the Administration is attempting to increase. In the FY2015 Administration's request, $31.6 million is proposed for Science Support under FWS, almost double the amount of funds appropriated to this program in FY2014. Increasing the scientific capacity of FWS might weaken the argument that the USGS is the scientific agency for DOI and some might question if FWS and USGS scientific efforts are overlapping or coordinated in certain mission areas.[36]

A related question is how USGS balances its efforts among program areas and whether certain program areas should have greater resources than others. While the allocation of funding for programs under USGS is a responsibility of Congress, USGS does address the issue of balance through a process for framing and guiding its research. Approximately every 10 years the USGS creates a Science Strategy to guide its scientific efforts. The latest strategy was created in 2007 and extends through 2017.[37] This strategy formed the basis for reorganizing the USGS from its traditional discipline-based program areas to interdisciplinary program areas in 2011.

(...continued)

112th Cong., 2nd sess., March 22, 2012.

[35] For an example of this sentiment, see Opening Statement of Hon. Lisa Murkowski, at U.S. Congress, Senate Committee on Energy and Natural Resources, *The Nominations of Dr. Suzette M. Kimball, to be Director of the United States Geological Survey ... etc.*, 113th Cong., 2nd sess., May 13, 2014, S.Hrg 113-287 (Washington: GPO, 2014), p. 2.

[36] Also see FN - also, see http://www.fws.gov/news/ShowNews.cfm?ID=8ECC57B8-DC4B-4C04-7E62B1F033C5353E.

[37] *USGS Science Strategy.*

The question of whether USGS is overreaching its authorities in conducting scientific activities in nontraditional subject areas might be answered through an analysis of congressional authorizations for USGS activities. (See **Appendix** for citations and descriptions of selected USGS authorities.) While the Organic Act provides the Director with broad authority, USGS has interpreted this language as providing flexibility to carry out a wide variety of scientific activities that address issues of national significance. Further, some USGS activities not directly specified by law are considered complementary to DOI actions and activities authorized under law. The DOI agency support role for the USGS has allowed the agency to conduct many activities or initiatives that are not specifically authorized by law, but instead are initiated by the Director or the Secretary of the Interior. For example, the USGS is participating in the DOI Powering Our Future Initiative by supporting agencies responsible for alternative energy permitting and developing methodologies to assess the impacts of wind energy, among other things.[38]

Streamgages

The USGS maintains a network of over 8,000 streamgages that monitor streamflow throughout the country. These streamgages monitor water flow and quality and aid in the collection and retention of streamflow data for the nation. Streamgage data have many applications including measuring flows to manage water supplies for urban, agricultural, and municipal water uses; measuring flows for assessing flooding or drought events; measuring water quality; and providing data to help inform compact or treaty requirements; among other things. Streamgages are funded through the USGS National Streamflow Information Program (NSIP), the USGS Cooperative Water Program, other federal agencies and over 800 state and local funding partners. (See box below for the most recent authorizing legislation concerning streamgages.) The NSIP was formed in 1999 by the USGS to consolidate and better manage the network of approximately 3,086 streamgages that are funded completely by the federal government. Other streamgages are cooperatively funded with other stakeholders and are administered through the Cooperative Water Program (CWP) of the USGS. This program is a partnership between the USGS and approximately 1,400 state, local, and tribal agencies. The USGS and its cooperating parties sign joint-funding agreements to share the cost of specific data collection and investigations undertaken by the USGS. Some streamgages are partially funded by other federal agencies, including the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation.

Funding streamgages is a perennial challenge for the USGS. Each year, there is a mix of certain streamgages that are proposed for discontinuation and other streamgages that are proposed for construction. Stakeholders that rely on streamgages which are proposed for discontinuation usually petition the USGS or cooperative entities to continue to fund the streamgages. An underlying question for the program is how many resources should be devoted to the NSIP streamgage network versus the Cooperative Water Program streamgage network. For FY2015, the Administration has requested an increase of $1.2 million for the NSIP, but a decrease of $3.3 million for the Cooperative Water Program. This could indicate a slight shift to fortifying the national network of streamgages and monitoring from cooperative efforts. In several cases, cooperative efforts to administer streamgages were discontinued due to the stakeholders not providing sufficient funds to support the streamgages. While there does not appear to be opposition to streamgages in Congress, the question remains of how much funding should be allocated toward maintaining streamgages and a streamgage network.

[38] Department of the Interior, *FY2015 Interior Budget in Brief*, Department of the Interior, March 2014, http://www.doi.gov/budget/appropriations/2015/highlights/index.cfm.

SECURE Water Act

Modern USGS efforts to monitor and research groundwater and surface water were formally authorized in the SECURE Water Act.[39] This law authorized the continued implementation of the National Streamflow Program. It also required the Secretary of the Interior to measure hydrological extremes (floods and droughts), measure streamflow and environmental variables in nationally significant watersheds, and integrate streamflow data with data from other federal agencies and state water resource agencies. Further, the SECURE Water Act authorized the Secretary of the Interior to develop a systematic groundwater monitoring program for each major aquifer in the United States, and conduct a study on available data on brackish groundwater.[40] The USGS Water Resources Program is involved in both initiatives. The SECURE Water Act also authorized a national water availability and use assessment program within the USGS. This assessment is to (1) to provide a more accurate assessment of water resources in the United States; and (2) to develop science to improve forecasts of water availability for economic, energy production, and environmental uses.[41]

Long-Term Continuous Observation: The Example of Landsat

Landsat satellites record and transmit space-based images of the Earth's land surface. The Landsat program represents the world's longest continuously acquired collection of land remote sensing data. Stakeholders working in fields such as agriculture, geology, forestry, regional planning, education, mapping, emergency response and disaster relief, and global change research use Landsat data. Landsat is a joint initiative between USGS and the National Aeronautics and Space Administration (NASA). On February 11, 2013, NASA launched Landsat 8, a remote sensing satellite jointly operated by the USGS and NASA that represents the latest in a line of Earth-observing satellites that first began on July 23, 1972, with the launch of Landsat 1. In the current partnership, NASA develops the satellite and the instruments, launches the spacecraft, and checks its performance. After it is launched, USGS takes over satellite operations and manages and distributes the data. All Landsat data held in the USGS archive are available for download with no charge and with no restrictions.[42]

Since 1972, Landsat satellites have continuously gathered land imagery from space using several instruments mounted on the satellite. The instruments have generally improved in capability with the launch of each successive mission,[43] and the resulting imagery data provide a long-term record of natural and human-caused changes to the Earth's land surface. Currently two satellites—Landsat 7 and Landsat 8—orbit the Earth at an altitude of 438 miles and complete 14 full orbits each day and cross every point on Earth once every 16 days. Landsat 7 carries an instrument called the enhanced thematic mapper, which captures visible, near-infrared, shortwave infrared, and thermal radiation reflected back from the Earth's surface. These observations allow

[39] SECURE Water Act (Subtitle F, Title IX of the Omnibus Public Land Management Act of 2009 (42 U.S.C. §10367).

[40] 42 U.S.C. §10367.

