Program Changes

Program Changes - USGS Initiatives

Component	Subactivity	2014 Program Change Amount ($000)	FTE Changes
Renewable Energy		**4,000**	**6**
	Energy Resources	[2,000]	[3]
	Wildlife Program	[2,000]	[3]
WaterSMART		**14,495**	**66**
	Fisheries Program	[1,386]	[5]
	Land Change Science	[136]	0
	Contaminant Biology	[1,000]	[3]
	Toxic Substance Hydrology	[1,800]	[4]
	Groundwater Resources	[1,827]	[7]
	National Water Quality Assessment	[3,300]	[24]
	Hydrologic Research & Development	[300]	[2]
	Hydrologic Networks & Analysis	[2.346]	[11]
	Cooperative Water Program	[2,000]	[10]
	National Cooperative Geologic Mapping Program	[200]	[0]
	National Geospatial Program	[200]	[0]
Earth Scientists for Tomorrow		**1,000**	**0**
	Science Support	[1,000]	[0]
Science for Adapting to a Changing Climate		**16,153**	**24**
	Carbon Sequestration	[2,958]	[5]
	Climate Research & Development	[3,172]	[10]
	National Climate Change and Wildlife Science Center /DOI Climate Science Centers (CSC)	[10,023]	[9]
Ecosystem Priorities		**16,571**	**34**
	Fisheries Program	[901]	[4]
	Environments Program	[5,284]	[8]
	Invasive Species	[4,000]	[8]
	Land Change Science	[1,500]	[6]
	Contaminant Biology	[200]	[0]
	Toxic Substance Hydrology	[200]	[1]
	National Water Quality Assessment	[1,700]	[5]
	Hydrologic Research & Development	[1,182]	[2]
	Science Synthesis, Analysis and Research Program	[800]	[0]
	National Geospatial Program	[804]	[0]
3DEP: Enhanced Elevation for the Nation		**11,000**	**2**
	Coastal & Marine Geology	[2,000]	[2]
	National Geospatial Program	[9,000]	[0]
Hydraulic Fracturing		**13,035**	**32**
	Fisheries Program	[2,200]	[10]
	Energy Resources	[1,250]	[6]
	Contaminant Biology	[1,400]	[5]
	Earthquake Hazards	[1,700]	[3]
	Groundwater Resources	[2,100]	[6]
	Hydrologic Research & Development	[2,200]	[2]
	Science Synthesis, Analysis and Research Program	[185]	[0]
	National Cooperative Geologic Mapping Program	[2,000]	[0]
Earth and Environmental Observations Innovation and Applications		**9,000**	**1**
	Science Synthesis, Analysis and Research Program	[9,000]	[1]
Science for Coastal and Ocean Stewardship		**6,050**	**9**
	Coastal & Marine Geology	[5,750]	[9]
	Science Synthesis, Analysis and Research Program	[300]	[0]
Environmental Impacts of Uranium Mining		**3,000**	**12**
	Contaminant Biology	[500]	[3]
	Toxic Substance Hydrology	[2,500]	[9]
Improving Rapid Disaster Response		**2,507**	**8**
	Land Change Science	[757]	[4]
	Earthquake Hazards	[850]	[1]
	Volcano Hazards	[400]	[1]
	Landslide Hazards	[500]	[2]
Total: USGS		**96,811**	**194**

* Estimated changes in FTEs compare against actual 2012 FTE usage, not 2012 enacted formulation estimates.

Program Changes - USGS Increases			
Component	**Subactivity**	**2014 Program Change Amount ($000)**	**FTE Changes**
White Nose Syndrome		**1,505**	**1**
	Wildlife Program	[1,505]	[1]
Coral Reefs		**442**	**1**
	Environments Program	[442]	[1]
Brown Tree Snakes		**500**	**0**
	Invasive Species	[500]	[0]
New and Emerging Invasive of National Concern		**874**	**4**
	Invasive Species	[874]	[4]
Rare Earth Elements Research		**1,000**	**5**
	Mineral Resources	[1,000]	[5]
High Priority Research on Critical Minerals		**1,130**	**7**
	Mineral Resources	[1,130]	[7]
Emerging Contaminants/ Chemical Mixtures		**2,000**	**5**
	Contaminant Biology	[1,000]	[3]
	Toxic Substance Hydrology	[1,000]	[2]
Pathogens and Contaminants		**611**	**2**
	Contaminant Biology	[611]	[2]
Earthquake Products and Improved Monitoring in Eastern U.S.		**1,200**	**0**
	Earthquake Hazards	[1,200]	[0]
Enhance Monitoring		**108**	**0**
	Geomagnetism	[108]	[0]
Enhanced Coastal Storm Response Capability		**850**	**3**
	Coastal & Marine Geology	[850]	[3]
Streamgages		**7,161**	**0**
	National Streamflow Information Program	[7,161]	[0]
Streamgage R&D		**1,000**	**1**
	Hydrologic Research & Development	[1,000]	[1]
Tribes		**1,000**	**7**
	Cooperative Water Program	[1,000]	[7]
NAQWA Related Studies		**1,000**	**7**
	Cooperative Water Program	[1,000]	[7]
Geological and Geophysical Data Preservation		**400**	**0**
	Science Synthesis, Analysis and Research Program	[400]	[0]
Alaska Mapping		**1,044**	**0**
	National Geospatial Program	[1,044]	[0]
Operations and Maintenance Efficiencies-Reduce Facilities Footprint		**6,385**	**0**
	Rental Payments and Operations & Maintenance	[6,385]	[0]
Total: USGS		**28,210**	**43**

* Estimated changes in FTEs compare against actual 2012 FTE usage, not 2012 enacted formulation estimates.

Program Changes - USGS Decreases			
Component	Subactivity	2014 Program Change Amount ($000)	FTE Changes
Geologic Carbon Sequestration		**-532**	**-1**
	Carbon Sequestration	[-532]	[-1]
National Civil Application Program/Civil Applications Committee		**-576**	**-2**
	Land Remote Sensing	[-576]	[-2]
North American Data Buy		**-1,000**	**0**
	Land Remote Sensing	[-1,000]	[0]
Minerals Information		**-1,157**	**-10**
	Mineral Resources	[-1,157]	[-10]
Minerals Resources		**-1,000**	**-8**
	Mineral Resources	[-1,000]	[-8]
Research and Assessment		**-2,803**	**-23**
	Mineral Resources	[-2,803]	[-23]
Eliminate Management-Supporting Habitat and Service Mapping		**-2,150**	**-8**
	Coastal & Marine Geology	[-2,150]	[-8]
Great Lakes Beach Health Study		**-600**	**-1**
	Coastal & Marine Geology	[-600]	[-1]
Methods Development and Assessments		**-5,000**	**-29**
	National Water Quality Assessment	[-5,000]	[-29]
Data Collection and Research		**-867**	**-9**
	Hydrologic Networks & Analysis	[-867]	[-9]
Interpretive Studies/Assessments		**-4,000**	**-25**
	Cooperative Water Program	[-4,000]	[-25]
Water Resources Research Act		**-5,490**	**0**
	Water Resources Research Act Program	[-5,490]	[0]
Federal Geographic Data Committee		**-1,697**	**-3**
	National Geospatial Program	[-1,697]	[-3]
Administrative Services		**-3,135**	**-18**
	Science Support	[-1,906]	[-8]
	Security & Technology	[-1,229]	[-10]
General Program Reductions		**-6,629**	**0**
	Status and trends	[-145]	0
	Fisheries Program	[-172]	0
	Wildlife Program	[-320]	0
	Environments Program	[-283]	0
	Invasive Species	[-59]	0
	Cooperative Research Units	[-132]	0
	National Climate Change and Wildlife Science Center /DOI Climate Science Centers (CSC)	[-89]	0
	Climate Research & Development	[-162]	0
	Carbon Sequestration	[-41]	0
	Science Support for DOI Bureaus	[-8]	0
	Land Remote Sensing	[-153]	0
	Land Change Science	[-83]	0
	Mineral Resources	[-439]	0
	Energy Resources	[-189]	0
	Contaminant Biology	[-67]	0
	Toxic Substance Hydrology	[-57]	0
	Earthquake Hazards	[-312]	0
	Volcano Hazards	[-188]	0
	Landslide Hazards	[-27]	0
	Global Seismographic Network	[-17]	0
	Geomagnetism	[-17]	0
	Coastal & Marine Geology	[-300]	0
	Groundwater Resources	[-69]	0
	National Water Quality Assessment	[-500]	0
	National Streamflow Information Program	[-114]	0
	Hydrologic Research & Development	[-280]	0
	Hydrologic Networks & Analysis	[-219]	0
	Cooperative Water Program	[-403]	0
	Water Resources Research Act Program	[-4]	0
	Science Synthesis, Analysis and Research Program	[-100]	0
	National Cooperative Geologic Mapping Program	[-165]	0
	National Geospatial Program	[-460]	0
	Science Support	[-22]	0
	Security & Technology	[-165]	0
	Rental Payments and Operations & Maintenance	[-868]	0
Total: USGS		**-36,636**	**-137**

* Estimated changes in FTEs compare against actual 2012 FTE usage not 2012 enacted formulation estimates.

Program Changes - USGS Internal Transfers			
Subactivity	**Internal Transfer**	**2014 Program Change Amount ($000)**	**FTE Changes**
Internal Transfer		**2,358**	**12**
Environments	Internal Transfer from Science Support for DOI Bureaus	[2,358]	[12]
Internal Transfer Decrease		**-2,358**	**-12**
Science Support for DOI Bureaus	Internal Transfer to Environments	[-2,358]	[-12]
Internal Transfer Total		**0**	**0**

* Estimated changes in FTEs compare against actual 2012 FTE usage, not 2012 enacted formulation estimates.

Priority Increases

Renewable Energy

Renewable Energy							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Wildlife Program		*592*	592	0	2,000	2,592	2,000
	FTE	*3*	3	0	3	6	3
Energy Resources		*1,600*	1,600	0	2,000	3,600	2,000
	FTE	*0*	0	0	3	3	3
Total Requirements ($000)		***2,192***	**2,192**	**0**	**4,000**	**6,192**	**4,000**
	Total FTE	***3***	**3**	**0**	**6**	**9**	**6**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for Renewable Energy is $6,192,000 and 9 FTE, a program increase of +$4,000,000 and +6 FTE from the 2012 Enacted level.

Overview

The proposed funding increase in 2014 would fund research to support permitting decisions for alternative energies on Federal lands and research to provide information on species, populations, habitats, and energy technology so that impacts of energy development on natural populations can be assessed and modeled as part of decision support tools.

Program Performance

Renewable Energy **+$4,000,000/+6 FTE**

Energy Future and Wildlife Sustainability **(+$2,000,000/+3 FTE)**

Wildlife Program (+$2,000,000/+3 FTE)

Traditional and alternative energy innovation, development, production and delivery will remain a national focus for decades. USGS ecosystems science is a key linkage between energy development and sustainability of our ecosystems, and is at the forefront of providing information for management decisions, particularly for renewable energy. The USGS is a leader in supplying science needed to solve the challenges of making progress in energy availability, while maintaining functioning natural systems. New research would build on the past three years of focused work on impacts to golden eagles, bats, condors, and tortoise from wind and solar energy development. The USGS would collect biological data; focus on strengthening and developing advanced technologies, such as algorithms and advanced computing infrastructure to mine bird and bat information from existing weather data; and thermal imaging and infrared videography to allow observations of birds and bats at night. In the Arctic, the USGS would build on pilot studies using remote data collection methods and multi-agency collaborations to solve unprecedented challenges in marine mammal research, resulting in information about mammals and their environments and address Native peoples' concerns about traditional polar bear research methods (physical capture using immobilizing drugs). Large tracts of the Arctic are now leased for oil and gas development and exploratory drilling, resulting in significant overlap between the leased areas

and those used by the Pacific walrus. Research would add new knowledge on potential impacts of seismic activities and ship traffic for this declining species.

Alternative Energy Permitting on Federal Lands **+$2,000,000/+3 FTE**

Energy Resources Program (+$2,000,000/+3 FTE)

This proposed increase allows the Energy Resources Program (ERP) to provide science support to the agencies responsible for energy resource management on Federal Lands in several ways. There is substantial potential for unconventional geothermal resources (Enhanced Geothermal Systems) on Federal lands, but these resources have not yet been thoroughly evaluated. The U.S. Geological Survey (USGS) would use core capabilities in geothermal research to evaluate the geology and subsurface characteristics to identify likely areas of potential exploration and development of geothermal resources. The Bureau of Land Management (BLM) and other bureaus could use this information for land use planning, lease sales, and potentially a targeted environmental impact statement for high grade areas. The proposed funding increase would allow a focused effort to survey and subsequently track the impacts of geothermal development over time, which have been poorly characterized to date. This effort would focus on key areas where there are, or may be, issues related to ongoing geothermal production. The increase would also allow for additional support for researching induced seismicity related to geothermal development on Federal lands, and help to determine the risks and potential mitigation plans should development be proposed.

Water Challenges: WaterSMART

WaterSMART		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Fisheries Program		*498*	498	0	1,386	1,884	1,386
	FTE	*0*	0	0	5	5	5
Land Change Science		*634*	498	136	0	634	136
	FTE	*0*	0	0	0	0	0
Contaminant Biology		*0*	0	0	1,000	1,000	1,000
	FTE	*0*	0	0	3	3	3
Toxic Substance Hydrology		*0*	0	0	1,800	1,800	1,800
	FTE	*0*	0	0	4	4	4
Groundwater Resources		*2,685*	2,685	0	1,827	4,512	1,827
	FTE	*0*	0	0	7	7	7
National Water Quality Assessment		*1,100*	0	1,100	2,200	3,300	3,300
	FTE	*6*	0	6	18	24	24
Hydrologic Research & Development		*0*	0	0	300	300	300
	FTE	*0*	0	0	2	2	2
Hydrologic Networks & Analysis		*5,393*	4,293	1,100	1,246	6,639	2,346
	FTE	*5*	3	2	9	14	11
Cooperative Water Program		*1,500*	0	1,500	500	2,000	2,000
	FTE	*0*	0	0	10	10	10
National Cooperative Geologic Mapping Program		*0*	0	0	200	200	200
	FTE	*0*	0	0	0	0	0
National Geospatial Program		*200*	0	200	0	200	200
	FTE	*0*	0	0	0	0	0
Total Requirements ($000)		***12,010***	**7,974**	**4,036**	**10,459**	**22,469**	**14,495**
	Total FTE	***11***	**3**	**8**	**58**	**69**	**66**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for the USGS's WaterSMART Availability and Use Assessment initiative is $22,469,000 and 69 FTE, a program increase of +$14,495,000 and +66 FTE from the 2012 Enacted level.

Overview

As competition for water resources grows for irrigation of crops, for growing cities and communities, for energy production, and for the environment, the need for information and tools to aid water and natural resource managers grows. WaterSMART is a Department of the Interior initiative that leverages and directs existing expertise and resources within the USGS (along with the Bureau of Reclamation) towards addressing complex, national and regional-scale water challenges. Among the primary focuses of the WaterSMART initiative are developing a national water census, better understanding water budgets, supporting ecologically-sound water management, and better understanding the connections between water quality and availability. Leveraging expertise across multiple disciplines enables a broader focus to address these challenging issues in a time of growing competition for water resources. The USGS possesses both the skills and foundational resources to unlock this knowledge and provide water resource, ecosystem, and land use managers the decision support tools to make more informed decisions. The goal of this initiative is to provide a well-integrated and thorough understanding of how water quantity and quality combine to influence water availability for human and ecosystem uses. USGS expertise in understanding the hydrologic cycle, water geochemistry, land use effects on water, human water use, and the ways in which water quality and quantity affect the natural environment make the USGS the premier

science agency to address this issue. WaterSMART, through the combined efforts of Bureau of Reclamation in the West and the USGS throughout the entire Nation, provides the foundation for a sustainable water strategy. The Nation will be well served through this effort, by gaining the ability to balance water resource sustainability through consideration of water quantity, quality, and uses, including ecological uses.

Program Performance

Water Quality Enhancement **(+$5,986,000/+25 FTE)**

National Water Quality Assessment (+$275,000/+2 FTE)

This funding increase within the National Water Quality Assessment subactivity is being implemented in the 2013 Operating Plan.

Fisheries	(+$1,386,000/+5 FTE)
Contaminant Biology	(+$1,000,000/+3 FTE)
Toxic Substances Hydrology	(+$1,800,000/+4 FTE)
National Water Quality Assessment	(+$1,525,000/+11 FTE)

Efforts in this area would produce a national synthesis of knowledge on the degree to which water quality influences the quantity of water suitable for both human and ecosystem uses. In 2014, the USGS would publish the results of synthesis efforts for five of the Nation's principal aquifers. Each report would describe what is known about water quality conditions for principal aquifers, the natural and human factors influencing water quality conditions, and the implications for water availability. The national synthesis would focus on understanding the natural and human-induced variability in quality across the Nation; developing fundamental ways of assessing the degree to which environmental contamination affects water quality, human and ecological exposure, and the associated adverse ecological effects on aquatic organisms; and improving understanding of the cause-and-effect linkages between water quality and availability. This involves the integration of water quality and quantity information in relation to the human and ecological needs for water in priority and representative settings across the Nation. The synthesis effort would add a strong component of water quality to the water availability analysis. Water quality would be examined in the context of suitability of ambient water for environmental needs, as well as potential increased costs for making the raw water suitable for intended human needs.

The USGS would identify the highest priority water resource contamination issues facing the Nation. Contaminants of emerging environmental concern would be identified. Studies would evaluate the overlay chemical occurrence with habitat utilization and land management practices in order to better quantify risk, and evaluate potential tools that resource managers might use to reduce exposure and impacts to terrestrial and aquatic organisms. New methods would be developed to measure these emerging contaminants and their impacts on the environment at levels that enable systematic assessment by monitoring and compliance programs. The information provided would guide decisions related to reducing environmental release of contaminants, protecting natural resources, and safeguarding public health. Models would be developed that use this information to enable evaluation of the regional and national implications of emerging environmental contamination issues

Ecological (or environmental) flows are defined as the quantity, quality, and timing of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Ecological flow recommendations are utilized by water management authorities to establish flow criteria, often minimum flow criteria, into allocation decisions for water withdrawals from streams, rivers, or basins. However, rivers, streams, and estuaries also support a wide

range of other ecosystems services with significant monetary and non-monetary benefits to society. With increased demand for consumptive freshwater use for domestic supply, agriculture, manufacturing, and energy production, there is a growing need to incorporate ecosystem service valuation into ecological flow guidelines that allow water managers to quantify trade-offs in monetary and non-monetary costs of water allocation decisions.