[41] Initially the WaterSMART (Sustain and Manage America's Resources for Tomorrow) Initiative. The WaterSMART Initiative provides funding to the USGS, Bureau of Reclamation, and U.S. Department of Energy to achieve a sustainable water strategy to meet the nation's water needs. WaterSMART funding also allowed the USGS to begin the national Water Availability and Use Assessment, as called for under the SECURE Water Act.

[42] USGS, *Landsat—A Global Land Imaging Mission*, Fact Sheet 2012-3072, May 30, 2013, http://pubs.usgs.gov/fs/2012/3072/fs2012-3072.pdf. Most of the technical details and descriptive information about the Landsat program in this section comes from this reference.

[43] The Landsat program has met with some failures in its 40+ year history. For example, Landsat 6 failed to achieve orbit, and an instrument aboard Landsat 7 stopped functioning properly—namely failure of the Scan Line Corrector (SLC), which compensates for the forward motion of the satellite to align forward and reverse scans necessary to create an image. More detailed information is available from the USGS in Fact Sheet 2012-3072.

users to distinguish soil from vegetation, and deciduous from coniferous trees; estimate peak vegetation; discriminate soil moisture content; and provide other information about the land surface. Landsat 8 carries two instruments: an operational land imager, which observes many of the same bands of radiation as Landsat 7 but with improvements; and a thermal infrared sensor as well.

The record of continuous observations by Landsat satellites over 40 years means that users can identify land-cover changes that happen slowly and subtly and are revealed by comparing current observations against those decades ago, like changes in the course of a river; and those that occur rapidly and devastatingly, like a volcanic eruption. The long-term comparability of observations is generally considered a prime value of the Landsat program. Some would also argue that the no-cost data policy for Landsat imagery is also a prime value of the program, but the current no-cost policy does not reflect the varied history of the program and earlier attempts to privatize Landsat.

In addition to recurring interest in privatizing or commercializing Earth observing satellite data, such as Landsat, other issues regarding the future of Landsat may be of interest to Congress. A perennial question would be whether the value of the imagery to its user community is worth the cost and effort of designing, building, launching, and operating the next Landsat satellite. Typically the timeline from design and planning to launch and operations takes years, sometimes approaching a decade or longer. Also, are there other sources of moderate resolution remote sensing data similar or comparable to Landsat available from other satellites operated by other countries? If so, what would be the advantages and disadvantages of acquiring data from those sources, versus a U.S.-built and operated satellite? Part of that discussion would necessarily include an evaluation of the intrinsic value of 40+ years of continuous observations from a series of comparable satellites and instruments—unique to Landsat—and what would be the consequences of terminating that long-term record.

Natural Hazards

Several natural disasters have hit the United States in recent years, ranging from hurricanes to drought. These disasters have generated congressional interest in the science behind natural hazards and efforts to mitigate their effects and predict their occurrences. The Disaster Relief Act of 1974 (P.L. 93-288, also known as the Stafford Act) gives authority to federal agencies to issue disaster warnings. The Stafford Act and other statutes provides the USGS with the authority to issue warnings on geologic hazards, such as earthquakes, volcanic eruptions, and landslides. The Earthquake Hazards Reduction Act of 1977 (P.L. 95-124) and subsequent laws established the National Earthquake Hazards Reduction Program (NEHRP), that authorizes the USGS to improve the basic understanding of earthquakes and characterize national earthquake risks, which are published as seismic hazard maps and used in support of building codes, among other applications.

Under its Natural Hazards Program area, the USGS pursues activities for other natural hazards, such as volcano hazards, landslide hazards, floods and droughts, and wildfire hazards. Arguably, the Organic Act provides authorization for these activities under the language directing the Survey to "... examine the geological structure ... of the national domain." All of the types of natural hazards addressed by the USGS have some fundamental relationship to geological structure, some perhaps more clearly than others. Slip along geologic faults is the primary mechanism for earthquakes, and movement of magma in the Earth's crust leads to volcanic eruptions. Floods, droughts, and wildfires may be less clearly linked to underlying geologic causes. Ultimately, however, the motion of tectonic plates around the globe is responsible for the

modern arrangement of the continents and oceans, which in part leads to weather and climate patterns, the underlying reasons for causing floods and droughts.

The USGS has investigated the geological aspects of natural hazards for a large part of its history. For example, the USGS has managed the Hawaiian Volcano Observatory (HVO) continuously since 1947, and also managed the HVO between 1924 and 1935.[44] The United States has 58 historically active volcanoes, mostly in Alaska, Hawaii, and the Pacific Northwest.

The USGS is also active in monitoring earthquakes and volcano hazards worldwide. For example, the Global Seismic Network (GSN), comprising over 150 seismic stations, is distributed globally to provide a permanent network of seismometers that help provide earthquake locations, information for earthquake hazard mitigation, and earthquake emergency response.[45] The GSN works with the International Monitoring System which is part of the monitoring organization that ensures compliance with the Comprehensive Nuclear Test Ban Treaty. Prior to the GSN, the USGS funded the development and deployment of the Worldwide Standardized Seismographic Network in the early 1960s, which served research purposes as well as for treaty monitoring of nuclear testing.[46] Some of the advances in modern global seismology emerged from the effort to monitor underground nuclear explosions beginning during the Cold War.

Induced Seismicity

One relatively recent addition to the natural hazards responsibilities at the USGS is how to deal with what is known as "induced" seismicity. The issue of induced seismicity has gained national attention because of its possible links to the deep-well injection and disposal of wastewaters from oil and gas operations. The number of deep disposal wells has spiked over the past 5-10 years because of the increase in the number of unconventional wells, namely shale gas and shale oil that benefitted from the process of hydraulic fracturing to recover oil and gas that was previously unrecoverable in economic quantities. (See text box, below, for a description of hydraulic fracturing and induced seismicity.) A challenge to the USGS seismic hazard evaluation is how to gage the earthquake hazard posed by induced seismicity versus the earthquake hazard that is related to tectonic forces.[47]

[44] USGS, "The Story of the Hawaiian Volcano Observatory-A Remarkable First 100 Years of Tracking Eruptions and Earthquakes," USGS General Information Product 135, 60 p., http://pubs.usgs.gov/gip/135/.

[45] The GSN is a cooperative partnership between the USGS and the Integrated Research Institutions for Seismology (IRIS). See http://www.iris.edu/hq/programs/gsn.

[46] Office of Technology Assessment, "Seismic Verification of Nuclear Testing Treaties," May 1988, NTIS order #PB88-214853, p. 64, http://www.fas.org/ota/reports/8838.pdf.

[47] For more information on USGS research into induced seismicity, see http://earthquake.usgs.gov/research/induced/.

The Potential for Human-Induced Earthquakes from Hydraulic Fracturing and Deep-Well Injection of Wastewaters

Human-induced earthquakes, also known as induced seismicity, are an increasing concern in regions of the United States where hydraulic fracturing is occurring and where the produced fluids and wastewaters from oil and gas activities are being injected into the subsurface via deep disposal wells. The immediate concern is that injection of these fluids into underground formations may be responsible for causing damaging earthquakes in regions that typically do not experience much seismic activity. It is also important to distinguish between seismic activity possibly related to hydraulic fracturing itself, versus the possibility of human-induced earthquakes related to injecting fluids down disposal wells, which may not be located near where hydraulic fracturing has taken place.