The following research in collaboration with Federal, Tribal, State, academic, and private partners would support better incorporation of ecosystem services valuation into current ecological flow recommendations:

- Coordinate data collection and analysis to qualitatively describe and quantitatively value the impact of alternative ecological flows on ecosystem services. Characterize and aggregate ecological and biological data (State, Tribal, and Federal) to support ecological flow criteria development and describe the ecosystem services and their values associated with alternative streamflows;
- Incorporate ecological services modules into existing water availability studies (WaterSMART) and biological components to existing nutrient transport models like Spatially Referenced Regressions on Watershed attributes (SPARROW). Development of information and tools to assist in understanding flow relationships on ecosystem services in the Upper Colorado River, Delaware River, and Apalachicola-Chattahoochee-Flint basins. Evaluate the transferability of science from one study basin to another. Incorporate a biological component into the Chesapeake Bay SPARROW model to help explain divergence of model nutrient loads from measured concentrations;
- Develop web-based tools to support the acquisition of ecological flow data and related ecosystem service information by stakeholders. Develop a cyber-data portal to allow researchers and others access to ecological data from a common database. The portal would be based on common technology standards for exchanging and integrating environmental observations and would enable connections to other large data collections including water-quality data collected by Federal, State, and tribal organizations. Stakeholder access would be through map-based displays and would serve biological and hydrologic information to facilitate studies of ecological flow at regional, state, or basin scales and their impact on ecosystem services; and
- Develop methods for incorporating ecosystem services into adaptive management and structured decision processes. Develop effective methods and practices of transferring information on ecosystem service valuation into ecological flow guidelines and decisions within adaptive management and structured decisionmaking processes.

National Groundwater Monitoring Network **(+$763,000/+3 FTE)**

Land Change Science (+$136,000/+0 FTE)

This funding increase within the Land Change Science Program subactivity is being implemented in the 2013 Operating Plan.

Groundwater Resources (+$627,000/+3 FTE)

The SECURE Water Act Section 9507(b) authorizes a National Groundwater Monitoring Network (NGWMN) to develop a systematic monitoring program for each major aquifer system in the United States, and to complete implementation of the groundwater Climate Response Network (CRN) into each of the Nation's 366 Climate Divisions. The proposed increase would support implementation of these two efforts, but would not fully fund the activities. The CRN would be expanded into additional

Climate Divisions. This effort would provide valuable data during ongoing and future droughts. The first year funding would be made available in 2014 to begin the implementation of the NGWMN as conceptualized by the Advisory Committee on Water Information, Subcommittee on Ground Water in its 2009 report, "A National Framework for Ground Water Monitoring in the United States." This initial funding would allow the NGWMN to move from the current pilot stage and begin initial implementation of the Network. The pilot scale NGWMN data and information portal would be upgraded to production scale, and the USGS would provide technical assistance to partner data providers who volunteer to join the NGWMN.

Regional Estimates of Baseflow and Recharge **(+$1,200,000/+4 FTE)**

Groundwater Resources (+$1,200,000/+4 FTE)

As part of the regional groundwater availability studies being conducted by the Groundwater Resources Program, water budgets are developed for a subset (40 of 62) of the priority principal aquifers mapped in the United Sates. Estimates of baseflow and recharge for the United States are required in a timely manner to generate water budgets for every watershed in United States under WaterSMART. In 2014, the GWRP would use the resources provided to develop regional techniques and further develop methods to extrapolate estimates of these parameters from areas currently being analyzed to areas with similar characteristics that are not scheduled for detailed study.

National/Regional Synopsis and Surveys **(+$500,000/+5 FTE)**

National Water Quality Assessment (+$275,000/+2 FTE)

This funding increase within the National Water Quality Assessment subactivity is being implemented in the 2013 Operating Plan.

National Water Quality Assessment (+$225,000/+3 FTE)

The USGS would conduct regional, multi-disciplinary streamflow and water-quality surveys to: (1) determine contaminant concentrations in relation to land use and chemical use in selected regions; (2) determine links between streamflow, contaminant conditions, and ecological impairment; and (3) evaluate the significance of contaminant distributions and levels to sources of drinking water. The first of these regional assessments is being developed in collaboration with the States and the U.S. Environmental Protection Agency's (EPA) National Rivers and Streams Assessment Program and will focus on stream quality in the agricultural Midwest, a region encompassing parts of 12 states. Other areas that are candidates for Regional studies in 2014 include the humid southeast, arid southwest, the Atlantic Highlands, and the Rocky Mountains. Targeted regional studies would provide resource managers with data and tools to understand and predict ecological conditions in relation to streamflow alteration and concentrations of contaminants, nutrients, and sediment.

Predictive Models **(+$500,000/+3 FTE)**

National Water Quality Assessment (+$275,000/+1 FTE)

This funding increase within the National Water Quality Assessment subactivity is being implemented in the 2013 Operating Plan.

National Water Quality Assessment (+$225,000/+2 FTE)

USGS researchers would develop predictive models, visual displays of scientific information, and other decision-support tools for developing scenario analyses on the water quantity and quality linkage and the effects on vulnerable resources, human uses, ecosystems, and species. These models would incorporate water quality data that have been collected by the USGS systematically across the Nation, and through geochemical studies of water and rock interactions. USGS water quality models**,** such as SPARROW and Watershed Regressions for Pesticides (WARP), which link concentrations and loads of pesticides, nutrients, sediment, or salinity to sources and hydrologic conditions would also be enhanced and improved through this effort. Dynamic SPARROW models that would predict changes in water quality in response to changes in land cover or hydroclimatic conditions would be developed.

Program and Information Management **(+$2,300,000/+7 FTE)**

National Water Quality Assessment (+$275,000/+1 FTE)
Hydrologic Networks and Analysis (+$1,100,000/+2 FTE)
National Geospatial Program (+$200,000/+0 FTE)

These funding increases within the National Water Quality Assessment, the Hydrologic Networks and Analysis, and the National Geospatial Program subactivities are being implemented in the 2013 Operating Plan.

National Water Quality Assessment (+$225,000/+2 FTE)
Hydrologic Networks and Analysis (+$300,000/+2 FTE)
National Cooperative Geologic Mapping (+$200,000/+0 FTE)

Managing the various data streams and integrating this information into a cohesive picture is a major effort under WaterSMART. In 2014, work to store, integrate and serve the data and information about water budget components within a defined watershed would continue. A pilot Web-based system is being developed with the capability to identify a watershed of interest and then access all information on daily streamflows, recharge, precipitation, evapotranspiration, changes in storage and monthly water use characteristics for that watershed and all watersheds above it. The same system would be used to develop the overall water budget and access information on historical trends in water budget components. New national and regional models of potential stressors, such as altered streamflow, nutrient delivery, and contaminant toxicity, would provide managers with critical information on stressors that affect ecological health. Other data and information management efforts would focus on supporting needs for stream ecological science by providing more effective ways to access biological data from multiagency sources and integrate that data with hydrologic information. WaterSMART would enhance USGS capabilities that link concentrations and loads of water quality constituents to the water resources that they influence, so that the consequences of changing water quality can be related to overall water availability. The USGS would integrate existing information with decision-support tools that facilitate exploitation of that information in a manner that is relevant to natural resource management and public use decisionmaking.

WaterSMART efforts would integrate water use location information into the National Hydrography Dataset. Such locations, from the Site-specific Water Use Data System (SWUDS), are places where water is withdrawn, diverted, transferred, or returned to the Nation's hydrographic network. The integration of these data would allow managers to view and model the downstream and interbasin effects of water use. The increase to the National Cooperative Geologic Mapping Program would be used to provide 3D subsurface geologic frameworks of glacially-derived deposits in the northern United States.

Streamflow Estimation and Stressors to Hydrology - Water Use Research (+$2,300,000/+12 FTE)

Hydrologic Research and Development	(+$300,000/+2 FTE)
Cooperative Water Program	(+$2,000,000/+10 FTE)

USGS researchers are developing a system by which water managers and the public would be able to access and use critical water budget information in their water availability analyses. Streamflow is one of the most critical components of a water budget. Water resource managers require this information at temporal and spatial scales which the USGS is unable to deliver through traditional monitoring programs. In order to deliver this information, the USGS must make use of hydrologic models in addition to traditional monitoring networks. These models must deliver daily values of streamflow at spatial scales relative to very small watersheds everywhere in the Nation. In order to support these models and deliver streamflow data that are of acceptable quality, the USGS must undertake various activities that improve the certainty of models for areas of the Nation where measured hydrologic information is sparse. These activities include acquisition of information on the hydrological characteristics of open-channel flows, additional data layers of basin characteristics, and representative streamflow discharges and velocities. The funds from the Hydrologic Research and Development and Cooperative Water Programs would be used to acquire this information and feed it into the models that are used to estimate streamflow data for water budget analysis under the WaterSMART water availability and use assessment. As with all, Cooperative Water Program efforts, appropriated funds could be leveraged by non-Federal partners who are interested in and willing to further these objectives.

Water use information, which delineates the direct hydrologic stresses caused by human water withdrawals and return flows, is also critical information for WaterSMART's water budget analysis. This information, which is mostly collected at State, tribal, regional, and local governmental levels, must be obtained on a geospatially site-specific scale in order to be fully useful in WaterSMART analyses. Directed work is required to develop better methods of sampling, estimating, aggregating, and presenting water use data. Research into new methods that use remote sensing and spatial datasets in water use estimation is needed. The research and networks and analysis functions of the USGS would work together to advance the development of those methods for use within the WaterSMART initiative. In addition, the Cooperative Water Program would work directly with State, tribal, regional, and local cooperators to make maximum use of their water use datasets in the water availability and use assessment. Priority would be placed on irrigation and self-supplied industrial water use. The USGS would integrate this information with decision-support tools that facilitate use of that information in a manner that is relevant to water resource management decisionmaking.

Estimating Water Budget **(+$100,000/1 FTE)**

Hydrologic Networks and Analysis	(+$100,000/1 FTE)

USGS researchers are developing a system by which water managers and the public will be able to access and use critical water budget information in their water availability analyses. New or improved methods for estimating various components of water use would be developed. Better estimates of the various components of the water budget also would allow the development of better flow and ecological models.

Ecological Flows and Water Use Science (+$846,000/6 FTE)

Hydrologic Networks and Analysis (+$846,000/6 FTE)

The USGS is advancing the understanding of the water availability needs of wildlife and habitat through the following major efforts:

- Developing a classification system, for use by stakeholders, of the streams across the Nation based on their hydro-ecological type;
- Systematically assembling and making available to the public biological and hydrological datasets for use in flow alteration–ecological response analysis;
- Developing statistical tools that allow stakeholders to analyze these data for their areas of interest and incorporate ecological water needs into water availability analysis; and
- Supporting ecological water needs work in geographic focus area studies.

In 2014, the USGS would begin the process of developing a statistical modeling approach to make the connection between hydrology and biology within any target watershed. This effort connects with the streamflow estimation and hydro-ecological classification efforts of WaterSMART. The USGS would look at a particular watershed and postulate what could be accomplished with differing levels of data ranging from data-poor to data-rich environments. This effort would be tested in 2014 in a variety of basins where the USGS possesses robust biological and hydrological datasets, for example biological GAP datasets.

Water use information would be made available in databases containing key hydrologic information that addresses precipitation; water in snowpack, ice fields, and large lakes; evapotranspiration; stream and river run-off characteristics; total water withdrawals by source; stream and river baseflow characteristics; interbasin transfers; groundwater level indices; consumptive uses; rates of groundwater recharge; changes in groundwater storage; and return flows.

Youth Stewardship: Earth Scientists for Tomorrow

Earth Scientists for Tomorrow							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Science Support		*1,602*	1,602	0	1,000	2,602	1,000
	FTE	*0*	0	0	0	0	0
Total Requirements ($000)		***1,602***	**1,602**	**0**	**1,000**	**2,602**	**1,000**
	Total FTE	***0***	**0**	**0**	**0**	**0**	**0**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for the USGS's Youth Stewardship initiative is $2,602,000 and 0 FTE, a program increase of +$1,000,000 and 0 FTE from the 2012 Enacted level.

Overview

The USGS has a proud history of mentoring and engaging the youth of the Nation. Prior to Secretary Salazar implementing the Youth Stewardship Agency Priority Goal (APG), the USGS had successful programs in place that provided a broad array of research and learning experiences to young people in the geosciences. Two programs that are excellent examples are the National Association of Geoscience Teachers (NAGT)/ USGS Cooperative Summer Field Training Program and EDMAP, a component of the National Cooperative Geologic Mapping Program. These mentoring opportunities are aimed at engaging and grooming students in pursuit of scientific careers, increasing science literacy, and instilling a sense of stewardship for the Earth. In 2014, the USGS would expand its education and internship programs for underrepresented students in Earth science fields relenvent to the USGS mission and recruitment needs, including tribal colleges and veterans, as well as expanded partnerships in support of the 21st Century Conservation Service Corps.

USGS engagement with youth covers a broad age range. Typically, USGS outreach activities and science camps are aimed at elementary and secondary school students, while internship programs employ students in high school, colleges and universities, and graduate school. The USGS also engages and hires post graduate young scientists that are critical to the development of the USGS science mission. The USGS values and supports youth programs and activities across the Nation.

As the Federal workforce faces the retirement eligibility of 53 percent of permanent full-time employees by 2014 (per OPM estimates), the USGS considers the development of a science workforce of tomorrow a vital tool in succession planning and passing on institutional knowledge.

Program Performance

Science Support **+$1,000,000/0 FTE**

21st Century Conservation and Natural Resources Science Corps **(+$1,000,000/0 FTE)**

Science Support – Office of Science Quality and Integrity (+$1,000,000/0 FTE)

As part of a proposed $10.0 million distribution among the Department of the Interior (Interior) bureaus, the USGS would receive an increase of $1.0 million to establish the science component of the 21st Century Conservation Service Corps , part of the America's Great Outdoors (AGO) initiative. This science component, the 21st Century Conservation and Natural Resources Science Corps (Science Corps), would put young Americans to work for USGS science programs, providing science for decisionmaking in support of protecting, restoring, and enhancing public and tribal lands and waters. The USGS would engage other Interior bureaus, Tribes, learning institutions and governmental and non-governmental organizations, to create partnerships and projects with the goal of developing USGS's next generation of scientists. The USGS provides critical early science experiences through its education programs, resources for teachers, and research oportunities for students to work with USGS scientists.

Career pathways in conservation and natural resources science would be provided to 50 students from underrepresented groups, by coupling Science Corps internships with cooperative training programs at two and four year colleges. This would help build upon and expand current hydrologic, biologic, and physical science technician programs with Gateway (Phoenix, AZ), Vermillion (Ely, MN), South Dakota, and Northern Virginia Community Colleges, and would be expanded to new minority-serving institutions and tribal colleges. The Science Corps would also provide internships, mentoring, and training in life skills, such as how to effectively apply to college, to approximately 50 urban high school youth by working with city governments, city schools, and inner city summer programs. Current pilot programs in Denver, CO, and Albuquerque, NM, would be expanded and new programs in Washington, DC, and other cities would be created. These examples highlight the USGS's unique role of working with a wide array of cooperators to bring world class Earth science to decisionmakers, communities, and schools.

The development of a new general Science Corps program of approximately 100 undergraduate students would work with the Interior bureaus and other partners, such as the National Science Foundation, University of Texas, Student Conservation Association, and GeoCorps America to create recruitment, hiring, and project placement processes that can be readily used by others. The students would work with USGS scientists and others on projects that support USGS mission goals. In addition, an effective, low cost evaluation methodology would be developed and implemented to ensure USGS youth programs are meeting goals, are based on best practices, and provide an evidence-based improvement process.

Science for Adapting to a Changing Climate

Science for Adapting to a Changing Climate							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
National Climate Change and Wildlife Science Center/DOI Climate Science Centers (CSC)		*25,198*	25,198	0	10,094	35,292	10,094
	FTE	*48*	48	0	9	57	9
Climate Research & Development		*21,759*	21,759	0	3,351	25,110	3,351
	FTE	*133*	133	0	10	143	10
Carbon Sequestration		*4,437*	4,437	0	2,958	7,420	2,983
	FTE	*19*	19	0	5	24	5
Total Requirements ($000)		***51,394***	**51,394**	**0**	**16,403**	**67,822**	**16,428**
	Total FTE	***200***	**200**	**0**	**24**	**224**	**24**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for the U.S. Geological Survey's Science for Adapting to Changing Climate initiative is $67,822,000 and 224 FTE, a program increase of +$16,428,000 and +24 FTE from the 2012 Enacted level.

Overview

Climate change is one of the greatest natural resource challenges the world faces. In both President Barack Obama's January 2013 inaugural speech and his 2013 State of the Union address, President Obama stated "…we must do more to combat climate change." The overwhelming judgment of science is that the climate is changing, and it is important to be prepared for extreme weather events and other impacts. American prosperity, security, resilience, and sustainability require investments in activities designed to improve our understanding and strengthen the Nation's climate preparedness and resilience. The USGS has conducted climate change research for over 100 years in an effort to understand the impact of climate change on humans and wildlife. In particular, the National Climate Change and Wildlife Science Center (NCCWSC)/Department of the Interior Climate Science Centers (CSC) Program, the Climate Research and Development (R&D) Program, and the Carbon Sequestration program in the USGS Climate and Land Use Change Mission Area all conduct research to inform resource managers' strategies to mitigate and adapt to climate change. Continued research leveraging all of these programs' strengths is needed to better understand climate change impacts on natural resources and the infrastructure of the Nation.

Program Performance

Climate and Land Use Change **+16,403,000/+24 FTE**

National Climate Change and Wildlife Science Center/Department of the Interior Climate Science Centers (+10,023,000/+9 FTE)

Established in 2008, the NCCWSC has created eight regional CSCs to provide resource management agencies with science and technical support on the impacts of climate change on fish, wildlife, and ecological processes. In early 2013, Interior released a policy that requires Interior bureaus and offices to incorporate climate adaptation into policies, programs, planning, and operations. Fundamental to such a policy, and essential for developing priorities for adaptations, is an improved understanding of Interior's

most vulnerable assets. Federal studies are underway that relate to the vulnerability of lands, water, wildlife, cultural resources, and other resource management responsibilities. In 2014 the NCCWSC would use work with an existing interagency coordination group to develop a public cross-agency database and field guide to vulnerability assessments. This would support Interior and other agencies in establishing standards and best practices and tracking progress for such assessments, and in strategically prioritizing management actions.

Interagency coordination would be important during the building and maintaining of the vulnerability assessment database. Interagency coordination would help to eliminate redundancy and make maximum use of existing data and information. In 2014, the NCCWSC would use a portion of the new funding to develop and implement the technical means to track relevant climate change adaptation science across Federal agencies and ensure the availability of this information in a web accessible format at the regional and national scale. Additionally, the CSCs would work with regional partners to identify common priorities and develop multi-agency strategies that ensure coordinated implementation of public science investments to target the most critical management needs. This cross-agency dialogue convened by the CSCs represents a critical component of an effective and efficient Federal response to the climate science needs of managers. Investment in better coordination allows the NCCWSC/CSCs to better leverage the capacity and expertise of existing institutions and better meet the needs of decisionmakers.