Some human activities have long been known to have induced earthquakes in some instances: impoundment of reservoirs, surface and underground mining, withdrawal of fluids such as oil and gas, and injection of fluids into subsurface formations. With the increase in the use of horizontal drilling and hydraulic fracturing to extract gas from shale, such as the Marcellus Formation, and the concomitant increase in the amount of fluids that are injected for fracturing and for disposal, there are several indications of a link between the injected fluids and unusual seismic activity. A 2013 review of studies of injection-induced earthquakes indicated that the vast majority of wells used for hydraulic fracturing itself cause microearthquakes—the results of fracturing the rock to extract natural gas—but which are typically too small to be felt or cause damage at the surface.[48] The review documents a few cases where fracking itself caused detectable earthquakes felt at the surface but were too small to cause damage. It further notes that although thousands of hydraulic fractures were created in the Marcellus Formation in Pennsylvania since major development of the field began in 2005, only six earthquakes of magnitude >2 were detected, the largest of which was magnitude 2.3—too small to be felt at the surface.

The principal seismic hazard that has emerged from the increased amount of oil and gas activity appears to be related to disposal of wastewater from deep-well injection. In the Marcellus Shale region, one sequence of earthquakes in 2011 near Youngstown, OH, is believed to be linked to deep-well injection of wastewaters transported across the border from Marcellus wells in Pennsylvania.[49] A series of earthquakes in 2011 in central Oklahoma is increasingly believed to be linked to a pair of wastewater injection wells that began injections 18 years earlier.[50] But the relationship between the timing of injection and subsequent earthquake activity, the amount of fluid injected, the rate, and other factors are still subject to uncertainty and are current research topics. For example, the 2011 Youngstown earthquakes occurred only months after injection began at nearby wells, in contrast to the 2011 central Oklahoma earthquakes where nearly two decades elapsed between injection and increased seismicity. Despite these scientific uncertainties, the evidence for a correlation between deep-well injection and increased earthquake activity appears to be mounting for some regions of the United States. In a May 2, 2014, joint statement between the Oklahoma Geological Survey and the U.S. Geological Survey, the researchers reported a 50% increase in the rate of earthquakes in Oklahoma since 2013.[51] A USGS analysis of the rising trend suggested that a likely contributing factor was deep-well injection of oil-and-gas-related wastewater.[52] The injection-induced earthquakes clearly contribute to seismic risk is those parts of the country where deep-well injection is occurring, according to the 2013 review article.[53] However, the article also notes that only a small fraction of the more than 30,000 UIC Class II wastewater disposal wells appears to be problematic for damaging earthquakes.

[48] William L. Ellsworth, "Injection-Induced Earthquakes," Science, vol. 341, July 12, 2013, http://www.sciencemag.org/content/341/6142/1225942.full.

[49] Ibid.

[50] Ibid.

[51] U.S. Geological Survey/Oklahoma Geological Survey joint statement, "Record Number of Oklahoma Tremors Raises Possibility of Damaging Earthquakes," May 2, 2014, http://earthquake.usgs.gov/regional/ceus/products/newsrelease_05022014.php.

[52] Ibid.

[53] Ellsworth, 2013.

Other Roles?

Several Members of Congress and some stakeholders have suggested that the USGS expand its role in the area of natural hazards. The USGS has contributed an improved fundamental understanding of geological processes, together with improvements in technology, on mitigating the negative impacts of natural hazards. For example, several Congressmen have supported a letter requesting the Administration to provide additional funds to fully develop an Early Earthquake Warning System that would cover the West Coast.[54] Although it is currently impossible to predict earthquakes accurately, an earthquake early warning system may provide some small amount of advance warning to mitigate severe damage and loss of life. An early earthquake warning system would work by detecting the first seismic wave to arrive after an earthquake—the P wave—and immediately transmitting the expected intensity and arrival time of the more damaging S- and surface-waves to critical locations and facilities. Just seconds of warning could allow critical power systems to go into a safe mode, alert medical professionals to stop delicate procedures, and mobilize emergency personnel to regions most likely affected by the strongest shaking.[55] However, implementing such a system could be costly, potentially in the hundreds of millions if done for the nation.[56]

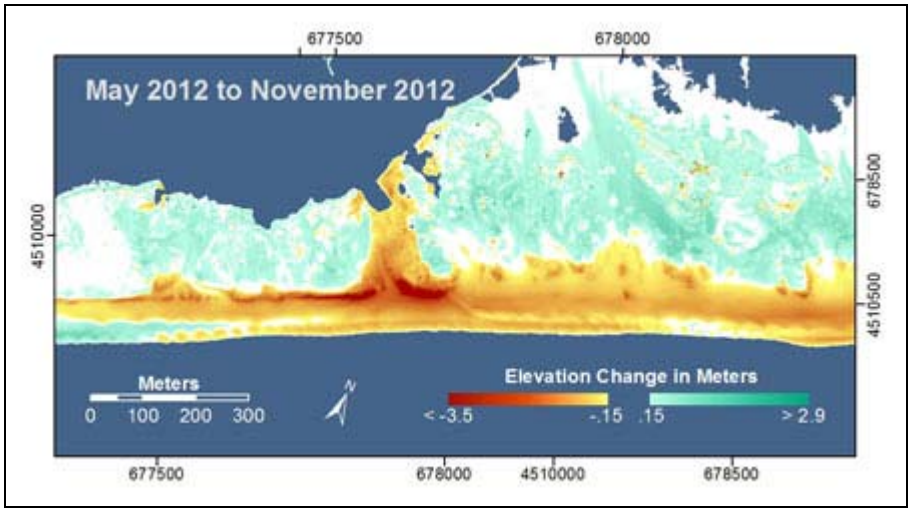
Other hazard mitigation initiatives include USGS work on understanding coastal processes and improving the ability to assess the nation's vulnerability to extreme coastal storms such as hurricanes. The improved will also likely yield better ways to predict how beaches will change after a big storm, and help support better management of coastal infrastructure and resources. For example, **Figure 4** shows the elevation changes pre- and post-Superstorm Sandy within the Fire Island National Seashore, indicating where sand was eroded and resulted in a new channel opening up that cut through the island. Studies such as the one shown in **Figure 4** provide some indication of the potential magnitude of change along sandy beach communities in the United States from a severe coastal storm. This type of information may help community planners, local zoning boards, and emergency response authorities, as well as local government leaders charged with evacuation responsibilities in the event of a pending coastal storm.

[54] Letter from Dianne Feinstein, United States Senator, and Adam Schiff, United States Representative, to President Obama, President of the United States, October 10, 2014.

[55] For more information, see USGS Earthquake Hazards Program, "Earthquake Early Warning," http://earthquake.usgs.gov/research/earlywarning/.

[56] Nationwide earthquake early warning is not a goal of the USGS, however coverage in some Western states is a goal.

Figure 4. Change in Elevation of Part of the Fire Island National Seashore After Superstorm Sandy



Source: USGS, Coastal Change Hazards: Hurricanes and Extreme Storms, http://coastal.er.usgs.gov/hurricanes/sandy/lidar/.

Notes: The section in the middle of the island showing the most elevation loss represents a new channel connecting the Atlantic Ocean on the bottom (south) to the lagoon on the top (north). Superstorm Sandy made landfall in the United States on October 29, 2012.

Brief Chronology of the USGS

Table 2 provides a chronology of selected milestones in the history of the USGS since 1879.

Table 2. Chronology of the U.S. Geological Survey

1879	Congress passes the Organic Act for the USGS, 43 U.S.C. §31.
	The first Director of the USGS, Clarence King (1879-1881), establishes a framework for USGS activities. He expands the scope of the USGS activities to include the entire United States, and leads USGS efforts to establish and implement a mining geology program to collect mineral statistics in the western states.
1880	The Mineral Geology Program begins and focuses on studies of commodities such as iron ore, coal, building stone, and petroleum. Annual volumes describing the mineral resources of the United States are published beginning in 1882.
1881	Under the second director, John Wesley Powell, mineral geology and topographic mapping are separated into two disciplines within USGS.
1888	Congress appropriates funds to the USGS to conduct an irrigation survey of the western United States. This marks the entry of the USGS into studying water resources. The first streamgage is established on the Rio Grande River to measure water flows in the West, primarily to assess the possibility of irrigation.
1894	Congress appropriates funding for streamgages to the USGS, thus initiating the measuring and monitoring of water resources by the USGS.
1895	Basic science becomes an integral part of the Geologic Branch program. Studies are conducted on the genesis of ore deposits, paleontology, stratigraphy, glacial geology, and petrography.

1898	Congress establishes a Division of Mines and Mining in the USGS to gather statistics on mineral resources and mineral production and to make investigations related to mines and mining.
1902	The United States Reclamation Service is established within USGS. The Service studies potential water development projects in each western state with federal lands.
1907	U.S. Bureau of Reclamation is created from the USGS Reclamation Service.
1910	The Bureau of Mines is created from activities previously done within the USGS. The Bureau is created as a response to the identified need for mine safety and mine research efforts. The USGS Technology branch is transferred to the Bureau of Mines.
1917	The USGS forms a Division of Military Surveys. The strategic minerals concept is born out of the necessity to find minerals to support the war effort. The USGS is the main source of information on mineral production, conducting mineral assessment surveys in the United States and in some foreign countries.
1925	DOI delegates the responsibility for supervising mineral leases on federal lands to the USGS.
1946	The Bureau of Land Management is created out of the General Land Office and part of the USGS.
1962	The USGS is authorized to conduct studies outside of the national domain where determined by the Secretary of the Interior to be in the national interest.
1964	A 9.2 magnitude earthquake in Alaska results in massive damage in Anchorage. USGS scientists are part of the task force that guides rebuilding. The USGS Center for Earthquake Research is established in Menlo Park, CA.
1968	The Santa Barbara oil spill raises environmental concerns and the USGS responds with greater work on environmental geology and related studies.
1970	The National Atlas of the United States is published by the USGS. It is the nation's first official atlas.
1974	The Disaster Relief Act of 1974 gave authority for the USGS to issue warnings on geologic hazards, such as earthquakes, volcanic eruptions, and landslides.
1977	Congress directs the USGS to establish a national water use information program. It becomes part of the federal-state cooperative program.
1978	The Conterminous U.S. Minerals Assessment Program is created.
1982	Part of the USGS staff and operating budget is split off to become the Minerals Management Service.
1986	The National Water Quality Assessment Program begins.
1991	1:24,000 topographic quadrangles are completed for the conterminous United States. More than 33 million person hours and $1.6 billion were invested in this project that began in the 1930s.
1992	The National Cooperative Geologic Mapping Program is created.
1996	In the congressional appropriations process, the National Biological Service is merged with the USGS. The USGS creates the USGS Biological Resources Division to conduct biological work.
1996	The Bureau of Mines is abolished and minerals information duties and other programs are transferred back to the USGS.
	DOI science and technology functions are consolidated within the USGS.
2000	The USGS begins a large-scale transformation of its traditional topographic mapping efforts. The National Map is a partnership-based effort led by the USGS to improve

	and deliver topographic information for the nation. The map is digital and enables users to create maps based on elevation, hydrography, and land cover, among other things.
2000	In FY2000, the USGS restructured its programs. The budget consolidated all facilities costs into an overall Facilities category, and administrative costs into a Science Support category. These shifts give the appearance that funding for programs throughout the Survey are decreasing. However, just the Facilities and Administration Costs that are previously part of program budgets are moved to Facilities and Science support categories.
2005	In FY2005, the Enterprise Information program is created. This program consolidates funding of all USGS information needs, including information technology, security, services, and resources management, as well as capital asset planning. Funding for these functions were previously distributed among several different USGS offices and budget sub-activities.
2008	The Global Change program area is created under the USGS. This program aims to provide science, monitoring, and predictive modeling to generate information on climate changes and their effect on the resources and landscape of the United States.
2011	The USGS is reorganized under seven interdisciplinary program areas that include: Ecosystems, Climate and Land Use Change, Energy and Minerals, and Environmental Health, Natural Hazards, Water, and Core Science Systems.

Source: USGS, "Celebrating 125 Years of the U.S. Geological Survey," http://pubs.usgs.gov/circ/2004/1274/2004-1274.pdf, among other sources.

Appendix. Selected USGS Authorities[57]

The USGS Organic Act

43 U.S.C. 31 et seq. The USGS Organic Act of March 3, 1879, as amended, establishes the United States Geological Survey. This act directs the Director of the USGS to classify the public lands and examine the geological structure, mineral resources, and products within and outside the national domain. This act establishes the Office of the Director of the United States Geological Survey under DOI. The Director of the USGS is appointed by the President by and with the advice and consent of the Senate. A section by section breakdown of the act follows:

§ 31. Director of United States Geological Survey

(a) Establishment of office; appointment and duties; examination of geological structure, mineral resources, and products of national domain; prohibitions in respect to lands and surveys The Director of the United States Geological Survey, which office is established, under the Interior Department, shall be appointed by the President by and with the advice and consent of the Senate. This officer shall have the direction of the United States Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain. The Director and members of the United States Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations.

(b) Examination of geological structure, mineral resources, and products outside national domain

The authority of the Secretary of the Interior, exercised through the United States Geological Survey of the Department of the Interior, to examine the geological structure, mineral resources, and products of the national domain, is expanded to authorize such examinations outside the national domain where determined by the Secretary to be in the national interest.

§ 31i. Report on resource research activities

Once every five years the National Academy of Sciences shall review and report on the resource research activities of the Survey.

§ 31j. Biological research activity of Survey; review and report by National Academy of Sciences

Beginning in fiscal year 1998 and once every five years thereafter, the National Academy of Sciences shall review and report on the biological research activity of the Survey.