The NCCWSC/CSCs would use additional funding in 2014 for translational science grants, particularly in resource management and in coordination with the biologic carbon sequestration project. The CSCs would significantly expand their activities that support adaptation planning, with a focus on meeting the needs of specific decisions and planning activities, and on delivering application-ready information. The CSCs would develop an approach that uses decision-focused methods to identify policy choices that could be informed by research outputs, then develop working groups of scientists, managers and decisionmakers to assure that science projects provide decision ready outcomes. Establishing an ongoing collaboration between research scientists and land managers is essential to the successful application of decision science. The NCCWSC would work with the biologic carbon sequestration project to find common themes and incorporate national assessment results into adaptation planning. The CSCs would pilot this effort through regional projects focused on sea level rise impacts to coastal habitats and on the impacts of extended drought on ecosystems.

The NCCWSC/CSC Program would also use additional funding to better develop tribal climate science partnerships. As Native American communities confront the challenge of a changing climate, their demand for scientific and planning information grows. The CSCs would work with tribes to identify a suite of high priority tribal resource management concerns and build a science portfolio that provides information directly responsive to these needs. In addition, the NCCWSC and CSCs would work to identify best practices for the potential integration of traditional ecological knowledge into science and funding opportunities. These efforts would be guided and supported by participation of tribal interests on CSC stakeholder committees and on the Federal advisory committee established to guide the NCCWSC. These efforts will also be coordinated with the Bureau of Indian Affairs climate programs, tribal governments, consortia, and organizations, and other Federal climate efforts in Indian Country.

Climate Research and Development **(+3,172,000/+10 FTE)**

For more than fifty years, the Climate Research and Development (R&D) Program has supported fundamental multidisciplinary research needed to understand patterns of climate and land use change and their impacts on the Earth system. In 2014, the Climate R&D Program requests an increase of $3.2 million to focus efforts on emerging science needs. This research would increase capabilities of the Climate R&D Program to understand regional responses to climate and land use stressors and to forecast impacts of different climate and land use scenarios.

An important emerging science need is the identification and documentation of long-term patterns of drought, storms, and ocean circulation. Recent drought events and model projections of increased aridity in parts of the world have raised concerns about the ability of society to respond to and mitigate impacts of altered water availability. Because monitoring of climate variables such as temperature and precipitation spans only the last century or so, it is critical to integrate them with fossil and chemical indicators of past climate to understand the magnitude, frequency, spatial impacts, and drivers of droughts and megadroughts (events that lasted decades). In 2014, the Climate R&D Program plans to initiate a coordinated research effort to document baseline levels of variability in water resources across the United States, complemented by research on ocean variability to determine whether changes in ocean circulation are tied to droughts, storms, and other events that affect coasts, urban areas, agriculture, and other sectors in our Nation.

Because of the high concentration of the U.S. population along our Nation's coastline, a rising sea level would have significant impacts on society, infrastructure, and coastal habitats that serve as buffers from storm surges and severe weather events. One emerging science need is to improve our ability to accurately forecast rates and magnitudes of future sea level rise. This can be done by understanding the potential contributions of melting glaciers and ice sheets to sea level. In 2014, The Climate R&D Program would conduct research to develop consistent methods to measure the amount of water contained in alpine glaciers. This research would reduce uncertainties regarding how much fresh water released from melting glaciers that leads to sea level rise. The Climate R&D Program would expand research on geologic records of past high sea levels. This effort would document the amount of sea level rise during past warm events as well as improve the interpretation of the impacts of melting of Antarctic and Greenland ice sheets versus warming of the oceans on sea level rise.

Another emerging science need is the response of coastal habitats to combined effects of sea level rise and changing land use. Both stressors affect the distribution of plant communities and the ecosystem services that they provide. In 2014, the Climate R&D Program would expand efforts to integrate ecological research on existing plant communities with reconstructions of past vegetation and aquatic communities to improve our understanding of how coastal habitats respond to specific changes. By designing projects in consultation with resource managers within national parks and U.S. Fish and Wildlife (FWS) Refuges, the results should facilitate development of sustainable resource management strategies for the Nation's coastlines.

An effective application of climate research to address resource management needs requires ongoing communication between USGS scientists and resource managers as well as an understanding of our scientific capabilities and limitations. This requires Climate R&D Program scientists to work with stakeholders in public lands to identify their most pressing science needs and coordinate with researchers to develop projects to address those needs. In 2014, the Climate R&D Program and the NCCWSC propose cost-sharing of staff with expertise in both natural resource management and research to work with stakeholders and researchers to design research efforts aimed at providing data on ecosystem response to climate and land use changes over appropriate temporal and regional scales that would facilitate development of sustainable management plans.

Biologic Carbon Sequestration **(+2,958,000/+5 FTE)**

In accordance with the Energy Independence and Security Act of 2007, the USGS began in 2009, assessing the potential capacity of carbon sequestration in ecosystems. In 2014, the USGS would complete the first-ever national assessment of carbon stocks and carbon sequestration for all ecosystems and evaluating effects of all major driving processes. This biological national assessment encompasses all 50 states and would provide estimates for both current conditions and for future carbon sequestration capacities. The biological carbon sequestration project is requesting new funding in 2014 to improve

methods and models, so that changes in ecosystem carbon storage can be monitored and reported consistently, future periodic assessments can be made with improved accuracy and confidence, and land managers and policymakers can use the assessment results in land management decisions.

The biological carbon sequestration assessment project would use a portion of the requested funding increase to improve methods and models for accounting and monitoring carbon in ecosystems. Research is needed to better quantify and monitor changes in carbon storage related to land use and climate change, so that such changes can be evaluated and reported consistently and in a timely manner. This new research includes developing methods in remote sensing; land use and land cover change detection; the mapping of fire and other natural disturbances; linking land use/cover change and ecosystem carbon models; and creating statistical methods that analyze and scale data from the USGS streamgage network. Besides the anticipated improvement in methods and models, the biologic carbon sequestration project would focus on the following thematic areas that represent key science and information gaps: the quantification of greenhouse gas emissions in different types of wetlands; the impacts of non-fire disturbances such as insect infestation and diseases; the integration of terrestrial and aquatic processes in selected watersheds; and the development of improved land use carbon models and testing of such models in selected ecosystems. Additional funding would be used to support adapting and enhancing existing ecosystem service portfolio models that would be used to support land management applications. Specific algorithms and calibrations that would be incorporated are tailored to the needs of specific land management applications.

The biological carbon sequestration project would also use a portion of the requested funding increase to link the national biological carbon sequestration assessment results to land management applications particularly in the FWS and the National Park Service (NPS).). The USGS will also reach out to the BIA to identify potential for integrating biological carbon sequestration into Tribal resource managers' decisionmaking. The USGS plans to collaborate with the FWS, the NPS, and academic experts on quantifying and reducing uncertainties in the estimates of the national assessment and developing decision support mechanisms such as models, workshops, and experiments. The goal of quantifying and reducing uncertainties in estimating carbon stocks and sequestration is to increase the accuracy and confidence of the assessment results. This work would quantify the uncertainties of the assessment and develop strategies for reducing these uncertainties by focusing on the scientific gaps identified. The goal of developing decision support tools is to allow land managers to ask “what-if” questions regarding potential land management strategies on carbon stocks and sequestration capacity, as well as on other ecosystem services, such as biodiversity, water quality, etc. These tools are effective only if they can be developed together with land managers and other users who have intimate knowledge of management and community requirements. The requested new funding would help the USGS to: conduct facilitated workshops with land management agencies to identify requirements and possible management actions; develop landscape or watershed-scale data to improve the resolution of the assessment results; test and adapt different ecosystem services management models; develop specific management tradeoff scenarios and related algorithms; and develop visualization tools. This project would be a multi-year collaboration that would continue through 2018.

Ecosystem Priorities

Ecosystem Priorities							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
California Bay-Delta		*6,002*	6,002	0	2,982	8,984	2,982
	FTE	*12*	12	0	4	16	4
Chesapeake Bay		*7,349*	7,349	0	1,815	9,164	1,815
	FTE	*29*	29	0	5	34	5
Columbia River		*12,537*	12,537	0	854	13,391	854
	FTE	*48*	48	0	2	50	2
Everglades		*6,882*	6,882	0	1,000	7,882	1,000
	FTE	*30*	30	0	2	32	2
Great Lakes		*3,117*	2,617	500	1,500	4,617	2,000
	FTE	*8*	6	2	2	10	4
Puget Sound		*6,396*	6,396	0	1,019	7,415	1,019
	FTE	*26*	26	0	2	28	2
Upper Mississippi River		*5,362*	4,862	500	700	6,062	1,200
	FTE	*24*	23	1	3	27	4
Klamath Basin		*2,631*	2,631	0	901	3,532	901
	FTE	*0*	0	0	4	4	4
Eco Informa		*500*		500	300	800	800
	FTE	*0*		0		0	0
National Ecosystems Services Framework		*0*	0	0	1,000	1,000	1,000
	FTE	*0*	0	0	1	1	1
Land Use Science		*0*	0	0	1,000	1,000	1,000
	FTE	*0*	0	0	4	4	4
Sustaining Environmental Capital		*500*	0	500	1,500	2,000	2,000
	FTE	*1*	0	1	1	2	2
Total Requirements ($000)		***51,276***	**49,276**	**2,000**	**14,571**	**65,847**	**16,571**
Total FTE		***78***	**74**	**4**	**30**	**208**	**34**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of Program Change **(+$16,571,000/+34 FTE)**

The 2014 budget request for Ecosystem Priorities is $65,847,000 and 208 FTE, a program increase of +$16,571,000 and +34 FTE from the 2012 Enacted.

Overview

Knowledge of ecosystems is critical to the well-being of the Nation because ecosystems supply the natural resources and other goods and services that humans require. The scope of science needed to improve conservation and restoration of ecosystems is complex. Regional environmental resource issues in many ecosystems are at critical decisionmaking junctures as they are challenged with balancing human needs with ecosystem health. The multidisciplinary approach applied by the USGS is necessary to develop an understanding both of individual ecosystem processes as well as holistic ecosystem level evaluations of responses to actual and proposed restoration alternatives and plans. Science enables resource managers to make informed decisions, to help resolve and prevent resource management conflicts, and to support the Interior's public trust stewardship responsibilities for the Nation's lands and waters.

Increases in 2014 support research and development efforts focused in the California Bay-Delta, the Chesapeake Bay, the Columbia River, the Everglades, the Klamath Basin, and Puget Sound. They also support critical invasive species research, including research on Asian carp control in the Great Lakes and the Upper Mississippi River Basin. These studies are designed to serve local ecosystem management

needs and provide knowledge and approaches transferable to similar ecosystems across the Nation. Specific research efforts are also focused on invasive brown tree snakes and white-nose syndrome in bats. Actions are being implemented to better understand and support decisionmaking in sustaining environmental capital.

Program Performance

California Bay-Delta **(+$2,982,000/+4 FTE)**

Environments Program	(+$1,000,000/+2 FTE)
National Water Quality Assessment	(+$1,000,000/+1 FTE)
Hydrologic Research and Development	(+$982,000/+1 FTE)

The California Bay-Delta Ecosystem (Delta) is recognized as one of the world's threatened treasures of biodiversity, supporting unique native species and their critical tidal and wetland habitats. Like other urban estuaries, this system has a history of anthropogenic changes involving multiple stressors including altered hydrodynamics, environmental contaminants, and invasive species that have degraded the ecosystem. The native fish fauna has been much reduced and key species are now protected by the Endangered Species Act. Among these species, the threatened Delta smelt most prominently impact human decisions about the movement of water through the system. The recovery of this species requires an improved understanding of habitat and ecosystem functions within the Delta. Policymakers now must plan for systemic changes that influence all stressors and parts of the system, including watersheds, rivers, deltas, bays, and the ocean. To assist policymakers, the USGS has developed a network of real-time flow monitoring stations in the Delta. These stations would be augmented to assist with determining the causes and rates of decreased sediment supply due to various alterations to the system and to monitor turbidity fields in the Delta, which may have implications for Delta smelt survival and movement. The USGS would expand its research efforts to understand how flow conditions, water quality, and fish behavior affect fish survival. In doing so, the USGS would advance fundamental understanding of the interactions among the physical, chemical, biological, and human components and multiple stressors of the Delta system to improve knowledge of system impacts to the Delta smelt and its critical habitat. Using this advanced understanding, USGS scientists would improve and develop advanced models of the Delta system to represent more comprehensively, and predict more realistically, Delta ecosystem component responses to management and restoration, including effects of climate change and potential seismic events. The USGS would advance the capability to collect, store, access, visualize, and share data and information about the Delta system, the vulnerabilities of Delta ecosystem components to change, and the potential responses to these vulnerabilities.

Chesapeake Bay **(+$1,815,000/+5 FTE)**

Environments Program	(+$615,000/+1 FTE)
Land Change Science	(+$500,000/+2 FTE)
Contaminant Biology	(+$100,000/+0 FTE)
Toxic Substances Hydrology	(+$100,000/+0 FTE)
National Water Quality Assessment	(+$500,000/+2 FTE)

The USGS provides science to restore the Nation's largest estuary and carry out the President's Chesapeake Bay Executive Order (EO) strategy and associated action plan. Interior, through the USGS, the FWS, and the NPS, is providing leadership, expertise, and resources to meet the major goals of the Chesapeake Bay Program (CBP) partnership and the associated EO to restore water quality, recover habitat, sustain fish and wildlife, and conserve lands and increase public access. The USGS has lead

responsibility under the EO (in collaboration with the National Oceanic and Atmospheric Administration's (NOAA) to strengthen science to support all of these goals. In 2013, the USGS had $7.3 million among multiple programs to conduct Chesapeake activities. In 2014, the requested $1.815 million increase would enhance activities to (1) restore brook trout and their habitats; (2) help identify contaminants affecting fish health; (3) forecast the effects of land change and sea-level rise on black ducks and their habitats (4) forecast effects of land and climate change on habitat conditions; (5) explain water-quality change, and (6) use remote sensing to assess effectiveness of conservation practices. This effort would be led by the programs listed below:

- Expand science to help restore Brook Trout and their habitats. The USGS worked with the FWS and partners to identify five research priorities to support brook trout conservation and restoration, which is an EO priority. Refining and developing patch-prioritization tools and assessing effects of shale-gas drilling would begin in 2014 (Environments Program in collaboration with Fisheries Program);
- Enhance science on the multiple factors affecting fish health in the Bay watershed and the associated effects and sources of toxic contaminants and endocrine-disrupting compounds. The USGS activities are needed to address recommendations in the recent EO report on the extent and severity of toxic substances and their biologic effects in the bay and its watershed. (Environments, Toxic Substances Hydrology and Contaminant Biology Programs);
- Assess the combined effects of land change and sea-level rise on black duck habitats. Additional funding would be used to improve energetics models for wintering black ducks within the Bay refuge system. A new effort would be started to have the energetics models coupled with new models of sea-level rise and land use change predict future impacts on coastal wetland and help identify the best areas for restoration of black duck habitats (Environments Program);
- Forecast the combined effects of land and climate change on habitat conditions. To support the brook trout, black duck, and water-quality studies, the USGS would enhance efforts to identify potential effects of land use and climate change by: (1) considering the potential effects of hydraulic fracturing and land change on stream quality; and (2) assessing potential changes in land cover on black duck habitats. (Land Change Science Program and Environments Program);
- Further investigate the factors affecting water quality to enhance progress toward the Bay total maximum daily load (TMDL). The USGS would enhance the use of models, land use information, and other data to explain changes in nutrients and sediment at key areas in the Bay watershed. The USGS has been asked by EPA and six States to better assess trends and explain the effects of water quality management practices as the Bay TMDL is implemented. The USGS would also work with the U.S. Department of Agriculture (USDA) to evaluate the effect of agricultural practices to improve water quality. (NAWQA, Environments, and Land Change Science Programs); and
- Increase research on the effectiveness of winter cover crops in reducing both soil erosion and nitrogen runoff from agricultural fields into the Chesapeake Bay. This research would support water-quality studies and is conducted in collaboration with the USDA Agricultural Resource Service, the Maryland Department of Agriculture, and local Soil Conservation Districts. Project scientists would use satellite-based remote sensing data products with site specific, privacy protected conservation program farm data records to measure cover crop success in preventing sediment and nutrients from reaching the Bay. (Land Change Science Program).

Columbia River (Salmon) (+$854,000/+2 FTE)

Environments Program	(+$300,000/+1 FTE)
Contaminant Biology	(+$100,000/+0 FTE)
Toxic Substances Hydrology	(+$100,000/+1 FTE)
National Geospatial Program	(+$354,000/+0 FTE)

The Columbia River is the largest river in the Pacific Northwest, and plays an important role in the Region's culture and economy through tribal fisheries, irrigation, power production, and recreation, among other goods and services. This system has been affected by a number of anthropogenic changes, including altered flows, environmental contaminants, and invasive species that have degraded the ecosystem. Managers and policymakers require scientific information to prevent the decline of critical species such as salmon, which are a valued tribal trust species; to manage ecological flows in this engineered river system; and to reduce risks from habitat degradation, changes in species composition, and climate change. With the proposed increase, the USGS would provide critical results to managers and decisionmakers on forage fish, which are a critical part of the Columbia River food web that supports a suite of important fish, bird and mammal species. The USGS would address forage fish life histories, invasive species, related climate impacts, chemical and physical habitat degradation, and effects on economic and trust species. USGS scientists would conduct research on the effect of altered flow regimes due to climate change and dam operations on habitats. A new Columbia River Treaty with Canada, which would take effect in 2025, could potentially affect flow regimes. USGS researchers would characterize ecological tradeoffs related to alternative flow regimes, as they affect physical habitat features, food webs, and ecological interactions influencing the sustainability of salmon, sturgeon and other key species populations. The increase in 2014 would address early detection and risk reduction of aquatic invasives in the Columbia River system. USGS researchers would determine conditions in mainstem, estuarine, and tributary systems that increase the risk of proliferation invasion of invasive species, and identify requirements for reliable early detection and adaptation/restoration actions by resource managers.

Everglades (+$1,000,000/+2 FTE)

Invasive Species	(+$1,000,000/+2 FTE)

In support of restoring the south Florida ecosystem and in partnership with the Comprehensive Everglades Restoration Plan and the South Florida Ecosystem Restoration Task Force (SFERTF), the USGS conducts scientific investigations to fill key science information gaps and to assist in the sustainable use, protection, and restoration of the South Florida ecosystem. South Florida is particularly vulnerable to the introduction and spread of invasive plants and animals and is highly colonized by a wide variety of exotic species such as water hyacinth, melaleuca, old world climbing fern, and the Burmese python. The SFERTF recognizes the challenges that invasive species pose to the success of overarching ecosystem restoration efforts. Funding would support high priority research needs identified by the interagency invasive species working group of the SFERTF, including quantifying ecosystem effects of invasive species to assist partnering agencies in deciding where best to allocate management and control efforts; filling key biological and ecological information gaps of invasive species to better inform early detection efforts of partnering agencies; and to improve methods to better detect and control species such as Burmese pythons, for which ecosystem effects have been documented.

Great Lakes **(+$2,000,000/+4 FTE)**

This funding increase within the Invasive Species subactivity is being implemented in the 2013 Operating Plan.