§ 32. Acting Director

[57] This information was obtained from the link, Congressional Authorizations, found at http://www.usgs.gov/budget/resources_tools.asp.

The Secretary of the Interior may authorize one of the geologists to act as Director of the United States Geological Survey in the absence of that officer.

§ 34. Scientific employees

The scientific employees of the United States Geological Survey shall be selected by the Director, subject to the approval of the Secretary of the Interior exclusively for their qualifications as professional experts.

§ 36. Purchase of books

The purchase of professional and scientific books and periodicals needed for statistical purposes by the scientific divisions of the United States Geological Survey is authorized to be made and paid for out of appropriations made for the said Survey.

§ 36a. Acquisition of scientific or technical books, maps, etc., for library

The Director of the United States Geological Survey, under the general supervision of the Secretary of the Interior, is authorized to acquire for the United States, by gift or devise, scientific or technical books, manuscripts, maps, and related materials, and to deposit the same in the library of the United States Geological Survey for reference and use as authorized by law.

§ 36b. Acquisition of lands or interests therein for use in gaging streams or underground water resources

The Secretary of the Interior may, on behalf of the United States and for use by the United States Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation, but not in excess of ten acres for any one stream gaging station or observation well site. For the same purpose the Secretary of the Interior may obtain easements, licenses, rights-of-way, and leases limited to run for such a period of time or term of years as may be required for the effective performance of the function of gaging streams and underground water resources: Provided, That nothing in this section shall be construed as affecting or intended to affect or in any way to interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this section, shall proceed in conformity with such laws, and nothing in this section shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water, in, to, or from any interstate stream or the waters thereof.

§ 36c. Acceptance of contributions from public and private sources; cooperation with other agencies in prosecution of projects

In fiscal year 1987 and thereafter the United States Geological Survey is authorized to accept lands, buildings, equipment, and other contributions from public and private sources and to prosecute projects in cooperation with other agencies, Federal, State, or private.

§ 36d. Cooperative agreements

Notwithstanding the provisions of the Federal Grant and Cooperative Agreement Act of 1977 (31 U.S.C. 6301–6308), the United States Geological Survey is authorized to continue existing, and

on and after November 10, 2003, to enter into new cooperative agreements directed towards a particular cooperator, in support of joint research and data collection activities with Federal, State, and academic partners funded by appropriations herein, including those that provide for space in cooperator facilities.

§ 38. Topographic surveys; marking elevations

In making topographic surveys west of the ninety fifth meridian elevations above a base level located in each area under survey shall be determined and marked on the ground by iron or stone posts or permanent bench marks, at least two such posts or bench marks to be established in each township, or equivalent area, except in the forest clad and mountain areas, where at least one shall be established, and these shall be placed, whenever practicable, near the township corners of the public land surveys; and in the areas east of the ninety-fifth meridian at least one such post or bench mark shall be similarly established in each area equivalent to the area of a township of the public land surveys.

§ 41. Publications and reports; preparation and sale

Except as otherwise provided in section 1318 of title 44, the publications of the United States Geological Survey shall consist of geological and economic maps, illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. All special memoirs and reports of said survey shall be issued in uniform quarto series if deemed necessary by the director, but otherwise in ordinary octavos. Three thousand copies of each shall be published for scientific exchanges and for sale at the price of publication, and all literary and cartographic materials received in exchange shall be the property of the United States and form a part of the library of the organization; and the money resulting from the sale of such publications shall be covered into the Treasury of the United States, under the direction of the Secretary of the Interior.

§ 42. Distribution of maps and atlases, etc.

The Director of the United States Geological Survey is authorized and directed, on the approval of the Secretary of the Interior, to dispose of the topographic and geologic maps and atlases of the United States, made and published by the United States Geological Survey, at such prices and under such regulations as may from time to time be fixed by him and approved by the Secretary of the Interior; and a number of copies of each map or atlas, not exceeding five hundred, shall be distributed gratuitously among foreign governments and departments of our own Government to literary and scientific associations, and to such educational institutions or libraries as may be designated by the Director of the Survey and approved by the Secretary of the Interior. On and after June 7, 1924, the distribution of geological publications to libraries designated as special depositaries of such publications shall be discontinued.

§ 42a. Use of receipts from sale of maps for map printing and distribution

In fiscal year 1984 and thereafter, all receipts from the sale of maps sold or stored by the United States Geological Survey shall be available for map printing and distribution to supplement funds otherwise available, to remain available until expended.

§ 43. Copies to Senators, Representatives, and Delegates

One copy of each map and atlas shall be sent to each Senator and each Representative and Delegate in Congress, if published within his term; and a second copy shall be placed at the disposal of each such Senator, Representative and Delegate

§ 44. Sale of transfers or copies of data

The Director of the United States Geological Survey shall, if the regular map work of the Survey is in no wise interfered with thereby, furnish to any person, concern, institution, State or foreign government, that shall pay in advance the whole cost thereof with 10 per centum added, transfers or copies of any cartographic or other engraved or lithographic data in the division of engraving and printing of the Survey, and the moneys received by the Director for such transfers or copies shall be deposited in the Treasury.

§ 45. Production and sale of copies of photographs and records; disposition of receipts

The Director of the United States Geological Survey on and after March 4, 1909 may produce and sell on a reimbursable basis to interested persons, concerns, and institutions, copies of aerial or other photographs and mosaics that have been obtained in connection with the authorized work of the United States Geological Survey and photographic or photostatic reproductions of records in the official custody of the Director at such prices (not less than the estimated cost of furnishing such copies or reproductions) as the Director, with the approval of the Secretary of the Interior, may determine, the money received from such sales to be deposited in the Treasury to the credit of the appropriation then current and chargeable for the cost of furnishing copies or reproductions as herein authorized.

§ 49. Extension of cooperative work to Puerto Rico

The provisions of law authorizing the making of topographic and geological surveys and conducting investigations relating to mineral and water resources by the United States Geological Survey in various portions of the United States be, and the same are, extended to authorize such surveys and investigations in Puerto Rico.

§ 50. Survey's share of cost of topographic mapping or water resources investigations carried on with States

The share of the United States Geological Survey in any topographic mapping or water resources data collection and investigations carried on in cooperation with any State or municipality shall not exceed 50 per centum of the cost thereof.

§ 50–1. Funds for mappings and investigations considered intra-governmental funds

Beginning October 1, 1990, and thereafter, funds received from any State, territory, possession, country, international organization, or political subdivision thereof, for topographic, geologic, or water resources mapping or investigations involving cooperation with such an entity shall be considered as intragovernmental funds as defined in the publication titled "A Glossary of Terms Used in the Federal Budget Process."

§ 50a. Working capital fund for United States Geological Survey

There is hereby established in the Treasury of the United States a working capital fund to assist in the management of certain support activities of the United States Geological Survey (hereafter referred to as the ''Survey''), Department of the Interior.

§ 50b. Recording of obligations against accounts receivable and crediting of amounts received; work involving cooperation with State, Territory, etc.

Before, on, and after October 18, 1986, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the United States Geological Survey may, notwithstanding any other provision of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation.

§ 50c. Payment of costs incidental to utilization of services of volunteers

Appropriations herein and on and after December 22, 1987, made shall be available for paying costs incidental to the utilization of services contributed by individuals who serve without compensation as volunteers in aid of work of the United States Geological Survey, and that within appropriations herein and on and after December 22, 1987, provided, United States Geological Survey officials may authorize either direct procurement of or reimbursement for expenses incidental to the effective use of volunteers such as, but not limited to, training, transportation, lodging, subsistence, equipment, and supplies: Provided further, That provision for such expenses or services is in accord with volunteer or cooperative agreements made with such individuals, private organizations, educational institutions, or State or local government.

§ 50d. Services of students or recent graduates

The United States Geological Survey may on and after November 29, 1999, contract directly with individuals or indirectly with institutions or nonprofit organizations, without regard to section 6101 of title 41, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purposes of chapters 57 and 81 of title 5, relating to compensation for travel and work injuries, and chapter 171 of title 28, relating to tort claims, but shall not be considered to be Federal employees for any other purposes.

Other USGS Authorities

Title 7—Agriculture

7 U.S.C. 136. The Federal Environmental Pesticide Control Act of 1972 amends the program established by the Federal Insecticide, Fungicide and Rodenticide Control Act of 1947 for controlling the sale and distribution of certain pesticides. The law requires registration of pesticides to avoid unreasonable adverse effects to humans or the environment. USGS measures pesticides in surface and ground water, and created the Pesticide National Synthesis Project. Pesticide use maps that show the geographic distribution of estimated average annual pesticide use were created under this Project.

7 U.S.C. 2201. The Department of Agriculture Organic Act of 1956 requires the Secretary of Agriculture to obtain the advice of the Secretary of the Interior as to whether certain lands that are being patented, disposed of, or exchanged, are mineral in character. USGS conducts mineral assessments to help determine whether lands are mineral in character.

7 U.S.C. 2204(b). The Rural Development and Policy Act of 1980 authorizes the Secretary of Agriculture to enter cooperative agreements with other federal agencies and organizations to address water management issues in rural areas. USGS conducts the Cooperative Water Program which partners the USGS with other entities to monitor and assess water resources.

Title 15—Commerce and Trade

15 U.S.C. 2901-2908. The National Climate Program Act of 1978 established a national climate program to assist the nation and the world in understanding and responding to natural and human-induced climate processes and their known and potential effects. The USGS Climate and Land Use Change program area conducts research to uncover the potential effects of climate change.

15 U.S.C. 2921 et seq. The Global Change Research Act of 1990 establishes the United States Global Change Research Program, which is aimed at understanding and responding to global change. This also includes studying the cumulative effects of human activities and natural processes on the environment and promoting discussions toward international protocols in global change research.

15 U.S.C. 5631 et seq. The Land Remote Sensing Policy Act of 1992 authorizes the USGS to provide data continuity for the Landsat program. This act also assigns responsibility for maintaining the National Satellite Land Remote Sensing Data Archive to the DOI. This act authorizes the DOI and other federal agencies to carry out research and development programs to make Landsat data available and useful to the public.

Title 16—Conservation

16 U.S.C. 17 et seq. Parts of the National Park Service Organic Act of 1916, as amended, apply to the USGS. Notably, the Outdoor Recreation Act of 1936 authorizes the Secretary of the Interior to sponsor, engage in, and assist in research related to outdoor recreation; undertake studies and assemble information concerning outdoor recreation; and cooperate with educational institutions and others to assist in establishing education programs and activities, among other things. USGS conducts various studies related to outdoor recreation in lands managed by the National Park Service.

16 U.S.C. 661 et seq. The Fish and Wildlife Coordination Act of 1934 authorizes the Secretary of the Interior to prepare plans to protect wildlife resources, conduct surveys on public lands, and accept funds or lands for related purposes; authorize the investigation and reporting of proposed federal actions that affect the development, protection, rearing, and stocking of all species of wildlife and their habitat; and conduct actions to minimize impacts on fish and wildlife resources. The USGS Ecosystems program area conducts studies that address these authorities.

16 U.S.C. 703-712. The Migratory Bird Treaty Act of 1918, as amended, implements four international treaties that affect migratory birds common to the United States, Canada, Mexico, Japan, and the former Soviet Union. The act establishes federal responsibility for protection and management of migratory and nongame birds. USGS actively studies migratory bird populations in its Northern Prairie Wildlife Research Center in North Dakota.

16 U.S.C. 715. The Migratory Bird Conservation Act of 1900 establishes the Migratory Bird Conservation Commission and authorizes the Secretary of the Interior to conduct investigations

and publish documents related to North American birds. USGS conducts several studies on migratory birds through its research centers.

16 U.S.C. 742(a) et seq. The Fish and Wildlife Act of 1956 authorizes the Secretary of the Interior to conduct investigations, prepare and disseminate information, and make periodic reports to the public regarding the availability and abundance and the biological requirements of fish and wildlife resources. The act also authorizes the Secretary to provide a comprehensive national fish and wildlife policy and to develop, manage, and conserve fisheries and wildlife resources. The USGS addresses all of these requirements through activities in its Ecosystem program area.

16 U.S.C. 742(l). The Fish and Wildlife Improvement Act of 1978, as amended, authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, state fish and game agencies, and nonprofit organizations, for the purpose of developing research and training programs for fish and wildlife resources. The USGS has entered into cooperative agreements with various states and universities to address the conservation of fish and wildlife resources. For example, see the Florida Cooperative Fish and Wildlife Research Unit.[58]

16 U.S.C. 931-939. The Great Lakes Fishery Act of 1956 implements the Convention on Great Lakes Fisheries between the United States and Canada; authorizes construction, operation, and maintenance of sea lamprey control works; sets forth procedures for coordination and consultation with States and other Federal agencies; and establishes the Great Lakes Fisheries Commission. The USGS has a Great Lakes Science Center that coordinates USGS research throughout the Great Lakes region.

16 U.S.C. 1131et seq. The Wilderness Act of 1964, as amended, requires the USGS to assess the mineral resources of each area proposed or established as wilderness. The studies are to be on a planned and recurring basis. The original series of studies was completed, and no recurring studies have been requested or funded, according to the USGS.

16 U.S.C. 1361 et seq. The Marine Mammal Protection Act of 1972, as amended, gives DOI the responsibility to conserve marine mammals such as the sea otter, walrus, polar bear, dugong, and manatee. USGS has conducted several population level studies on these species.

16 U.S.C. 1451 et seq. The Coastal Zone Management Act of 1976 provides that each department, agency, and instrumentality of the Executive Branch of the federal government assist the Secretary of Commerce in carrying out research and technical assistance for coastal zone management. The USGS coordinates with states and other federal agencies in conducting studies that address coastal management.

16 U.S.C. 1531 et seq. The Endangered Species Act of 1973, as amended, provides for the conservation of threatened and endangered species of fish, wildlife, and plants, and authorizes the establishment of cooperative agreements and grants-in-aid to states that maintain programs for endangered and threatened wildlife and plants. The USGS has conducted several studies that analyze the population dynamics of species listed under the Endangered Species Act.