Invasive Species (Asian Carp) [+$500,000/+2 FTE]

Funding would augment current support of the ACRCC's Asian Carp Control Strategy Framework. This research focuses on providing scientific information and methodologies to better prevent, detect, and control Asian carp. Specific research activities include developing methods for the oral delivery of registered fish toxicants; identifying and developing attractant pheromones and food lures to aid in targeted removal of Asian carp from infested waters; and testing seismic technology as a means to affect the distribution of Asian carp and to restrict their passage through lock and dam structures. The proposed increase would enable research to accelerate from "proof of concept" stage to transferring technology to resource managers for field use.

Invasive Species (Asian Carp) (+$1,500,000/+2 FTE)

The ability of Asian carp to grow large, spread quickly, and become abundant has prompted national and regional planning efforts to prevent further introductions and to contain and manage existing populations. In 2009, the Administration established the Asian Carp Regional Coordinating Committee (ACRCC), which consists of Federal, State, and local agencies and other private stakeholder entities, to protect and maintain the integrity and safety of the Great Lakes ecosystem from an Asian carp invasion. The USGS, a charter member of this group, has been conducting research to provide critical information to the ACRCC since 2010.

Klamath Basin Restoration Agreement **(+$901,000/+4 FTE)**

Fisheries Program (+$901,000/+4 FTE)

The Klamath Basin Restoration Agreement was signed on February 18, 2010, and engages Federal, State and local government agencies, Tribes and non-governmental organizations with the intention of restoring natural production and providing for full participation in harvest opportunities of fish species throughout the basin, establishing reliable water and power supplies which sustain agricultural uses and communities and national wildlife refuges, and contributing to the public welfare and the sustainability of all basin communities through these and other measures. With this funding, the USGS would determine relationships between water availability, fish habitats, and water quality on sucker growth, condition, and survival in Upper Klamath and Clear lakes; investigate aquatic productivity with special attention to intensity, magnitude, and composition of plankton blooms; investigate production of blue green algae and transfer of cyanotoxins through food webs to endangered suckers; and assess the biological effects of exposures of cyanotoxins in leading to a possible bottleneck in population recovery. If these agreements are implemented, the application of research results would extend to the possible reintroduction of Chinook salmon in the Upper Klamath Basin and to enhanced understanding of the effects of harmful algal blooms throughout the basin.

Puget Sound **(+$1,019,000/+2 FTE)**

Environments Program	(+$369,000/+1 FTE)
Hydrologic Research and Development	(+$200,000/+1 FTE)
National Geospatial Program	(+$450,000/+0 FTE)

The Puget Sound (Sound), the second largest estuary in the United States, provides diverse benefits to a growing regional human population. It provides a home, recreation and economic opportunity to millions of people. The Sound is a natural resource treasure, supporting hundreds of species of fish, sea birds, and marine mammals, many of which are of enormous economic and cultural importance to the region. Human development and land use changes, as well as climate change, will likely affect the future sustainability of the Sound, particularly watershed and shoreline alterations that are likely to reduce critical habitat for species and reduce water quality. More than 20 Native American Tribes are protected in perpetuity in their uses of salmon. However, salmon are in decline due to reductions in habitat quantity and quality. The USGS is providing critical science to a major ecosystem restoration effort involving tribal, local, State, and Federal entities. The proposed increase would support managers and decisionmakers by developing process based monitoring and models at the ecosystem scale to identify and address risks to salmon. In addition, the USGS would investigate the status of forage fish populations—some of which are in decline—and identify linkages between population dynamics, bioenergetics, predation, habitat alterations, disease, and food availability. In support of the restoration, this work would result in new molecular tools and sampling methods. Finally, the recent removal of two major dams on the Elwha River is one of the largest river restoration projects in history, requiring active management of former submerged reservoir lands; use of hatcheries to supplement wild fish populations; and monitoring of specific aquatic, terrestrial, and near-shore marine responses of the ecosystem. USGS science would provide managers with information on ecosystem responses to specific post-removal restoration actions, to ensure that restoration is effective.

Upper Mississippi River **(+$1,200,000/+4 FTE)**

This funding increase within the Invasive Species subactivity is being implemented in the 2013 Operating Plan.

Invasive Species (Asian Carp) [+$500,000/+1 FTE]

Funding would support new research using priorities identified for the Upper Mississippi River System (UMRS) in the 2007 "Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States," as well as those identified in the newly released "2011 Asian Carp Action Plan" developed by the Minnesota-Wisconsin Asian Carp Task Force. The increase would augment ongoing USGS efforts initiated in 2013 and target specific research gaps identified in these collaborative planning efforts, including improving methods to detect Asian carp at low population levels; identifying habitats and locations most vulnerable to colonization by these invasive fishes; and improving methods for containment and control of Asian carp in UMRS habitats.

Invasive Species (Asian Carp) (+$500,000/+1 FTE)

The ability of Asian carp to grow large, spread quickly, and become abundant has prompted national and regional planning efforts to prevent further introductions and to contain and manage existing populations. The USGS is a charter member of the Minnesota-Wisconsin Asian Carp Task Force, the USGS was instrumental in helping to produce the 2011 Asian Carp Action Plan that assesses the threat to the Upper Mississippi River System posed by Asian carp and actions needed to minimize their impact, and has unique capabilities in the region to provide research critical to its implementation.

National Water Quality Assessment (+$200,000/+2 FTE)

This initiative builds on ongoing USGS activities in the Upper Mississippi River Basin (Basin). The Basin contains a wide diversity of landscape types that include major agricultural operations headwaters with major urban landscapes. Both landscape types can have negative impacts on aquatic ecosystem health of the Mississippi River and connecting rivers downstream resulting in maintaining or expanding hypoxia conditions in the Gulf of Mexico. Existing USGS programs in this region are developing a better understanding of water resources through critical streamflow measurement stations that characterize water quality. The USGS has been collecting samples of contaminants of emerging concern and learning about the potential effects of these contaminants on aquatic organisms living in the streams and rivers. Data collections and interpretive studies addressing water quality concerns are shared with State and local partners in this five State region (Minnesota, Wisconsin, Illinois, Iowa and Missouri).

Sustaining Environmental Capital **(+$2,000,000/+2 FTE)**

Environments Program (+$500,000/+1 FTE)

This funding increase within the Environments subactivity is being implemented in the 2013 Operating Plan.

Environments Program (+$1,500,000/+1 FTE)

The President's Council of Advisors on Science and Technology (PCAST) recommended that the Federal government provide "integrated information on the condition of U.S. ecosystems, including but not limited to their biodiversity, as well as on measures of ecosystem services flowing from them and the contributions of these to human health, economies, and other aspects of well-being." The USGS is contributing to that goal by bringing together data on water and aquatic organisms (from NAWQA, Water SMART and other studies), and ecosystem services. The objective is to provide resource managers access to ecosystem service valuations based on these scientific data, which are integrated within a decision support system. The USGS would build this information and capability into PCAST's online resource for ecosystem services, habitat criteria, and biodiversity information, EcoINFORMA (Ecoinformatics-based Open Resources and Machine Accessibility). The ultimate goal is to develop a national level ecosystem service valuation tool that can be used in conjunction with ongoing streamflow monitoring programs (e.g., NAWQA and WaterSMART) for decisionmaking. The increase request would provide for the development of methodologies in several pilot areas, and gaps in information being identified. These contribute to the Federal PCAST effort by providing a linked package of tools and data to support valuation of ecosystem services information for water based resource decisionmaking, a key element in the overall Federal ecosystem services blueprint.

In addition, the increase would enable the USGS ultimately to build standard methods and a National capability to value water related ecosystem services. By adding an ecosystem services component, the USGS would be able to assess trends in ecosystem services, and provide ecosystem service information to a broad network of resource managers for decisionmaking. The USGS would determine the conditions under which these methods can be used as standard methods, and the applicability of these methods to other geographic areas.

National Ecosystem Services Framework (+$1,000,000/+1 FTE)

Environments Program (+$1,000,000/+1 FTE)

The President's Council of Advisors on Science and Technology (PCAST) recommended that the Federal government provide "integrated information on the condition of U.S. ecosystems, including but not limited to their biodiversity, as well as on measures of ecosystem services flowing from them and the contributions of these to human health, economies, and other aspects of well-being." As part of a multi-agency assessment of activities that contribute to the identification, assessment, valuation and use of ecosystem services, the USGS would assess of gaps in valuation of ecosystem services; develop and test alternative methodologies; and develop standards and practices for implementation in natural resource decisionmaking. The USGS would collaborate with the Committee on Environment, Natural Resources and Sustainability's Subcommittee on Ecological Systems and other cross-government efforts to make these methods available and to test them.

EcoINFORMA (+$800,000 /0 FTE)

Science Synthesis, Analysis, and Research (+$500,000 /0 FTE)

This funding increase within the Science Synthesis, Analysis, and Research subactivity is being implemented in the 2013 Operating Plan.

Science Synthesis, Analysis, and Research (+$300,000 /0 FTE)

The President's Council on Science and Technology Advisors (PCAST) report, "Sustaining Environmental Capital: Protecting Society and the Economy" recommended a series of Federal actions including the Econinformatics-based Open Resources and Machine Accessibility (EcoINFORMA) initiative to enable integration and use of current knowledge to inform decisions. EcoINFORMA improves and expands Federal and non-Federal biodiversity, ecosystem, and ecosystem service information access, data exploration, availability, and interoperability for decisionmakers. EcoINFORMA facilitates cost savings by providing ready access to data, improved applications and availability, and useful tools to resource managers and decisionmakers.

In 2013, the USGS funded ($0.5 million) activities associated with implementing recommendations in the PCAST report, including the development of the EcoINFORMA Implementation Blueprint. The Blueprint calls for implementation of resource hubs supported by existing communities of practice that improve data standards, interoperability, and ecosystems data reuse. In 2013, two hubs were established and a third hub was proposed: (1) the biodiversity resources hub that leverages the USGS BISON program (Biodiversity Information Serving Our Nation); (2) the ecosystem hub that powers the Environmental Protection Agency's EnviroAtlas; and, (3) the Multi-Resolution Land Characteristics Consortium that support the land cover dynamics resource hub.

In 2014, the USGS requests an additional $0.3 million to continue implementing the PCAST report recommendations. The two established hubs would be expanded by working directly with agencies that provide key data and Ecosystems.data.gov would be initiated as the public presence for EcoINFORMA.

Land Use Science **(+$1,000,000/+4 FTE)**

Land Change Science (+$1,000,000/+4 FTE)

The Land Change Science Program (LCS) conducts research on the land changes occurring in the United States to better assess the causes and consequences of land cover change. The program would assess ecosystem changes due to a variety of external drivers, such as climate change, invasive species and land cover-land use change (including those resulting from resource extraction techniques) and identify their impacts on conservation objectives and local communities. Building from current projects, LCS researchers would analyze how these ecosystem changes impact the services provided by the ecosystems, including water filtration and storage, carbon sequestration, fisheries, and recreation. Research would be conducted in collaboration with other Interior bureaus, the Department of the Interior Climate Science Centers (CSCs), the Department of the Interior Landscape Conservation Cooperatives (LCCs), other Federal agencies, and State and local governments. Research products would include journal articles, geospatial datasets of both current and possible future ecosystem conditions and decision support tools allowing resource managers to assess the impacts of various ecosystem conservation and restoration activities.

3D Elevation Program – Enhanced Elevation for the Nation

3DEP: Enhanced Elevation for the Nation							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Coastal & Marine Geology		*1,500*	1,500	0	2,000	3,500	2,000
	FTE	*8*	8	0	2	10	2
National Geospatial Program		*11,201*	11,201	0	9,000	20,201	9,000
	FTE	*49*	49	0	0	49	0
Total Requirements ($000)		***12,701***	**12,701**	**0**	**11,000**	**23,701**	**11,000**
	Total FTE	***57***	**57**	**0**	**2**	**59**	**2**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for the U.S. Geological Survey's 3D Elevation Program – Enhanced Elevation for the Nation (3DEP) initiative is $23,701,000 and 59 FTE, a program increase of +$11,000,000 and +2 FTE from the 2012 Enacted level.

Overview

The 3DEP initiative will systematically collect enhanced elevation data using Light Detection And Ranging (LiDAR) and other technologies over the United States during an eight- year period. In 2012, a study funded by the USGS and partners identified 602 mission-critical activities of 34 Federal agencies; the 50 States; and selected local and tribal government, private, and other organizations that would benefit from enhanced elevation data. The Nation would receive up to $13 billion annually in new benefits from enhanced elevation data. An independent study of 500 remote sensing systems, the National Earth Observations Strategy sponsored by the Office of Science and Technology Policy, identified enhanced elevation data from sensors such as LiDAR among the top ten needs nationally. The National Geospatial Advisory Committee, the National States Geographic Information Council, and the Management Association for Private Photogrammetric Surveyors endorsed the 3DEP plan. Interior, staffed by the NGP, is organizing an interagency 3DEP Executive Forum to identify interagency funding strategies and coordinate Federal activities.

Accurate, precise, and up-to-date elevation data is the foundational requirement for efforts to quantify current and future coastal vulnerability to storms, flooding, tsunamis, and climate driven change. Provision of more accurate elevation data and resulting products that enhance access for varied applications would substantially reduce a major uncertainty in existing decision support tools, facilitate development of improved models, and enable users to access appropriately formatted and merged data streams. As a consequence, users across State, Tribal, and Federal entities and the NGO and academic communities would incur substantially reduced costs and technical burdens related to access and application.

Program Performance

Core Science Systems **+$9,000,000/0 FTE**

National Geospatial Program (+$9,000,000/0 FTE)

The NGP worked with partners to identify an optimal program design to meet needs identified in the 2012 3DEP study. The current approach, in which multiple agencies and States acquire data as needed and as funding partnerships allow, addresses only 10 percent of the needs identified in the study and will not lead to national data coverage. Through the 3DEP initiative, more economical project design and economies of scale would reduce the unit costs of data acquisition by 25 percent. If funded at the proposed level, this initiative would yield national coverage in eight years. The resulting data would meet 58 percent of needs identified in the study. Data would be acquired through contracts with the private sector. In the initial phase, data acquisition will focus on coastal areas.

Natural Hazards **+$2,000,000/+2 FTE**

Coastal and Marine Geology **(+$2,000,000/+2 FTE)**

Collecting Coastal LiDAR Data (+$2,000,000/+2 FTE)

Prioritization of data collection would be coordinated with NOAA and other agencies, through the 3DEP, the Interagency Working Group for Ocean and Coastal Mapping (IWG-OCM), and the Interagency National Digital Elevation Program (existing coordination groups chaired by the USGS with wide agency participation) to ensure application of appropriate technologies; to effectively utilize 3DEP procurement process for private sector data collection; to ensure that all data meet shared standards reflecting application and integration requirements; and to support cooperative development of data collection, processing, and delivery capabilities across the community of practice. Resources provided herein, coordinated with broader 3DEP efforts and thus part of a cooperative National LiDAR program, would focus on addressing priority data gaps and newly arising needs as identified through stakeholder engagement with regional ocean alliances and coastal zone resource and emergency management agencies at the State, Tribal, and Federal levels. The proposed activity would advance 3DEP objectives through collection of bathymetric and topographic “near shoreline” elevation data, and integration of elevation data from other sources, to provide seamless elevation coverage across coastal settings as required for adaptive management of terrestrial and submerged resources and to forecast the coastal change vulnerability of resources and communities.

Hydraulic Fracturing

Hydraulic Fracturing								
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Fisheries Program		*108*	108	0	2,200	2,308	2,200
	FTE	*1*	1	0	10	11	10
Energy Resources		*5,850*	4,600	1,250	0	5,850	1,250
	FTE	*29*	23	6	0	29	6
Contaminant Biology		*0*	0	0	1,400	1,400	1,400
	FTE	*0*	0	0	5	5	5
Earthquake Hazards		*800*	300	500	1,200	2,000	1,700
	FTE	*2*	1	1	2	4	3
Groundwater Resources		*520*	520	0	2,100	2,620	2,100
	FTE	*1*	1	0	6	7	6
Hydrologic Research & Development		*1,300*	50	1,250	950	2,250	2,200
	FTE	*1*	0	1	1	2	2
Science Synthesis, Analysis and Research Program		*0*	0	0	185	185	185
	FTE	*0*	0	0	0	0	0
National Cooperative Geologic Mapping Program		*0*	0	0	2,000	2,000	2,000
	FTE	*0*	0	0	0	0	0
Total Requirements ($000)		***8,578***	**5,578**	**3,000**	**10,035**	**18,613**	**13,035**
Total FTE		***34***	**26**	**8**	**24**	**58**	**32**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for hydraulic fracturing research is $18,613,000 and 58 FTE, a program increase of +$13,035,000 and +32 FTE from the 2012 Enacted level.

Overview

In 2012, the President issued an Executive Order (EO), "Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources," as a component of the energy strategy. The goal of the EO is to ensure coordination among Federal agencies regarding natural gas development activities. In support of this effort, the Interior, Department of Energy (DOE), and the EPA signed a Memorandum of Agreement (MOA) formalizing a Multi-Agency Collaboration on Unconventional Oil and Gas Research. This collaboration is aimed at improving our ability to understand and address potential environmental, human health, and safety impacts of hydraulic fracturing and associated operational activities. The three agencies are working together to engage other organizations involved in research on hydraulic fracturing in the pursuit of collaborative research opportunities. Through the MOA, the USGS is applying and building its research strengths with focused studies on resource characterization and assessments, water quality and availability, ecological effects, effects on people and their communities, and induced seismicity. The interagency collaboration is intended to build on the core capabilities of each agency in synergistic ways that lead to complementary and non-duplicative work. To accomplish this, Interior, the DOE, and the EPA are developing a multi-year National Research Framework designed to address the highest priority research questions, new and innovative technological opportunities, and community concerns associated with safely and prudently developing resources through hydraulic fracturing.

The development of oil and gas resources through hydraulic fracturing is playing an important and rapidly growing role in the domestic energy portfolio of the United States. Shale and other unconventional oil and gas formations are found throughout the United States beneath Federal, State, tribal and private lands.

The development and extraction of unconventional oil and gas resources are accomplished through hydraulic fracturing, a technique that entails horizontal drilling, perforation of steel casing and cement grout using explosive charges, and expansion of fractures using fluids and propellants under high pressure.

While there are economic benefits associated with oil and gas production and industry has developed best management practices for well site activities, concerns remain about potential environmental, health, and safety impacts of hydraulic fracturing. A comprehensive understanding of these potential impacts will require a significant research effort, including baseline data collection, across the various geologies involved. Potential effects of hydraulic fracturing may include impacts to water resources, including the contamination of aquifers and surface waters from drilling and hydraulic fracturing chemicals; the cross-contamination of aquifers through faulty well construction and casing installation; the release of methane and other greenhouse gases into aquifers and the atmosphere; contamination from radioactive elements and other toxic chemicals in waters recovered during gas production; and the reduced availability of water, particularly in water-scarce areas; landscape changes including soil erosion and habitat fragmentation; generation of airborne pollutants; and unintended seismic events from the subsurface injection disposal of recovered hydraulic fracturing and rock formation fluids. Singly or in combination, these potential effects might result in harmful impacts on human health or on terrestrial and aquatic wildlife and ecosystems. Oil and gas development can also cause socio-economic impacts to communities.