[58] See http://www.wec.ufl.edu/coop.

16 U.S.C. 1604. The Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976, authorizes the USGS as a party in an interagency agreement with the Forest Service to assess the mineral resources of National Forests.

16 U.S.C. 3141 et seq. The Alaska National Interest Lands Conservation Act of 1980 designates certain public lands in Alaska as units of the National Park, National Wildlife Refuge, Wild and Scenic Rivers, National Wilderness Preservation and National Forest Systems. The act requires the Secretary of the Interior to assess the oil and gas potential of federal lands in Alaska north of 68 degrees north latitude and east of the western boundary of the National Petroleum Reserve–Alaska. The act also authorizes the Secretary of the Interior to initiate and carry out a study of all federal lands in designated areas of Alaska. The study is to contain an assessment of the potential oil and gas resources of these lands; review of the wilderness characteristics of the lands; and a study of the wildlife resources of these lands. The law states that the USGS "has made and may be called upon to make water studies pertinent to implementation of the act." Further, the law authorizes the Secretary to conduct studies of the oil and gas potential of non-North Slope federal lands, and ecosystem and wildlife resources that would be affected by oil and gas exploration. Under the authority of this law, the USGS has the responsibility to assess the oil, gas, and other mineral potential on all public lands in Alaska. The law also contained a requirement to present an annual minerals report to Congress. The preparation of this report was delegated to the USGS. The annual reporting requirement was terminated, effective May 15, 2000, pursuant to section 3003 of P.L. 104-66, as amended.

16 U.S.C. 3501 et seq. The Coastal Barrier Resources Act of 1982 designates various underdeveloped coastal barrier islands depicted by specific maps for inclusions in the Coastal Barrier Resource System. USGS conducts research on coastal barrier ecosystems and their resiliency under stress of flooding and storm surges.

P.L. 106-514. The Coastal Barrier Resources Reauthorization Act of 2000 reauthorizes and amends the Coastal Barrier Resources Act of 1999. The act authorizes cooperative efforts between the Secretary of the Interior and the Director of FEMA to provide existing digital spatial data of the John H. Chafee Coastal Barrier Resource System. If data do not exist to carry out this pilot project, the USGS is instructed to obtain and provide the data required to the Secretary.

16 U.S.C. 4701 et seq. The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 establishes a federal program to prevent introduction and control the spread of introduced aquatic nuisance species. USGS conducts studies that characterize invasive species, their spread, and potential control.

Title 25—Indians

25 U.S.C. 450 et seq. The Tribal Self-Governance Act of 1994 authorizes USGS participation in the Tribal Self-Governance Program. The USGS discusses programs and activities with interested tribal governments.

Title 30—Mineral Lands and Mining

30 U.S.C. 21(a). The Mining and Minerals Policy Act of 1970 provides the DOI with the responsibility for assessing the mineral resources of the Nation. The USGS Mineral Resources Program aims to provide scientific information for mineral resource assessments, and conducts research on mineral production, consumption, potential, and environmental effects.

30 U.S.C. 201. The Federal Coal Leasing Amendments Act of 1976 provides that no lease sale may be held on federal lands unless the lands containing the coal deposits have been included in a comprehensive land-use plan. Under this act, the Secretary of the Interior is authorized to collect data and information to evaluate the extent, location, and potential for developing the known recoverable coal resources within the coal lands. The USGS provides data and information from coal research and field investigations to the Bureau of Land Management to meet the requirements of the coal leasing program.

30 U.S.C. 641 authorizes the Secretary of the Interior to search for domestic mineral reserves and to establish and maintain a program for mineral exploration by private industry within the United States, territories, and possessions.

30 U.S.C. 1026 requires the Secretary of the Interior to (1) maintain a monitoring program for significant thermal features within units of the National Park System, and (2) establish a research program to collect and assess data on the geothermal resources within units of the National Park System in cooperation with the USGS. Under this law, the USGS is directed to conduct a study of the impact of present geothermal development in the vicinity of Yellowstone National Park on the thermal features within the park.

30 U.S.C. 1028. The Energy Policy Act of 1992 directs the Secretary of the Interior, through the USGS and in consultation with the Secretary of Energy, to establish a cooperative government-private sector program with respect to hot dry-rock geothermal energy resources on public lands. The act authorizes recurring assessments of the undiscovered oil and gas resources of the United States.

30 U.S.C. 1101, 1121, 1123. The Geothermal Energy Research, Development, and Demonstration Act of 1974 gives DOI the responsibility for evaluating and assessing the geothermal resource base and the development of exploration technologies. The USGS and other appropriate agencies are directed to develop and carry out a plan to inventory all forms of geothermal resources of federal lands; conduct regional surveys; publish and make available maps, reports, and other documents developed from the surveys; and participate with non-federal entities in research to develop, improve, and test technologies for the discovery and evaluation of geothermal resources.

30 U.S.C. 1201-1202, 1211. The Surface Mining Control and Reclamation Act of 1977, as amended, establishes the Office of Surface Mining Reclamation and Enforcement (OSM). OSM depends, in part, upon the USGS for researching the potential hydrologic consequences of mining and reclamation operations.

30 U.S.C. 1419 et seq. The Deep Seabed Hard Mineral Resources Act of 1980 authorizes a program of ocean research that includes the development of studies on the ecological, geological, and physical aspects of the deep seabed in areas of the ocean where exploration and commercial development are likely to occur. The USGS provides geological and mineral resource expertise in responding to the requirements of the act.

30 U.S.C 1601 et seq. The National Materials and Minerals Policy, Research and Development Act of 1980 gives the responsibility of assessing the mineral resources of the nation to DOI.

30 U.S.C. 1901-1902. The Methane Hydrate Research and Development Act of 2000 authorizes appropriations for the establishment of a methane hydrate research and development program within the Department of Energy (DOE). DOE is directed to carry out this program in

consultation with the United States Navy, USGS, Minerals Management Service, and National Science Foundation through grants, contracts, and cooperative agreements with universities and industrial enterprises. The law also authorizes studies on the use of methane hydrate as a source of energy.

Title 33—Navigation and Navigable Waters

33 U.S.C. 883(a). The Great Lakes Shoreline Mapping Act of 1987 authorizes the USGS to participate in the creation of a shoreline map of the Great Lakes.

33 U.S.C. 1251-1274, 2901. The Federal Water Pollution Control Act Amendments of 1972, Clean Water Act of 1977, and Water Quality Act of 1987, authorize water quality planning, studies, and monitoring under the direction of the Environmental Protection Agency (EPA). The USGS contributes to this effort by providing surface and ground water data to the EPA. Under this act, EPA is authorized to establish national programs for the prevention, reduction, and elimination of pollution, including the establishment of a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters, using the resources of the USGS and others. This act also authorizes research on water quality in large ecosystems throughout the country, including the Chesapeake Bay, the Great Lakes, and Puget Sound. The USGS actively monitors and studies water quality in these ecosystems and others.