Program Performance

Hydraulic Fracturing **(+$13,035,000/+32 FTE)**

The 2014 budget supports a collaborative interagency research and development effort by the USGS, DOE, and EPA to conduct a national science, research, and development program aimed at understanding and reducing the potential environmental, health, and safety impacts of hydraulically fractured oil and gas resources and to address the most urgent questions and decision-support needs surrounding hydraulic fracturing. Through this effort, the three agencies are building upon current work and collaboratively identifying and coordinating new priority research and development activities that support sound management and policy decisions by Federal, State, tribal, and local entities. The goal is to produce decision-ready information to ensure the prudent development of energy resources and the protection of human health and the environment.

In 2013, USGS research efforts are focused on a number of activities including resource characterization and assessments, water quality and availability, ecological impacts, effects on people and their communities, and induced seismicity. The USGS conducted research and assessments of undiscovered, technically recoverable unconventional oil and gas resources for high-priority shale and tight gas basins. It is important to understand where these resources are located, their potential volumes, and their character so as to understand where production might occur, and to understand potential environmental impacts should development commence.

Also in 2013, the USGS continued to, or initiated, selected monitoring and research efforts directed toward understanding potential effects of unconventional oil and gas production on water resources. Baseline monitoring of groundwater was conducted in a number of States, notably in Arkansas, where hydraulic fracturing is underway, and in North Carolina, where hydraulic fracturing was not allowed prior to the time of sampling. Surface water monitoring was conducted in Pennsylvania and New York, among other areas. The USGS conducted studies of produced waters to investigate the occurrence of naturally occurring radioactive materials contained within the waters, as well as research on proper disposal methods. The USGS worked collaboratively with EPA and others to develop appropriate groundwater

sampling protocols in regions subject to hydraulic fracturing. New laboratory methods for analysis of flowback and produced waters are being developed collaboratively with EPA. A USGS-wide effort to compile water quality data extending back more than 60 years continued, potentially leading to a better understanding of water quality trends in relation to unconventional oil and gas development. A compilation of national water quality databases associated with unconventional oil and gas production is being done in 2013. In addition, the USGS published studies on the occurrence of, and potential for, earthquakes triggered by the injection disposal of hydraulic fracturing flowback fluids and produced formation fluids into deep rock formations, and studies on the impact of shale gas development activities on land use change. The USGS continued to monitor and model the effects of shale gas development on wildlife and aquatic species and ecosystem integrity.

The budget increase in 2014 would expand the collaborative, interagency research and development effort to address the highest priority challenges and to answer critical research questions. The USGS would focus on research that builds upon and enhances ongoing studies, as well as new and innovative investigations, assessments, technique development, modeling, and monitoring to address urgent research questions identified for the following subject areas: resource assessments and characterization; water quality; water availability; ecological impacts; effects on people and their communities; and induced seismicity. The USGS research would be designed in collaboration with the DOE and EPA, and where appropriate and beneficial to the achievement of program goals, would include input from State, tribal, academic, and non-governmental organization partners. A detailed research and development plan is currently under development by DOI, EPA, and DOE. In this plan, the highest priority science and information needs of decisionmakers will be identified as a basis for prioritizing the specific research that will be undertaken in 2014. Below is a discussion of potential projects that could be undertaken. Resource assessments provide critical evaluations of where future energy development might take place, or equally important, where it is unlikely to take place. The USGS is the sole provider of publicly available estimates of undiscovered, technically recoverable unconventional oil and gas resources of onshore lands and offshore state waters. In 2014, a portion of the requested new funding would allow the USGS to begin an assessment of the size and location of hydraulically fractured oil and gas resources in a new basin such as assessments underway in the Barnett Shale, Permian Basin, and Bakken Formation. Geologic mapping conducted by the USGS would support research on the geological parameters of unconventional oil and gas basins under current or near-term development.

The development and extraction of shale gas and other unconventional oil and gas resources require large quantities of water for hydraulic fracturing and produce large volumes of fluids during flowback and production. In 2014, a portion of the requested funding increase would be used for water availability studies to: 1) assess the water needs associated with unconventional oil and gas development; 2) evaluate and estimate the volumes and spatial distributions of non-potable (brackish) water resources for use in hydraulic fracturing; and 3) characterize flowback fluids and brines from hydraulically fractured wells, which would be important to identify and track potential contamination. The USGS would also conduct studies that address the identification of alternative sources of water used for hydraulic fracturing to replace the use of scarce fresh water sources. In addition, the USGS would address water availability through the development of groundwater flow and transport models in selected case study areas. These models would be used to understand the effects of withdrawals whether water would be used for hydraulic fracturing operations or produced waters, on basin-wide water availability.

In 2014, the USGS would use a portion of the requested funding to expand baseline surface water and groundwater quality monitoring. In order to support the monitoring activities, the USGS would support the continued development of analytical methods for the detection of contaminants associated with produced and flowback waters in the environment, including an enhancement of methods for sampling and measuring methane. This would include enhanced methods for monitoring and characterization of "stray gas". The USGS would support research on the development of geochemical methods and

groundwater flow models used to determine if hydrofracture fluids and other drilling materials are contaminating water supplies. These tools and monitoring data would enable assessments and prioritization of key human and ecological exposure pathways associated with natural or anthropogenic contaminants created and mobilized throughout the life cycle of hydraulic fracturing activities.

Additionally, the USGS would develop new methods to detect and understand the mobilization and occurrence of naturally-occurring contaminants resulting from hydraulic fracturing. The USGS would be working with EPA and other partners at prospective sites as part of the EPA hydraulic fracturing drinking water program to assess potential groundwater and surface water contaminants associated with hydraulic fracturing operations.

In 2014, the USGS would support research that assesses potential ecological impacts associated with unconventional oil and gas development. This research includes how changes in land use, water quality, and water availability from hydraulically fractured oil and gas operations affect biological communities and specific species of management concern. The USGS would conduct studies to identify those practices that minimize risks or mitigate impacts to ecological resources, as well as identify potential socioeconomic impacts from hydraulically fractured oil and gas resource development on nearby communities. These studies would examine how this development would affect the production of critical ecosystem services and would explore the potential for estimating the value of these services. In addition, an ecosystem services analytical framework would be developed for evaluating the environmental and social consequences of developing unconventional oil and gas resources.

The USGS would assess the risk of earthquakes associated with oil and gas production in 2014 with the requested increase in funding. The risks are primarily associated with wastewater disposal using deep well injection. The USGS plans to analyze earthquake sources that are induced by injection activities along with related geologic data to determine those factors that affect induced seismicity from subsurface disposal of waste fluids. This information could be used to guide changes to disposal operations, such as adding new wells or changing injection parameters. Cataloging the presence or absence of earthquakes induced by injection activities would yield critical information on the regions and conditions that are favorable for induced seismicity. This would be combined with probabilistic seismic hazard analysis to assess the hazard and risk of damaging earthquakes.

The USGS would emphasize products that contain decision-ready information. Deliverables would include new assessments of undiscovered technically recoverable unconventional oil and gas resources to inform the public about the magnitude and location of potential future production and its associated impacts. These and other assessments would form a foundation for planning where and what kind of additional studies are needed, such as those involving water quality and quantity, potential ecological impacts, and induced seismicity. Three-dimensional geologic models and a better understanding of rock structures form the basis to characterize the hydro-geologic framework used to understand impacts. Results of water budget analyses and water requirements for unconventional oil and gas development would help water managers better utilize existing water resources and protect scarce potable resources. Maps and databases showing the occurrence and distribution of naturally occurring radioactive elements would be used to inform water disposal management in a way that reduces or eliminates the potential for buildup of radiation to dangerous levels. Data and reports that characterize baseline surface water and groundwater quantity and quality of selected sites would be produced. These assessments would provide the information needed to determine pathways of human and ecological exposures to natural and anthropogenic contaminants associated with hydraulic fracturing activities.

The USGS plans to release reports describing the factors controlling the occurrence of earthquakes due to fluid injection activities to inform both Federal and state agencies that permit the injections and the industry operators who wish to minimize the risk of damaging earthquakes. The USGS would produce

updated probabilistic seismic hazard maps that incorporate the contribution from injection induced seismicity, so that building codes (which reflect long-term hazard) can appropriately account for the local or regional effects of induced earthquakes. Finally, the USGS would plan to release reports and other publications that outline effects of hydraulic fracturing and associated activities on terrestrial and aquatic species and create decision support systems that would help avoid or minimize ecological impacts associated with hydraulic fracturing.

Earth and Environmental Observations Innovation and Applications (Big Earth Data Initiative)

Earth and Environmental Observations Innovation and Applications							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Science Synthesis, Analysis and Research Program		*0*	0	0	9,000	9,000	9,000
	FTE	*0*	0	0	1	1	1
Total Requirements ($000)		***0***	**0**	**0**	**9,000**	**9,000**	**9,000**
Total FTE		***0***	**0**	**0**	**1**	**1**	**1**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2013 Program Changes

The 2014 budget request for the Earth and Environmental Observations Innovation and Applications (Big Earth Data Initiative) is $9,000,000 and 1 FTE, a program increase of +$9,000,000 and 1 FTE from the 2012 Enacted level.

Overview

The Federal government invests several billion dollars annually across numerous Federal agencies to collect information about the Earth from satellite, airborne, terrestrial, and ocean-based systems. This information can be used to achieve broad benefits ranging from climate change resilience planning to natural disaster impact mitigation to commercial supply chain management to natural resource management. Access to and use of these data is fundamental to supporting decisionmaking, scientific discovery, and technological innovation. The Earth and Environmental Observations Innovation and Applications is USGS and DOIs contribution to the Big Earth Data Initiative. The President's 2014 Budget invests in standardizing and optimizing the management of data from Federal Earth observations systems. Interagency coordination for this effort will be accomplished through the U.S. Group on Earth Observation (USGEO) Subcommittee of the National Science and Technology Council (NSTC), led by the Office of Science and Technology Policy (OSTP). The USGS budget request includes $9.0 million to support these efforts.

Program Performance

Science Synthesis, Analysis, and Research +$9,000,000/ +1 FTE

The USGS is home to high value Earth observations, both satellite and in-situ, that are critical to providing reliable scientific information to the Nation 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 our quality of life. USGS data sets are regularly recognized as a high priority from a Federal science perspective. These data are regularly used for science and decisionmaking, and this additional funding to enable innovation would dramatically expand the utility of this information and the array of users that can tap into the resource.

As part of the Big Earth Data Initiative, efforts would be initiated to implement an agency-wide framework for the Department of the Interior for managing and curating Earth system data that would: (1) maximize the availability and timeliness of Earth system observations; (2) broaden the potential uses of observations and data through the use of open, machine readable formats and Application Programming Interfaces (APIs); and (3) encourage the development and use of uniform tools and practices across Federal agencies for the handling of Earth system data and information to increase interoperability. Funding would be focused on high-value data sets, particularly those data sets derived from the high-impact observing systems and surveys by Interior stakeholders. For example, development of a seamless map database and web service for the Nation's coastal areas that is easy to access and apply has been a critical goal of the Earth science community. Funding for this initiative would dramatically advance this work and provide society with critical information needed to respond to coastal storms and sea level rise.

In coordination with the NSTC/USGEO led by OSTP, the USGS would coordinate with Interior bureaus, other Federal agencies, Tribes, and States to develop a cohesive strategy that contributes to and follows guidelines for governmentwide interoperability improvements that focus on web service access layer development to deliver underlying Earth observations. For example, investments under this initiative would enable access and integration of data from State Wildlife Management Plans, the U.S. Fish and Wildlife Service Wetland Inventory and USGS habitat and water quality databases to inform management strategies needed to restore the Gulf Coast Ecosystem.

Within the USGS, efforts would be focused on providing expanded scientific discoverability, access, and integration of critical Earth observations. Working across the Mission Areas, high-value data sets would be identified, prioritized, and made available using web services and standards. Resources would focus on ensuring the data are documented, discoverable and useable. Results would include expanded, sustainable delivery of high-value scientific monitoring. For example, the USGS initiated an effort to increase standardization of water use databases that are critical to ensuring the Nation has information available to manage an increasingly scarce resource. For example, water use information is managed by many entities across the country. Funding from this initiative could provide the infusion of resources necessary to rapidly advance this effort.

Resource Management Tools

Societal challenges such as the availability of water resources for agriculture are often better understood and addressed through analysis of many large and complex data sets The USGS is addressing this challenge, in part, with a tool called the *Geo Data Portal*. Based on open standards, this tool allows many databases to be queried for a particular area and time period of interest. Water resource managers use the results to answer specific questions such as how a particular section of the country or urban area might be affected by changes in water availability through time.

Science for Coastal and Ocean Stewardship

Science for Coastal and Ocean Stewardship							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Coastal & Marine Geology		*2,000*	2,000	0	5,750	7,750	5,750
	FTE	*5*	5	0	9	14	9
Science Synthesis, Analysis and Research Program		*0*	0	0	300	300	300
	FTE	*0*	0	0	0	0	0
Total Requirements ($000)		***2,000***	**2,000**	**0**	**6,050**	**8,050**	**6,050**
Total FTE		***5***	**5**	**0**	**9**	**14**	**9**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for Science for Coastal and Ocean Stewardship is $8,050,000 and 14 FTE, a program increase of +$6,050,000 and +9 FTE from the 2012 Enacted level.

Overview

Federal, State, local and tribal entities are challenged to better coordinate their efforts to reduce vulnerabilities of both human and ecological communities from land-based and marine-based changes to habitats, resource and water availability, and natural hazards. Current mandates to sustain economic growth, without compromising national security or ecosystem protection, require providing scientific information to better inform decisions and improve understanding for diverse audiences ranging from the general public to policymakers. The USGS is recognized as a critical source of assessments of resources and their vulnerability; data and models to assess the consequences of changing conditions and alternative management scenarios; and monitoring and interpretive tools to advance integrated systems for observations, mapping, and infrastructure.

Program Performance

Enhancing Coastal Communities **+$6,050,000/+9 FTE**

Coastal and Marine Geology (+$5,750,000/+9 FTE)
Science Synthesis, Analysis, and Research (+$300,000/0 FTE)

The proposed increase would fund regionally-focused science efforts in the Arctic and Pacific Islands. While these efforts would address objectives specific to those regions, the effort would also provide models for application to national issues arising in other regions.

Integrated Resource and Coastal Vulnerability Assessments – Arctic (+$2,500,000/ +4 FTE)

The proposed increase would improve the integrated science needed to inform sustainable development of resources and would balance with mandates to conserve the Nation's unique coastal and marine Arctic ecosystems under Interior's stewardship. A significant portion of the Nation's undiscovered oil and gas potential and a vast proportion of the Nation's endowment of wildlife, biodiversity, and wild places can be found in the U.S. Arctic. It is a place where Native peoples must also thrive through sustainable economies, infrastructures, and culturally important subsistence foods. The Arctic is not static; its changing climate is increasing access to exploitable resources, bringing the world to the Arctic through

polar navigation routes, and shifting fish, wildlife, and plant habitats in ways that are not fully understood. The increase would support new understanding in several major areas important to current and future energy and natural resource decisions in the Arctic.

Specifically, the USGS would produce:

- Improved geological and geophysical data to refine understanding of oil and gas resources (through acquisition and interpretation of seismic data pertaining to both the fundamental geology and petroleum potential of Chukchi shelf, the northwest Beaufort shelf, and the marine slope of the deep Canada Basin), which would improve understanding of the petroleum potential across Exclusive Economic Zone (EEZ) and Extended Continental Shelf (ECS). USGS resource assessments differ significantly from industry assessments in several ways: USGS assessments are: (1) transparent, from methodology to assumptions to results; (2) publicly available to all parties; (3) consistent so the results are comparable. For these reasons, and because the methodology is externally peer reviewed, USGS assessments are considered robust and objective. The USGS has a unique Federal role to provide the geologic characterization of public lands required to assess resource potential. Very little is known about the geology or the oil and gas resources on the Arctic extended continental shelf (this area is beyond any BOEM analysis or resource assessment or current industry activity), and thus there is a need to understand what potential may exist. The analysis and resource evaluation need to be made publicly available, in a manner that is comparable to other areas, so resource managers, Arctic policy analysts, and national security agencies may understand the resource potential of this area. This is the only source of information to inform U.S. Government decisions regarding ECS claims.
- Sea floor and habitat maps and analyses to inform resource management and development using bathymetric sonar and sea floor video surveys resulting in a comprehensive sea floor map for some 100 square kilometers of priority habitat. These maps would be designed in consultation with key partners and management agencies to support existing environmental and energy development programs in the Arctic Outer Continental Shelf and statistical analyses of habitats;
- Geochemical surveys to map vulnerability of priority marine species to ocean acidification by completing and disseminating seawater analyses of archived ocean acidification samples and develop predictive models to link benthic habitat change to ice cover change and increased atmospheric carbon dioxide; and acquiring additional baseline data in sensitive areas;
- Shoreline vulnerability assessments and coastline projections from high resolution digital coastal maps which inform forecasts of likely erosion patterns under current and future climate scenarios and inundation vulnerability assessments under recurring and extreme storm events; and
- Enhanced data access and community involvement through metadata produced according to Federal and Alaska Data Integration Working Group standards; delivery of new and existing data to science portals such as the Alaska Ocean Observing System, Alaska Emergency Response Management Application, and the CMSP National Information Management System; and engagement of Native communities by training youth in USGS project efforts, designing community protocols for information sharing, and piloting approaches to incorporate local knowledge into project efforts.

Integrated Resource and Coastal Vulnerability Assessments – Pacific Island Communities

(+$2,000,000/ +3 FTE)

Accelerated sea level rise in low lying Pacific Islands threatens coastal communities by impacting groundwater supplies and agro-forestry production and exposes coastal ecosystems and communities to erosion, storm inundation, and groundwater salinization. Recent storm events, combined with extreme

high tides, have highlighted the vulnerability of these communities, resulting in widespread coastal flooding, erosion, and groundwater contamination in the Republic of the Marshall Islands and the Federated States of Micronesia, in which Federal Government has trust responsibilities. The extreme vulnerability of these communities to changing sea level and ocean conditions represents a serious potential threat through impacts to public safety, environmental health, and food and water security. The USGS would focus on selected vulnerable population centers in the Pacific Islands to develop assessments, forecasts, and decision support tools to anticipate consequences of more frequent, persistent, and extreme wave run-up, overwash, and coastal inundation on communities and the resources on which they depend. Areas of ongoing collaborative development, and likely enhancement of efforts through this activity, include Kwajalein Atoll and Palau (Freely Associated States of the Republics of the Marshall Islands and Palau), the Northern Marianas, and the Federated States of Micronesia. Final decisions on initial focus of activities will respond to stakeholder input and engagement with other Federal programs, primarily within DOD and DOI.

Products developed would include assessments of resource status and vulnerability, including coral reef ecosystems, groundwater, and agricultural resources; forecasts of changing ecosystem and community vulnerability as a consequence of future scenarios including sea level rise, changes in storm climatology, and alteration of natural features (corals, coastal landscapes and vegetation) that mitigate impacts; and integrated models that augment forecasts to understand consequences in terms of community and ecosystem vulnerability and facilitate the development and evaluation of alternative approaches to resource management and adaptation to climate change.

Comprehensive Mapping and Resource Assessments (+$1,250,000/ +2 FTE)

In priority regions, the USGS would engage with Federal, State, tribal, and other regional partners to provide access to comprehensive maps and assessments of seabed and coastal conditions and vulnerability. These efforts would support the Interior priorities by focusing on areas proposed for advancing renewable energy development (e.g., the Interior's Smart from the Start initiative for offshore wind energy development off the Atlantic coast). Activities supported would include development of comprehensive seabed and geologic characterization; multi-resolution and multi-temporal elevation models; indices of seabed disturbance potential and resilience; assessments and forecasts of the vulnerability and response of indicator species; and integrated coastal vulnerability assessments.

The USGS has a unique Federal role to provide the geologic characterization of public lands required to assess hazard and resource potential. Marine assessments of hazard sources and the location and potential of energy and mineral resources are the foundation for policy and management decisionmaking across the vast EEZ and the ECS. Assessments in these poorly surveyed and remote regions require marine field programs utilizing large research vessels and specialized technologies. Access to these assets and effective utilization of USGS resources demands collaborative marine field programs with other USGS programs, Federal agencies, and academic partners. Increased funding would provide opportunities to leverage ongoing USGS activities, such as the ECS study, and broader federally supported programs to ensure that expensive marine field programs are cost effective and meet the compelling need for marine geologic surveys and the resulting resource and hazards assessments.

Science Synthesis, Analysis, and Research (+$300,000/ 0 FTE)

The proposed increase would provide quality assured data in standard formats to enable users easy and integrated access to comparisons of environmental responses across regions to facilitate better planning decisions. New data and products would result from efforts that would include creation of Web maps or feature services for Web enabled datasets; updating Web services to current and appropriate technology;

enhancement of metadata creation tools; improved mechanisms for storage and delivery of data and products; and development of tools that facilitate integration and analysis of data into models.

Environmental Impacts of Uranium Mining

Environmental Impacts of Uranium Mining							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Contaminant Biology		*50*	50	0	500	550	500
	FTE	*0*	0	0	3	3	3
Toxic Substance Hydrology		*100*	100	0	2,500	2,600	2,500
	FTE	*0*	0	0	9	9	9
Total Requirements ($000)		***150***	**150**	**0**	**3,000**	**3,150**	**3,000**
	Total FTE	***0***	**0**	**0**	**12**	**12**	**12**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2013 Program Changes

The 2014 budget request for the Environmental Impacts of Uranium Mining is $ 3,150,000 and 12 FTE, a program increase of +$3,000,000 and +12 FTE from the 2012 Enacted level.

Overview

In January 2012, the Secretary of the Interior withdrew over 1 million acres of public lands in the Grand Canyon region from mineral entry for 20 years under the Mining Law of 1872. However, even under the withdrawal, some mining will occur on valid existing claims. For example, the Canyon Mine (on U.S. Forest Service (USFS) lands south of the Grand Canyon) and the EZ Mine (on Bureau of Land Management (BLM) property north of the Grand Canyon) are expected to begin ore extraction in 2014 and 2016, respectively. Recognizing a lack of scientific information on the potential impacts of mining, a key factor in the Secretary's decision, the USGS developed a 15-year science plan in collaboration with the BLM, National Park Service, U.S. Fish and Wildlife Service, and the USFS. The studies would provide critical information for future decisions on withdrawal of lands and help inform the development, mitigation, reclamation, and ecological restoration of mines on valid existing claims, as applicable.

Program Performance

Northern Arizona Uranium Mining Science **+$3,000,000/+12 FTE**

Toxic Substances Hydrology Program (+$2,500,000/+9 FTE)

The proposed increase would begin the implementation of the integrated 15-year science plan by collecting new baseline data, expanding smaller scale studies begun in previous years, and lay the foundation for future modeling and monitoring efforts. Work in 2014 would characterize the baseline conditions of soil, groundwater, and surface water at the Canyon and EZ Mine sites before ore extraction begins. This would be done in cooperation with agency partners and the private mining companies, and would complement USGS work on Trust resources (animal and plant species) started at Canyon Mine in 2013. This baseline work is crucial for comparison after extraction occurs and enables understandings of the extent of naturally occurring versus mine related uranium and associated contaminants in soil, water, and biota.

In addition, work would begin to determine potential pathways of uranium exposure, such as movement through groundwater-flow paths, surface water, and wind dispersion. This includes continued and expanded monitoring of water quality and uranium levels in the Colorado River in the Grand Canyon, Kanab and Havasu creeks, and other regional rivers, streams, intermittent washes, and springs. USGS researchers would analyze data continually in preparation for presenting an interim report at the end of the third year of the study that describes spatial and temporal patterns of uranium in soil and water samples, and includes regional exposure models that would shape subsequent research and monitoring components.

Contaminant Biology Program (+$500,000/+3 FTE)

The proposed increase would support characterization of baseline radiation and chemical concentrations in sentinel species (e.g., burrowing mammals and reptiles, waterfowl) at targeted new mine sites (including the Canyon Mine) before ore extraction begins. Before reclamation is scheduled to begin in 2014, biological surveys and samples would also be collected at the Kanab North Uranium Mine, Arizona Strip. This site is considered to be representative of legacy contaminated abandoned mines. These activities would be conducted in collaboration with agency partners and the private mining companies. Establishment of baseline data, along with determining priority toxicological pathways of exposure and biological effects of exposure, are crucial to evaluate if chemical and radiation contamination are increased due to mining activities and pose unacceptable risk to biota in and around uranium mine sites. Interior and other key stakeholders would be kept apprised of progress on the project.

Improving USGS Rapid Disaster Response through Preparedness and Robust Monitoring

Improving USGS Rapid Disaster Response through Preparedness and Robust Monitoring							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Land Change Science		*550*	550	0	757	1,307	757
	FTE	*1*	1	0	4	5	4
Earthquake Hazards		*715*	715	0	850	1,565	850
	FTE	*0*	0	0	1	1	1
Volcano Hazards		*800*	800	0	400	1,200	400
	FTE	*0*	0	0	1	1	1
Landslide Hazards		*200*	200	0	500	700	500
	FTE	*3*	3	0	2	5	2
		60	60	0	0	60	0
National Streamflow Information Program	FTE	*0*	0	0	0	0	0
Total Requirements ($000)		***2,325***	**2,325**	**0**	**2,507**	**4,832**	**2,507**
Total FTE		***4***	**4**	**0**	**8**	**12**	**8**

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Justification of 2014 Program Changes

The 2014 budget request for Improving USGS Rapid Disaster Response through Preparedness and Robust Monitoring is $4,832,000 and 12 FTE, a program increase of +$2,507,000 and +8 FTE from the 2012 Enacted level.

Overview

Every year the United States faces natural and human disasters that threaten the Nation through loss of life and property, degradation of human health and the environment, and threats to national security and economic vitality. In domestic and global events, the Nation's emergency managers and public officials look to USGS science to inform them of the risks that hazards pose to human and natural systems, and how to reduce losses and improve response capabilities.

Events like the 2011 magnitude-9.0 earthquake and accompanying tsunami which struck the eastern coast of Japan are solemn reminders of the challenge that even the most developed nations face. As tragic as the disaster was, early warning systems for both the earthquake and tsunami combined with public preparedness and strong building codes saved many lives that otherwise would have been lost. Even much smaller events like the magnitude-5.8 earthquake that struck central Virginia caused significant disruption and damage in the Nation's Capital some 80 miles away. This earthquake was felt by at least 30 million people and caused disruption and concern throughout the Eastern third of the United States. More than 160 USGS scientists, technicians, and specialists responded to Hurricane Sandy, providing critical information on inundation levels and issuing predictions of coastal impacts to help guide response.

These events, each in their own way, demonstrate the seriousness and pervasiveness of natural hazards with threats that are unavoidable but with consequences that are not. This is where USGS science can make a difference and faced with rising expectations for rapid, robust information in response to these events, the 2014 budget request would allow the USGS to strengthen its capabilities both before and after disasters strike.

Program Performance

Robust Monitoring Networks for Effective Warning **+$1,750,000/+4 FTE**

Earthquake Early Warning and Rapid Event Characterization (+$850,000/+1 FTE)

Earthquake Hazards Program (+$850,000/+1 FTE)

USGS and its partners in California and Washington State have made substantial progress toward the development of a prototype earthquake early warning system along the U.S. West Coast with a goal of delivering public alerts before strong shaking arrives at population centers. This progress has been accomplished by leveraging small amounts of research funding with a combination of economic stimulus funding and private research funds. The economic stimulus funding from the American Recovery and Reinvestment Act was used to upgrade seismic and Global Positioning System (GPS) networks in California, Oregon and Washington. This funding has enabled earthquake detection and evaluation within seconds, a basic requirement of early warning. A test system is operating now in California. The private funding, from the Gordon and Betty Moore Foundation, is being used by USGS and its university partners to continue research and development efforts.

To complete a fully functional, robust prototype system, further improvements to hardware, software and communications are needed. The USGS would extend earthquake early warning development to include a partnership with social scientists to better understand how the technical information can be most effectively communicated. The proposed funding would be used for these tasks. The result would be a system better suited to support emergency managers and other decisionmakers as they respond to earthquake activity.

In the state of California, legislation has been introduced to supplement the Federal investment in early warning. The USGS is specifically included in the proposed law, which calls for the California Emergency Management Agency to collaborate with the USGS, the California Institute of Technology (Caltech), the California Geological Survey, the University of California Berkeley, and others, to develop a comprehensive statewide earthquake early warning system in California.

Improve Rapid Response to Eruptions of Volcanic Ash (+$400,000/+1 FTE)

Volcano Hazards Program (+$400,000/+1 FTE)

The Icelandic volcanic ash eruptions of April 2010 and May 2011, and the Chilean ash eruption of June 2011, provide examples of the importance of volcano monitoring, early warning, and pre-crisis planning. Improved early warning of impending ash eruptions, followed by rapidly updated forecasts of ash impacts as an eruption progresses, maximizes the time and information available for undertaking mitigating actions. Tasks would be undertaken to mitigate risk from volcanic activity to aviation, airports, communities, and infrastructure, to improve resiliency, and to enhance monitoring of ash producing volcanoes. These steps comprise continued gradual implementation of the National Volcano Early Warning System (NVEWS) and recognize the emerging urgency of the ash issue.

Volcanic ash is a major threat to both national and international aviation. In-flight encounters with ash clouds result in engine and avionic failures, with potential for catastrophic losses. Explosive eruptions of volcanoes in California, Oregon, Washington, and Hawaii could have major regional impacts on the ground as well. Volcanic ash can disrupt power generation and distribution, transportation systems, water supplies, business operations, and agriculture, and poses a direct threat to public health and safety. The USGS proposes to implement a real-time, ashfall modeling capability to provide emergency managers,

decisionmakers, and the public with the best possible information on expected time of onset and amount of ashfall. Working together with the NOAA National Weather Service (NWS), and the Air Force Weather Agency, the USGS would engage users to design and provide useful text and graphic products derived from model runs and real-time observations. This would be complemented by field work to construct a more comprehensive database of ashfall deposits in the western United States to better inform and guide preparedness. Upgrades would commence to the monitoring network at Mount Hood, a very high threat ash-producing volcano adjacent to Portland, OR, designated as a high priority for NVEWS. The USGS Volcano Hazards Program in partnership with the U.S. Army Corps of Engineers and Southern Methodist University would install seismic and infrasound sensors on Pagan, a high threat volcano in the Commonwealth of the Northern Mariana Islands.

Expanded Debris Flow Warning System (+$500,000/+2 FTE)

Landslide Hazards Program (+$500,000/+2 FTE)

The prototype debris flow early warning system developed by the USGS and the NWS is assisting in the protection of lives, important infrastructure, and lifelines in southern California. This initiative would expand the successful partnership to northern California and the southern part of Oregon. It would support the development of predictive tools (rainfall intensity and duration thresholds and susceptibility models) in fire related and non-fire related areas, as well as expanding monitoring efforts in intensely burned areas. Partners include NOAA, local and State governments, and the private sector. The products are rainfall thresholds and real-time warnings of debris flows, particularly in burned areas.

Disaster Scenarios and Strategic Science Crisis Response **+$757,000/+4 FTE**

Land Change Science (+$757,000/+4 FTE)

To prepare for the impacts of hazards before they strike, the USGS would develop fully realized scenarios of disaster events in collaboration with Federal, State, tribal, local, and university partners, by simulating a real hazard event. By understanding the potential impacts of these hazards before they occur, the USGS would strengthen capabilities in warning, responding and recovering from such events. These scenarios would improve the Nation's resilience to natural hazards, biological epidemics (e.g., epidemic avian influenza), and human-triggered disasters (e.g., industrial accidents). These scenarios apply integrated science across multiple mission areas, including modeling of the hazard process (e.g., ground motion modeling for earthquakes or wave modeling for tsunamis), environmental health and economic consequences to inform community decisionmaking on hazard mitigation and emergency response. In 2014, efforts would facilitate development of a standing Interior capacity for rapidly implementing strategic science working groups, similar to what was done during the Deepwater Horizon Oil Spill disaster, to allow crisis responders to quickly evaluate the impacts of alternative response strategies. The working groups would engage with other Interior bureaus, the Landscape Conservation Cooperatives (LCC), and the Department of the Interior Climate Science Centers (CSC).

Other Program Changes

Program Increases

Ecosystems

White Nose Syndrome **(+$1,505,000/+1 FTE)**

Wildlife Program (+$1,000,000/+1 FTE)

This funding increase within the Wildlife Program subactivity is being implemented in the 2013 Operating Plan.

Wildlife Program (+$505,000/+0 FTE)

White-nose syndrome (WNS) is an emergent disease of hibernating bats. Since first described among bats in New York during the winter of 2007, the disease is estimated to have killed over five million bats, and declines greater than 95 percent have been documented for some affected populations. The disease is caused by a fungus, *Geomyces destructans*. Bats are the primary predators of night-flying insects and the natural pest-control services they provide are valued at $22.9 billion each year for agriculture in the continental United States. The USGS is working closely with the FWS, State natural resource agencies, academic institutions, and non-governmental organizations to implement a collaboratively developed National Plan for managing WNS, and the USGS continues to lead disease investigations, research, and development of strategies to mitigate the effects of the WNS. Ongoing USGS research and monitoring activities are geared toward providing enhanced disease surveillance, improving diagnostic tools, and providing a better understanding of WNS disease ecology with the ultimate goal of developing practical management solutions to reduce the impacts of this devastating disease. The proposed increase would enhance surveillance and diagnostic capacity to detect the continued spread of WNS, develop an oral vaccine for WNS; and provide for the development of non-bat models for studying virulence of *G. destructans*.

Coral Reef Ecosystem Research **(+$442,000/+1 FTE)**

Environments Program (+$442,000/+1 FTE)

Coral reefs are among the most diverse and biologically complex ecosystems on Earth. They support more species per unit area than any other marine environment; provide important fishery habitat, economic and environmental services to millions of people for recreation, sources of food, jobs, chemicals, pharmaceuticals; and offer unparalleled shoreline protection. Under threat from multiple stressors that are overwhelming their natural resilience, an estimated 27 percent of reefs globally have already been lost and 60 percent are threatened by ocean warming, disease and anthropogenic activities including coastal development, polluted runoff from unsustainable land use practices, over-harvesting, destructive fishing, and global climate change.

In 2014, the increase in the Environments Program would enable the USGS to increase research to support the U.S. Coral Reef Task Force (CRTF) in collaboration with the Office of Insular Affairs. The USGS would provide the science to better understand how corals respond to natural and anthropogenic changes in the environment by increasing understanding of how stressors affect the physiologic processes of coral reef organisms and reef structure; provide state-of-the-art science to support development of effective, science-based methodologies for quantifying lost ecosystem services from degraded coral reefs

as well as the potential environmental benefits associated with coral reef restoration; and support a rapid response team to assess extreme coral events (e.g., heating or cooling events, disease outbreak).

Expected products include developing, with interagency collaboration through the CRTF, a reef manager's resource guide to coral reef impacts; contributing to the scientific basis for developing a functional assessment methodology for quantifying reef ecosystem services; and assessing coral reefs undergoing extreme events. This information would provide insight into how corals are actively responding to stressors and enable reef managers to make better decisions for managing in and around the watershed where the reef is located.

Brown Tree Snakes – Detection and Control **(+$500,000/0 FTE)**

Invasive Species Program (+$500,000/0 FTE)

Shortly after World War II, the brown tree snake (BTS) was accidentally transported from its native range in the South Pacific to Guam. As a result of abnormally abundant prey on Guam and the absence of natural predators and other population controls, BTS populations reached extraordinarily high numbers. Snakes have caused the extinction of most of the native forest vertebrate species; thousands of power outages affecting private, commercial, and military activities; and widespread loss of domestic birds and pets. The highest priority needs for control and management of BTS are the development of landscape scale methods to suppress or eradicate snakes on Guam and to detect and eradicate incipient populations of snakes accidentally transported to other islands such as Hawaii and the Northern Mariana Islands. The military expansion on Guam will raise the profile of these issues because military construction will result in mitigation actions that include snake suppression in areas of high ecological value, and because increased military cargo transport and off-Guam training exercises will increase the odds of transporting snakes to other islands, such as Hawaii. With the increase, the USGS would focus on high-priority research to validate the population-level efficacy of aerially-delivered toxicants for snake control at landscape scales; predict the results of snake suppression on Guam in terms of recovery rates of snake populations as well as recovery of potentially problematic species (such as non-native rats) that would benefit from snake suppression; develop novel methods for detection and control of juvenile snakes, which are not susceptible to the attractant used to deliver toxicants; and revive the USGS "Dogs in the Woods" program, to assess the utility of detector dogs for detecting snakes on recipient islands; and, for eliminating snakes that escaped poisoning in areas that have received toxicant applications.

New and Emerging Invasive Species of National Concern **(+$874,000/+4 FTE)**

Invasive Species Program (+$874,000/+4 FTE)

The introduction, establishment, and spread of invasive species will be important drivers of biodiversity loss over the next century and will pose substantial risks to native species, valued ecosystem services, and human and wildlife health. Ongoing global changes such as more frequent transcontinental and transoceanic trade and tourism, land and water use changes, and climate change are facilitating ever-faster rates of establishment and spread of harmful, invasive plant and animal species around the world. The challenge for scientists will be to determine which newly established nonnative species may cause significant impacts and become high priority invaders. While many invaders come without noticeable impact, causing little or no observed change in the invaded ecosystem, a small percentage of species that become established alter ecosystem structure and function in detectible and deleterious ways. The USGS has gained an understanding of the qualities and characteristics to help identify the next generation of invaders – hopefully in time to take action to prevent large-scale landscape changes like those caused by invasive cheatgrass which have changed fire dynamics in ecosystems in the Western United States. USGS research on current high priority invasive species, tamarisk in the Southwest, nutria in the Gulf of

Mexico, Burmese pythons in the Everglades, and Asian carps in the Mississippi River Basin, provides information to identify the next generation of invaders and to forecast their impacts. Assessing the factors influencing such known invasions improves the National ability to predict invasions and to take preventative measures early enough to better address new invasive species.