33 U.S.C. 1271. The Water Resources Development Act of 1992 establishes a National Contaminated Sediment Task Force, with USGS as a member, to conduct a comprehensive national survey of aquatic sediment quality.

33 U.S.C. 2701, 2761. The Oil Pollution Act of 1990 authorizes the establishment of an Interagency Coordinating Committee on Oil Pollution Research, of which the DOI is a member. One task of the Committee is to develop a plan for oil pollution research, oil extraction development, and a demonstration program.

Title 42—The Public Health and Welfare

42 U.S.C. 300(f) et seq. The Safe Drinking Water Act Amendments of 1996 authorize research on the causes, propagation, and prevention of contaminants in drinking water. The USGS and EPA have an interagency agreement for conducting studies on sole source aquifers.

42 U.S.C. 2021(b) et seq. The Low-Level Radioactive Waste Policy Act of 1980 requires intra-state or regional arrangements for disposal of low-level radioactive waste. The USGS provides geo-hydrologic research and technology to federal and state agencies for developing plans to address low-level waste management.

42 U.S.C. 4001 et seq. The National Flood Insurance Act of 1968 authorizes floodplain mapping and collecting data on flood frequency. Both activities are aided by USGS efforts to measure floodplains and estimate flooding under various scenarios.

42 U.S.C. 5121, 5132. The Disaster Relief Act of 1974 (P.L. 93-288, also known as the Stafford Act) gives authority to federal agencies to issue disaster warnings. The Stafford Act provides the USGS with the authority to issue warnings on geologic hazards, such as earthquakes, volcanic eruptions, and landslides.

42 U.S.C. 5845(c). The Energy Reorganization Act of 1974 directs federal agencies to provide research for the Nuclear Regulatory Commission, consult and cooperate with the Commission on research matters of mutual interest, and provide such information and physical access to its facilities to help the Commission perform its licensing and related regulatory functions. The USGS conducts geological mapping in areas where nuclear reactor construction is anticipated and conducts investigations of geologic processes that could imperil the safe operation of reactors or other critical energy facilities.

42 U.S.C. 6217. The Energy Act of 2000 extends energy conservation programs authorized under the Energy Policy and Conservation Act. The USGS acts on behalf of the Secretary of the Interior to conduct and update an inventory of all onshore energy production on federal lands. The inventory identifies reserve estimates of the oil and gas resources underlying these lands and restrictions or impediments to development of such resources.

42 U.S.C. 6901 et seq. The Resource Conservation and Recovery Act of 1976 and Hazardous and Solid Waste Amendments of 1984 require the EPA to promulgate guidelines and regulations for identifying and managing solid waste, including disposal. The USGS assists this process by defining and predicting the hydrologic effects of waste disposal.

42 U.S.C. 7401 et seq. The Clean Air Act of 1977 regulates air quality and emissions from mobile and stationary sources. The act also establishes requirements to prevent significant deterioration of air quality in the nation, and aims to preserve air quality in national parks, national wilderness areas, national monuments and national seashores. The USGS monitors air quality in specific areas and measures the effects of air quality on ecosystems and surface waters (e.g., effects of acid rain).

42 U.S.C. 7701 et seq. The Earthquake Hazards Reduction Act of 1977 sets as a national goal the reduction in the risks of life and property from future earthquakes in the United States through the establishment and maintenance of a balanced earthquake program encompassing prediction and hazard assessment research, seismic monitoring and information dissemination. Subsequent public laws establish a National Earthquake Hazards Reduction Program and authorize the USGS to improve the basic understanding of earthquakes and characterize national earthquake risks, which are published as seismic hazard maps and used in support of building codes, among other applications.

42 U.S.C. 8901 et seq. The Acid Precipitation Act of 1980 authorizes activities to address acid rain. The USGS conducts research on acid rain and coordinates interagency monitoring of precipitation chemistry. The USGS National Coal Resources Data System was named by the EPA as the official database for information on coal quality. The EPA, utility companies, and coal mining industries use the database to estimate the amount of air pollution derived from coal combustion.

42 U.S.C. 9601 et seq. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) establishes a Hazardous Substance Superfund (26 U.S.C. 9507) to help finance cleanup programs at heavily contaminated sites with toxic wastes. The USGS works with the EPA and state agencies to investigate and determine the extent of contamination and remedial measures at some of these sites.

42 U.S.C. 10301 et seq. This law addresses water resources research and authorizes research activities through State Water Resource Research Institutes. Further, this law provides for water

resources research, information transfer and student training in grants and contract programs that aim to augment federal and state efforts to discover practical solutions to water shortage and quality deterioration problems.

42 U.S.C. 10367. This law authorizes the continued implementation of the National Streamflow Program implemented by the USGS, and authorizes the Secretary of the Interior to measure hydrological extremes (e.g., droughts and floods), and streamflow and other environmental variables in national significant watersheds.

Title 43—Public Lands

43 U.S.C. 31 et seq. The Organic Act of the USGS directs the director of the USGS to classify the public lands and examine the geological structure, mineral resources, and products within and outside the national domain. The Organic Act was amended by the National Geologic Mapping Act of 1992. This authorizes the creation of the National Cooperative Geologic Mapping Program (43 U.S.C. 31(a–h)). Further, it directs the Secretary of the Interior to provide biennial reports on the status of the program, progress in developing the national geologic map database, and recommendations for legislative or other action to achieve the purposes of the act. The act also requires the National Academy of Sciences to review and report on the resource research activities of the USGS, and report on the biological research activity of the USGS once every five years. This section of the code authorizes several other activities of the USGS, including, for example: creating topographic surveys, writing and distributing scientific reports and geological maps; cooperative work with state or municipalities on topographic and water resources work that does not exceed 50% of the cost; and international work that addresses issues of national interest.

43 U.S.C. 371. The Reclamation Projects Authorization and Adjustment Act of 1992 directs the President to undertake a comprehensive review of federal activities in the 19 western states that directly or indirectly affect the allocation and use of surface or subsurface resources. The Secretary of the Interior, through the USGS, conducts investigations and reviews ground water resources in these states.

43 U.S.C. 1334 et seq. The Outer Continental Shelf (OCS) Lands Act authorizes the Secretary of the Interior to prescribe rules and regulations that aim to conserve natural resources of the OCS; to allow for geological and geophysical explorations of the OCS; and to direct the Secretary of the Interior to conduct a study of any region containing a gas and oil lease sale. The study is done to obtain information on the management of environmental impacts oil and gas extraction might have on human, marine and coastal areas.

Title 50, Appendix—War and National Defense

50 U.S.C. 98. The Strategic and Critical Materials Stock Piling Act of 1946 directs? USGS to assess the quantity of domestic minerals, especially minerals used for strategic and critical purposes. The act also authorizes USGS efforts to study the economic conditions affecting mining and materials processing industries and conduct scientific, technological, and economic investigations on the development, mining, preparation, treatment, and utilization of ore and other minerals.

Author Contact Information

(name redacted)
Specialist in Natural Resources Policy
#redacted#@crs.loc.gov, 7-....

(name redacted)
Specialist in Energy and Natural Resources Policy
#redacted#@crs.loc.gov, 7-....