This proposed increase would allow researchers to investigate the relationship between landscape scale alterations such as hydrologic alterations, drought, climate change and hurricanes and invasive species, and enhance our ability to improve our predictive tools. The USGS would develop models, decision tools and other approaches to predict geographic distribution of invasive species based on parameters such as temperature, precipitation, elevation, and vegetation. These models would provide screening tools to focus early detection efforts by predicting potential range and resulting distribution. The USGS would also enhance existing efforts focused on the development, evaluation, and improvement of early detection and control methods for high profile invasive species such as Asian carp and Burmese pythons. The USGS would utilize eDNA or similar methods, as well as other advanced next-generation molecular methods to detect invasive species at very low densities in the field. These USGS research endeavors would provide information for assessments of risk and predictions; determine effects of invasive species; develop tools and innovative methods for control and management; and deliver information management tools to more effectively integrate and utilize available data on invasive species. The end result is a greatly enhanced capability for early detection and control of the next, as yet unknown, generation of invasive species.

Energy Minerals and Environmental Health

Rare Earth Elements Research **(+$1,000,000/+5 FTE)**

Mineral Resources Program (+$1,000,000/+5 FTE)

This funding increase within the Mineral Resources Program (MRP) is being implemented in the 2013 Operating Plan to support Rare Earth Elements Research activities.

High Priority Research on Critical Minerals **(+$1,130,000/+7 FTE)**

Mineral Resources Program (+$1,130,000/+7 FTE)

The USGS Mineral Resources Program (MRP) will continue to conduct research on rare earth element (REE) resources as described above for 2013. In addition, in 2014, this research will be expanded to cover a broader range of critical materials such as the platinum group elements, tellurium, and lithium.

Advancing Environmental Health

The Contaminant Biology and Toxics Substances Hydrology Programs conduct research on the environmental impacts of chemical and pathogenic contaminants that enter the environment through natural and anthropogenic mechanisms, and threaten human, animal (fish and wildlife), and ecological health. In 2013, the USGS published the Environmental Health Science Strategy which summarizes national environmental health priorities that USGS is best suited to address, and will serve as a strategic framework for USGS environmental health science goals, coordination of research efforts, partnerships, and outcomes for the next decade. This strategy delineates the connection between USGS scientific research and its ability to support decision making to safeguard environmental health. The following three program increases are efforts to bring together science and decision making to further the USGS environmental health mission.

Emerging Contaminants and Endocrine Disrupting Chemicals **(+$1,000,000/+3 FTE)**

Contaminant Biology Program (+$1,000,000/+3 FTE)

One of the most important groups of emerging contaminants is endocrine disrupting chemicals (EDCs). Exposure to EDCs can cause reductions in reproduction, deformities, behavioral abnormalities, and immune dysfunction. The proposed increase would support laboratory research and field investigations focused on the effects of EDCs on terrestrial and aquatic wildlife species. Research topics would include: 1) assessing sources and effects of agricultural-related EDCs on the health of birds, fish and amphibians; 2) understanding how EDCs impact the immune function and disease resistance; 3) identifying both trans-generational genetic effects and behavioral effects; and 4) investigating the movement of EDCs through ecosystems to characterize risk across species.

Research would assess how differences in animal agriculture practices and intensity can affect reproductive output (e.g., mating behavior, egg production and hatchability, early life stage development, and sexual differentiation). Studies would evaluate the overlay of wildlife habitat utilization, EDC exposure, and land management practices to better quantify risk, and evaluate potential tools that resource managers might use to reduce wildlife EDC exposure and impacts. Much of the research done on EDCs to date has focused on assessing effects on reproduction; relatively little has been done to assess the effects on immune function and disease resistance. Funding would expand pilot studies designed to assess the biochemical changes that occur when organisms exposed to an EDC are subsequently exposed to a bacterial or viral agent. This work would enhance understanding of the effect EDCs have on disease susceptibility in native fish, such as largemouth bass, and facilitate development of a diagnostic field test to rapidly detect EDC exposure in wild fish.

Epigenetic effects of EDCs (e.g., alteration of the expression of genes in offspring), have been demonstrated in mice and humans. Proposed studies would be the first to investigate epigenetic effects in fish and wildlife. Fish exposed to a model EDC would be evaluated for genetic alterations and subsequent effects on reproduction, immune function and behavior. Behavioral changes associated with sub-lethal exposure to EDCs can impair long-term survival and reproduction. These studies would evaluate how EDCs affect different behaviors; how changes in those behaviors relate to the physiologic health of the organism and whether those changes can be used for predicting the sustainability of natural populations.

Within ecosystems, EDCs likely exert impacts differentially among fish and wildlife species, which can result in ecosystem-level impacts. Thus, it is important to characterize how exposure to pathways partition through food webs will improve predictions of which species are likely subjected to the greatest risk. Studies would examine predator-prey pathways of EDC exposure to key representatives of fish and wildlife guilds across a range of different habitat types, and provide risk profiles based on both exposure probability and EDC sensitivity. This work would facilitate a broad characterization of EDC dynamics in wild populations to more efficiently target mitigation such as exposure reduction efforts.

Emerging Contaminants **(+$1,000,000/+2 FTE)**

Toxics Substances Hydrology Program (+$1,000,000/+2 FTE)

The proposed increase would support a National assessment of contaminant mixtures at stream locations affected by combinations of contaminant sources, including wastewater treatment plant discharges, industrial discharges, landfill leachate, crop agriculture, and animal agriculture. Samples of stream waters and sediments would be analyzed using USGS analytical capabilities for approximately 800 common and emerging chemical contaminants. In addition, extensive forensic analyses would be employed to identify

unknown contaminants in these environmental samples. This project would be coordinated with the EPA and their capability to conduct *in vitro* bioassays of the same environmental samples. The information produced by these activities would provide a basis for toxicity testing for chemical mixtures and low-level exposures; would help improve understanding groups of contaminant effects on organism health; and would identify unidentified contaminants of emerging concern based their actual presence and their levels in the environment. A pilot project currently ongoing in 2013 is testing chemical mixtures and forensic methods in stream waters at a limited number of stream sites; scientists from the EPA National Exposure Research Lab, National Risk Management Research Lab, and National Health and Environmental Effects Research Laboratory are testing the same water samples for biological activity using bioassays. The expanded effort would enable testing at additional sites for other contaminant source types and combinations, and would enable contaminants to be tested in both stream water and sediments providing a better estimate of total contaminant mass and exposure potential.

Pathogens and Contaminants **(+$611,000/+2 FTE)**

Contaminant Biology Program (+$611,000/+2 FTE)

Historically, researchers studied effects of pathogens (infectious disease) and contaminants (toxicological disease) in isolation; yet animals and people are often exposed to these agents simultaneously in the environmental. Concurrent exposure to these disease agents can produce significant, and sometimes unexpected, interactions which affect the health and well- being of fish, wildlife and people. For example, exposure to contaminants can impact the immune systems of organisms, making them vulnerable to pathogens. USGS research has demonstrated that immunosuppression, caused at least in part by exposures to chemical contaminants in the environment, is a potential contributing cause of massive fish die-offs in the Potomac River.

The proposed increase would integrate expertise that is not traditionally brought together in environmental studies. The studies would focus on enhancing the understanding of the effects of exposure to complex combinations of disease agents, identifying the mechanisms of interactions, and helping to more accurately quantify the individual impacts of different disease agents on the health of aquatic and terrestrial organisms. Resource managers would use this knowledge to identify vulnerable populations and to better diagnose and respond to disease outbreaks that cannot be fully explained by our understanding of the effects of single classes of disease agents. Human health researchers can utilize this information to better understand the potential effects of these combined interactions on public health.

Natural Hazards

Earthquake Products and Improved Monitoring in Eastern U.S. **(+$1,200,000/0 FTE)**

Earthquake Hazards Program (+$1,200,000/0 FTE)

Following every significant earthquake, the USGS quickly distributes several "situational awareness" products, including *ShakeMap*, *ShakeCast*, *Prompt Assessment of Global Earthquakes for Response* (*PAGER)* and *DidYouFeelIt?,* which governments and emergency response organizations use to gauge the earthquake's impact and to plan response activities. These products have wide use but have technical limitations because the seismic network coverage is too sparse in many areas of the country, especially in the Central and Eastern United States, and other input data is too sparse and results in high uncertainties in shaking and loss estimates.

To address these technical limitations, the USGS is proposing to:

- Release Version 2 of the *ShakeMap Atlas*, with nearly 10,000 global earthquake ShakeMaps for years since 1973. This database, to be released online, would be used for PAGER, Global Earthquake Model (GEM), the United Nations, and dozens of loss modelers and researchers. The USGS would supplement the *ShakeMap Atlas* with older and smaller events for New England, the Central and Eastern United States, and for landslide and liquefaction case history events;
- Implement a new scientific and technical strategy to address the challenges of geospatial site amplification. This would move beyond employing only shallow velocity profiling to estimate site amplification (still the current standard). This work will address a long-term goal of being able to improve ShakeMap with any available method for refined site amplification;
- Develop ShakeCast, Version 3.0 applications, under contract to Caltrans and the U.S. Nuclear Regulatory Commission. These would include customizable settings for vulnerability, landslide probability, and liquefaction potential. External user coordination would continue to be supported by reimbursable contracts to the Fort Collins Science Center, and via workshops and visits to critical users around the country;
- Develop effective relocation procedures for mainshock/aftershock sequences. Such procedures have been used to assess the magnitude 8.8 earthquake in Maule, Chile, and the magnitude 7.2 earthquake in Van, Turkey, and are being used to improve constraints on earthquake source parameters in the magnitude 7.2 Virginia earthquake sequence; and
- The USGS would extend PAGER by enhancing the ShakeMap hazard layer to assess the likelihood and spatial distribution of secondary hazards. Estimating both liquefaction and landslide probabilities are not yet applicable on a global scale in practice. On-going calibrations are being performed with the greatly improved subset of recent landslide and liquefaction case-history events provided by the ShakeMap Atlas 2.0.

In addition, the USGS has been working for the past 18 months with the Office of Science and Technology Policy, the Office of Management and Budget, the National Science Foundation (NSF), the Department of Energy and the Nuclear Regulatory Commission (NRC) to develop a plan to make 150-200 seismic stations in the Central and Eastern United States permanent. These seismic stations are currently part of the "USArray" transportable array, funded by the NSF. A comprehensive and detailed plan for widespread conversions to make these stations permanent has been completed and the NSF is taking the first steps toward implementation of this plan in 2013 with funding in its budget. This proposed funding would complement the NSF's continuing investment in the station conversion project

Enhancing Monitoring **(+$108,000/ 0 FTE)**

Geomagnetism Program (+$108,000/0 FTE)

The proposed increase would help maintain and modestly expand USGS work on geomagnetically-induced currents (GICs). GICs are produced when space weather impacts the Earth, causing damaged electric power grids and other electricity conducting infrastructure, affecting the availability of power to millions of Americans and impacting regional economies. The USGS, in collaboration with the NOAA Space Weather Prediction Center and NASA-Goddard GIC, are building monitoring tools that include a nationwide conductivity model, a local magnetic field model and regional electric field estimates.

Enhanced Coastal Storm Response Capability: Improved Assessments of Coastal Storm and Climate Impacts and Vulnerability ($850,000/+3 FTE)

Coastal and Marine Geology Program ($850,000/+3 FTE)

The USGS, in anticipation of Hurricane Sandy and through the subsequent response and recovery, provided pre-storm forecasts of Sandy impacts, surveys to assess coastal and community impacts, and assessments of coastal conditions and vulnerability reflecting the altered post-storm landscape. The USGS Sandy response continues an investment in developing capabilities to anticipate and document the impact of hurricanes, other major storms, and the long-term consequences of coastal erosion and sea-level rise. The resulting data and tools have high-visibility and have established expectations for USGS products with wide applicability, as well as products targeted to the requirements of specific coastal resource and emergency managers at both the state and Federal level.

Demands for USGS data and products subsequent to Hurricane Sandy exceeded USGS capacity. In response, the USGS is implementing changes to ensure that data and products are more readily available (through, for example, the *ocean.data.gov* portal), that standard products meet broad needs, and that USGS information systems facilitate the ability of users to access and integrate information to meet their specific requirements. The proposed funding increase would support evaluation of the accuracy and effectiveness of current forecast products; development of improved models for storm impacts at regional and national scales (including cumulative impacts over management relevant time scales and reflecting climate change scenarios); and development of products for application to specific management needs such as public safety, infrastructure vulnerability, and cultural and natural resource management. Project execution would include collaborative efforts with diverse users, particularly other Interior bureaus and State resource managers, to ensure products and delivery mechanisms are accessible, reflect management processes and technical capacities, and are applied in a manner consistent with product uncertainties.

Water Resources

Streamgages and Streamgage R&D (+$8,161,000/+1 FTE)

The USGS streamgage network provides streamflow information and understanding for National, State, Tribal, and local economic well-being, the protection of life and property, and efficient and effective water resource management. Research and development into complimentary methods of stream flow data collection is important to measure areas in which it is not practical or feasible to place a gage.

National Streamflow Information Program (+$7,161,000/+0 FTE)

The increase proposed for the National Streamflow Information Program (NSIP) would enhance its stability by retaining streamgages that would otherwise be discontinued. It is expected that the NSIP would be able to fully fund at least another 100 NSIP streamgages and partially fund over 200 other streamgages. However, there would be more streamgages at risk due to anticipated partner (other Federal, State, Tribal and local agencies) reduction in funding because of economic conditions. The proposed 2014 increase would provide for a full-time Flood Coordinator and a half-time Drought Coordinator who would help plan and oversee the USGS response to ongoing floods and droughts and documentation for nationally consistent data acquisition and analyses. With the proposed increase, the program can help support a highly reliable system for real-time and historic streamflow information delivery to customers that includes data processing, quality assurance, storage, and easy data access. These funds would help ensure that the National Water Information System (NWIS) database, critical to the success of NSIP, is operated and maintained at peak efficiency and effectiveness. Additional efforts are needed to provide real-time data users information on the range

of uncertainty of the streamflow information they use to make decisions on a regular basis. Proposed funding would support software upgrades for time series information.

Hydrologic Research and Development (+$1,000,000/+1 FTE)

The USGS would expand research and development on the next generation of streamflow and bathymetric measurement techniques, which would incorporate remote sensing to achieve cost efficiencies and improve capabilities for measuring discharge and depth profiles at ungaged sites. High-speed infrared video and particle image velocimetry have demonstrated potential for generating accurate, spatially detailed measurements of water-surface velocities and channel bathymetry. Laboratory experiments and field tests of these techniques use data collected by aircraft and unmanned aerial vehicles (UAV's) to enhance current capabilities for measuring discharge in ungaged streams. The resulting methods would eventually be applied to remote sensing data from satellite platforms currently in development and scheduled to become operational in a few years. This capability has applications that could potentially reduce loss of life and property damage during floods; other applications include hydrographic charting for navigation, ecological monitoring and restoration, water resource management, and contaminant transport.

Water Science and Technical Support for Tribes (+$1,000,000/+7 FTE)

Cooperative Water Program (+$1,000,000/+7 FTE)

The CWP monitoring and assessments will continue and expand work related to water availability issues on Tribal lands in order to address such topics as water rights, water use, hydrologic conditions, and water-quality issues. The CWP would continue development of quantitative models of water budgets, including groundwater and surface-water interactions, that provide information on how human and natural factors, such as groundwater pumping and climate change, affect stream flows so that Tribal river managers can develop effective strategies to maintain and restore critical habitats and healthy ecosystems. Funding for tribal cooperators, including an increase in the 2014 budget will be allocated in coordination with the DOI Secretary's Indian Water Rights Office and other Bureaus (including Indian Affairs and Reclamation) that support the Federal trust responsibility for water in Indian Country.

NAWQA Related Studies (+$1,000,000/+7 FTE)

Cooperative Water Program (+$1,000,000/+7 FTE)

The Cooperative Water Program (CWP) monitoring and assessments would continue to provide watershed insights to meet national objectives of the National Water-Quality Assessment (NAWQA) program, including on the transport and fate of nutrients and sediment through watersheds to receiving waters; enhancement of real-time continuous monitoring at streams and rivers; natural and man-made contaminants in deep groundwater used for drinking; ecological modeling of ecosystems; and forecasting of water quality resulting from land-use and climate change.

Core Science Systems

Geological and Geophysical Data Preservation (+$400,000/0 FTE)

Science Synthesis, Analysis and Research Program (+$400,000/0 FTE)

The National Geological and Geophysical Data Preservation Program (NGGDPP) is dedicated to preserving physical and analog geoscience data including rock and ice cores, fossils, fluid samples of oil, gas, and water, and geochemical samples that represent potentially beneficial or harmful chemical compounds in the rocks. To accomplish this work, the NGGDPP cooperates with state geological surveys and other Interior bureaus. The USGS Libraries Program identifies, acquires, manages, and provides access to a broad collection of scientific information for a wide range of internal and external customers. It maintains physical and digital collections and provides tools for accessing them onsite and remotely. The increase would: 1) provide more states with funds to inventory and preserve physical collections, such as core samples, fossil and fluid samples, and derived and indirect data, such as geochemical and seismic data, maps, or field notebooks; 2) improve the National Digital Catalog, which makes it possible to find, get, and use preserved geoscience data from over 750 collections on nearly 3 million geoscience data points provided by 44 states and USGS collections; and, 3) expand digitization, description, and accessibility of scientific research products in the possession of the USGS and its partners for the broader content availability for integration and discovery.

Alaska Mapping (+$1,044,000/0 FTE)

National Geospatial Program (+$1,044,000/0 FTE)

The National Geospatial Program (NGP) is working with the State of Alaska and Federal partners to replace more than half-century-old topographic maps and to provide current geospatial data for Alaska. New and accurate geospatial data are needed to improve aviation safety; understand and mitigate the effects of coastal erosion and storm surge; plan infrastructure for Arctic shipping and resource extraction; and protect biodiversity and habitats. The NGP and its partners are working on a five-year effort (2013-2018) to acquire geospatial data to remap the State. The topographic maps generated from the data would be completed in 2019.

The Alaska Mapping Executive Committee, an interagency group chaired by Interior and staffed by the NGP, is identifying and pooling funds to acquire elevation and hydrography data. The State works with the Federal Committee members and its Technical Subcommittee. The highest priority need identified by the Committee is for elevation data. Approximately 35 percent of the elevation coverage for the State has been updated. The proposed increase would bolster funding for elevation data acquisition contracts, and reduce the estimated $37.8 million shortfall needed to complete the State. Some funding would be used to improve techniques to increase the efficiency of acquiring hydrography data, which is the second highest priority.

Facilities

Operations and Maintenance Efficiencies--Reduce Facilities Footprint (+$6,385,000/0 FTE)

Rental Payments and Operations and Maintenance (+$6,385,000/0 FTE)

With the proposed increase, Facilities, Rental Payments and Operations and Maintenance would have the ability to invest in Cost Savings and Innovation Plan (CSIP) projects, that allow the USGS to consolidate

space, reduce the occupancy footprint, improve utilization and create real property cost savings and other efficiencies. Funding would enhance the ability to meet requirements of statutory energy goals; increase efforts for energy reduction, water conservation, and waste reduction; and enhance the USGS's ability to meet specified environmental requirements, as well as enable more efficient and economical maintenance of its real property assets.

Program Decreases

Climate and Land Use Change

Geologic Carbon **(-$532,000/-1 FTE)**

Carbon Sequestration (-$532,000/-1 FTE)

The geological storage of carbon dioxide (CO_2) in porous and permeable rocks involves injecting high pressure CO_2 into a subsurface rock unit and displacing the fluid that initially occupied the pore space. The proposed funding reduction in 2014 would delay assessment and research activities planned by the geologic carbon sequestration project. For example, the completion of a three-year assessment of the recoverable oil and gas resources resulting from carbon dioxide sequestration associated with enhanced oil and gas recovery would be delayed by one year. Another example is that the program would delay the development of economic assessment methodologies to evaluate the results of the national geologic carbon sequestration assessment until 2015. A third example is that the program would scale back the scope of ongoing investigations into the potential for induced seismicity related to carbon dioxide injection and subsurface storage; this would affect the number of sites studied and the amount of data collected. Finally, the geologic carbon sequestration program would curtail on-going collaboration on geological storage of CO_2 with universities and State and Federal agencies.

National Civil Applications Program/Civil Applications Committee **(-$576,000/-2 FTE)**

Land Remote Sensing (-$576,000/-2 FTE)

The National Civil Application Program (NCAP) serves USGS science programs and other Federal civil agencies by providing for the acquisition, dissemination, archive, and exploitation of classified remote sensing systems and data to address land and resource management, environmental, socioeconomic, hazards, disasters, and other geospatial scientific analysis and policy issues. In addition, NCAP provides support for the Civil Applications Committee (CAC), an interagency committee that provides coordination and oversight of Federal civil use of classified collections. The LRS Program would reduce the NCAP/CAC funding by $0.6 million in 2014. The program would reduce it through cost savings associated with two activities: 1) a migration of secure communications capabilities to a less expensive but sufficiently capable communications provider, and 2) reduced office space footprint at the LRS Program's secure facilities. These activities are expected to reduce costs without compromising core program capabilities.

North American Data Buy **(-$1,000,000/0 FTE)**

Land Remote Sensing (-$1,000,000/0 FTE)

In 2014, the Land Remote Sensing (LRS) Program would reduce its data acquisition expenditures by $1.0 million through the cancellation of the North American Data Buy (NADB) program. The NADB first started in 2009. This program was particularly necessary in 2012 during the suspension of operations for Landsat 5 and in 2013 to address gaps in Landsat coverage during the decommissioning of Landsat 5. Landsat 8 operational data collection is expected to begin by June 2013. Should Landsat 8 data collection be delayed, reducing the NADB incurs some additional risk of a gap in data provided to all users. However, its continuation is not deemed critical to address core program requirements.

Energy Minerals and Environmental Health

Minerals Information **(-$1,157,000/-10 FTE)**

Mineral Resources Program (-$1,157,000/-10 FTE)

This proposed reduction would reduce the support for the collection, analysis, and dissemination of minerals information. There is increasing need for this information due to emerging technologies and supply risk, as seen most recently for rare earth elements. This reduction would diminish the ability to collect and analyze both domestic and international data, and to provide this information to Congress and Federal agencies that count on USGS minerals information for mineral policy decisionmaking. Partners impacted would be the Federal agencies and departments that require an understanding of domestic mineral resource production and consumption in the context of global mineral resource availability and supply (e.g., Commerce, Defense, State, intelligence community).The proposed reductions to MRP would result in diminished workforce expertise to address important mineral resource issues for the Nation. Once lost, this expertise would take many years to reestablish. As the minerals program is realigning its structure and science with the Mission Area strategic science plan, the program is evaluating options for right-sizing various components of the program to meet the changing science and minerals information needs of the Nation.

Mineral Resources – Research **(-$1,000,000/-8 FTE)**

Mineral Resources Program (-$1,000,000/-8 FTE)

This funding reduction to research and assessment activities within the Mineral Resources Program (MRP) is being implemented in the 2013 Operating Plan. As the minerals program is realigning its structure and science with the Mission Area strategic science plan, the program is evaluating options for right-sizing various components of the program to meet the changing science and minerals information needs of the Nation.

Research and Assessment **(-$2,803,000/-23 FTE)**

Mineral Resources Program (-$2,803,000/-23 FTE)

This proposed reduction would eliminate research on mineral environmental health. As a result of this reduction, the USGS and the Federal government would lose the capability to understand the interactions of mineral resources with the environment, both natural and as a result of resource extraction, and the capability to predict the impact that resource development may have on human and ecosystem health. Partners impacted by the reduction would include regulating agencies such as the EPA, the BLM, the USFS, and State and local governments. This proposed funding scenario would reduce mineral resources field and research studies in Alaska, which represents one of this Nation's final frontier regions for geologic and mineral resource research. The world's largest zinc producer and one of the world's largest undeveloped gold-copper resources are in Alaska. This reduction would diminish the Federal Government's ability to investigate Alaska's mineral resources and fully understand the region's potential as a major supplier of mineral resources that are important to the Nation's economic and national security. Partners impacted would be the State of Alaska, industry, and Federal land management agencies.

The MRP would delay domestic mineral and environmental assessments until adequate resources are available. The MRP conducts mineral resource and mineral environmental assessments at local, regional, and national scales to estimate the quality and quantity of undiscovered mineral resources and potential

impacts of mineral resource development on environmental health. This unbiased objective geologic-based information is used in land planning and mineral policy decisionmaking. Currently, no other private, State, or Federal entity is capable of doing this work. Loss of this capability would severely impact the Federal government's ability to provide science-based decisionmaking on mineral related issues. Partners impacted would be the Federal land management agencies (e.g., BLM and the USFS) and Federal organizations that require an understanding of the national mineral resource endowment (e.g., Commerce, Defense, and the intelligence community).

These proposed reductions would result in further diminished workforce expertise to address important mineral resource and mineral environmental issues for the Nation. Once lost, this expertise would take many years to reestablish. As the minerals program is realigning its structure and science with the Mission Area strategic science plan, the program is evaluating options for right-sizing various components of the program to meet the changing science and minerals information needs of the Nation.

Natural Hazards

Eliminate Management-Supporting Habitat and Service Mapping (-$2,150,000/-8 FTE)

Coastal and Marine Geology Program (-$2,150,000/-8 FTE)

CMGP supports field and interpretive activities to provide environmental mapping to meet management needs within Marine Sanctuaries, National Parks, Fish and Wildlife Refuges, Marine Monuments, and for management of fisheries and other living marine resources in State and Federal Waters. Those benthic habitat and other mapping programs that exclusively respond to the needs of management agencies would be eliminated. Continuing service mapping would only be supported where it enables scientific studies addressing CMGP research priorities and where substantial cost-sharing from partnering agencies is available. As a consequence of this reduction, the USGS would no longer apply expertise in physical characterization of the sea-floor and coastal systems to the development of interpretive maps for use by resource managers. Mapping will remain a foundational CMGP activity, but mapping activities will be less available in response to site-specific and single-user requests for data-only products. Elimination of field mapping activities supporting this objective will reduce the availability of data for interpretive mapping by other State and Federal agencies.

Great Lake Beach Health Study (-$600,000/-1 FTE)

Coastal and Marine Geology Program (-$600,000/-1 FTE)

This funding reduction within the Coastal and Marine Geology Program is being implemented in the 2013 Operating Plan. The Great Lakes Beach Health study has been completed. USGS worked collaboratively with NOAA, EPA, and State and local public health agencies to expand the use of beach health predictive models to over 40 recreational beaches in five Great Lake States; develop new rapid field technology to determine bacteria concentrations at beaches; and increase understanding of the occurrence of true, rather than indicator, pathogens and viruses. This work provides beach managers the ability to issue warnings and closures, which have substantial public health and economic consequences, with greater certainty of risk.

Water Resources

Methods Development and Assessments **(-$5,000,000/-29 FTE)**

National Water Quality Assessment (NAWQA) Program (-$5,000,000/-29 FTE)

Within NAWQA, resources are being redirected from projects that are nearing completion as well as projects that are lower in priority, to WaterSMART, Ecosystems Priorities, and other higher priority projects. This will, however, impact the program's ability to meet some stakeholder needs for timelier reporting of water quality information and development of decision support tools. In particular, the program's ability to provide: (1) annual Web-based reporting of the concentrations, loads, and trends of nutrients, sediment and other contaminants in rivers flowing into important estuaries such as the Gulf of Mexico, Chesapeake Bay, San Francisco Bay; and (2) development, installation and calibration of real time water-quality sensors, training of field staff in the installation and operation of these sensors and the development of new laboratory analytical methods for new pesticides, high production volume chemicals and pharmaceuticals.

These decisions reflect a redirection of funds to protect, sustain and enhance USGS operational data networks and data management and delivery systems. Consistent, high quality, reliable, and uninterrupted hydrologic data are critical for the protection of life and property and to support the myriad of resource management decisions by public and private sectors as the Nation continues to strive for a robust economy and safe environment in the face of continued population growth, land and habitat changes, and climate variability. The primary implication of the 2014 decisions means that USGS assessments and research activities, other than those activities that advance cost-effective and innovative monitoring and data management technology, are reduced significantly. Applications developed to deliver USGS data in accessible, user-friendly, graphical and tabular formats, also are diminished.

Data Collection and Research **(-$867,000/-9 FTE)**

Hydrologic Networks and Analysis (HNA) Program (-$867,000/-9 FTE)

HNA support for the Priority Ecosystem Science (PES) would be reduced, which would affect data collection, assessments, and research conducted at the sites supported by the Priority Ecosystem Science program. Sites include Chesapeake Bay, San Francisco, Everglades, Mojave Desert, Yellowstone, and Platte River. These reductions would affect the efforts to develop new integrated science approaches that can be developed to address the needs of decisionmakers and to meet the Interior's responsibilities to manage the Nation's lands.

These reductions were made as a decision by the Program Council to preserve data networks over general assessment. It is felt that currently, networks are a higher priority than assessments. HNA provides general support to the Ecosystems Mission Area in the affected PES', this support will be reduced as a result of this reduction.

Interpretative Studies/Assessments **(-$4,000,000/-25 FTE)**

Cooperative Water Program (-$4,000,000/-25 FTE)

The proposed redirection of funds and FTE within the Cooperative Water Program (CWP) would reduce available science funding that supports assessments and research on selected issues; emerging topics first identified at local and State levels; and quality assurance that ensures that information collected across State boundaries are consistent and comparable. The funds would be used to support NAWQA and

WaterSMART studies and prioritizes CWP science to assess occurrence and transport of nutrients and other contaminants in streams and groundwater; to estimate streamflow at ungaged sites for more accurate water budgets; track site specific public-supply water use and consumptive uses; and increase understanding of streamflow and water availability for future needs on Tribal lands. The number of monitoring sites would remain stable, but may shift in location with the possible shift in assessment priorities.

The shift in Cooperative Water funding allows the USGS to use scarce resources to more strategically address USGS and nationally oriented priority issues. Decisions reflect a redirection of funds to protect, sustain and enhance USGS operational data networks and data management and delivery systems.

Water Resources Research Act Reduction **(-$5,490,000/0 FTE)**

Water Resource Research Act Program (-$5,490,000/0 FTE)

In 2012, the Water Resource Research Institutes (WRRI) program provided about $5.5 million of funding to the Institutes as annual base grants and an additional $1.0 million to 6 Institutes for successful national competitive grants. The proposed reduction would eliminate the annual base grants, but would continue to provide funding for the national competitive grant. The National Institutes for Water Resources (NIWR)-USGS National Competitive Grant Program supports research on water problems and issues that are of a regional or interstate nature beyond those of concern only to a single state. These grants prefer substantial collaboration between the USGS and university scientists. Collaboration ranges from the use of USGS data and information in the research to mutual involvement of USGS and University scientists on projects.

More than 250 applied research and information transfer projects funded through the annual base grants would be discontinued as would education and research opportunities offered by the Institutes to students. Many Institutes depend on the annual base grants to keep the Institute operating and would not be able to function. NIWR and the USGS have had good working relations over the years and are looking to better develop collaborative opportunities through development of an Internal Committee. The research priorities of the National Competitive Grant Program will better align with the USGS Strategic Plans (especially Water and Ecosystems) that were recently developed for the Mission Areas. The USGS will work with the Institutes to develop more rigorous oversight and performance measures to ensure that Federal investments effectively and consistently maximize national science goals and leverage all available resources, particularly in the areas of water availability, quality, and climate change.

Core Science Systems

Federal Geographic Data Committee (FGDC) Legacy Activities **($1,697,000 /-3 FTE)**

National Geospatial Program ($1,697,000 /-3 FTE)

In 2014, the USGS proposes to reduce funding for the FGDC. The FGDC would be funded at approximately $3.8 million. At this funding level, the FGDC Office of the Secretariat (OS) would provide support for the Steering Committee, Executive Committee, Coordination Group, and the National Geospatial Advisory Committee and support the Geospatial Line of Business/Federal Geospatial Platform. Support for key initiatives and Office of Management and Budget Circular A-16 components including architecture, the USGS National Spatial Data Clearinghouse network, geospatial standards development, National Spatial Data Infrastructure (NSDI) development and training, metadata program, and some of implementation of the A-16 Supplemental Guidance would continue. The reduction to the

FGDC OS would result in a reduced level of staff and capacity to address the balance of the implementation of the A-16 Supplemental Guidance, interagency policy, program, and coordination functions and requirements that would impact the Federal and national geospatial communities. The proposed reduction would eliminate the NSDI Cooperative Agreements Program and cloud computing initiative and significantly reduce International activities. The FGDC is funded through an interagency line of business. As the interagency steward of the program USGS funds the Office of the Secretariat. This reduction will eliminate funding for lower priority activities that have been historically provided by the Office.

Administration and Enterprise Information

Reduction to Administrative Services **(-$3,135,000/-18 FTE)**

Science Support (-$1,906,000/-8 FTE)

The Administration and Enterprise Information program funds the bureau and region leadership and management that provide guidance, direction and oversight of all USGS science activities and resource management and business and information systems, which provide the framework for science activities. The proposed reduction would result in the loss of core administrative and information technology services impacting the ability to deliver critical resources and business services to science centers, and reducing the availability of USGS science data used by emergency planners, natural resource planners and managers, and the general public.

The Science Support subactivity includes science quality and integrity, communications, and bureau management activities, such as leadership and budget formulation and analysis. Administrative support would be severely impacted, resulting in decreased support services in acquisitions, policy analysis and accounting and financial management oversight, including internal controls. Acquisition and Grant services necessary for conducting science projects would be delayed and would result in reducing the number of awards that can be made in a fiscal year. A reduction in Human Capital services would severely impact responsiveness, service, and the expectations of the Interior, the Office of Personnel Management, and USGS customers. A reduction in communication services could limit key proactive outreach activities directed at the public, policy makers and stakeholders about USGS science and capabilities. Timely and accurate responses to inquiries and data calls would also be negatively affected resulting in incomplete information being provided in a less-than-timely manner.

The proposed budget reduction would leave organizations without the employees needed to maintain fiscal accountability and internal controls; procure essential goods and services for science; maintain and operate facilities; manage equipment and property; and provide USGS maps and science products to the public. There would be an increased risk of material weakness in financial controls, property management and acquisition actions, which could lead to undetected fraud, waste, abuse or mismanagement.

Essential services including purchasing science equipment and field supplies; executing science agreements with partners; contracting for support scientists and researchers; vehicle management; funds accounting; oversight of cost savings and innovation projects, safety training; and hazardous waste management would be reduced and delivery of services delayed. Results of scientific studies and updates to datasets would lag or possibly would not be available to the public or other research agencies due to lack of resources for accomplishing reviews for scientific rigor and integrity and editing and preparing documents for publication.

Mandated goals to improve contract processes and eliminate sole source contracts would not be met. Insufficient numbers of acquisition employees could result in lack of quality control and risks increased liability to the government for improper contract actions.

The availability of authoritative USGS scientific data and products, used by emergency responders and the public would be limited and the timeliness of updates on social media sites reduced.

Prior year gains in building future scientific capacity through youth hiring and youth outreach activities would be lost through required cuts to these programs. Further, cooperative science projects and training with Native American tribes would be reduced, resulting in less science conducted by students on tribal lands and the elimination of important natural resources management training for hundreds of tribal members.

USGS activities with tribes would be negatively affected due to the reduced ability to hire interns for the Students In Support of Native American Relations (SISNAR) program, which brings interns to work on USGS research studies on tribal lands. Budget cutbacks would impact the ability to provide capacity-building tribal trainings and support for Tribal Colleges and Universities (TCUs).

At the proposed funding level:

- Bureauwide research support tools such as scientific journal subscriptions would be reduced or eliminated, making it more difficult for USGS researchers to conduct comprehensive literature reviews.
- Staffing, classification, labor relations advice and assistance to science managers would be reduced, negatively impacting the ability to effectively manage the workforce and accomplish strategic workforce planning.
- Science facility leasing contracting officers and construction project managers would increase the number of projects managed by employees, increasing the risk of accepting construction work or space contracts that do not achieve maximum benefit for funds expended or would require additional work to correct substandard construction.
- Environmental specialists would perform fewer NEPA site visits to assist science center staff with the complex process of properly managing and disposing of hazardous materials.

Security and Technology (-$1,229,000/-10 FTE)

Security and Technology facilitates science through technologies that enable collaboration and knowledge and information sharing between scientists across the landscape in addition to providing the communications and data management backbone. The proposed level of funding would require reductions to the Enterprise Geospatial Information Services (EGIS) support effort that works with mission programs to leverage GIS software and services to visually communicate natural science information to improve scientific understanding. Maintenance and technology refresh for telecommunications, computing infrastructure hardware and system software contracts and services would be deferred, increasing risk of a hardware failure. Additionally, software licenses, software database and information services management and maintenance contracts that have been centrally funded would be reduced or eliminated. This includes eliminating the bureauwide Oracle license, and security and maintenance support contracts for routers, security devices, portable personal communications devices, Norton antivirus, firewalls, and backup software. Failure to renew these services reduces core capability, increasing the likelihood of a critical systems failure, jeopardizing compliance and internal controls, and delaying and reducing distribution of USGS information.

Service contracts that sustain the underpinning of science computing infrastructure for mission data systems, administrative and security systems would be significantly downgraded and response times would decrease by ten percent, this would require a workforce reduction equivalent of 27 full time employees.

General Program Reductions (-$6,629,000/0 FTE)

These funding reductions are being implemented in the 2013 Operating Plan in part to offset increased costs to USGS programs due to fixed costs, to attain greater cost efficiencies, and support higher priorities.

Ecosystems	**(-$1,111,000/0 FTE)**
Status and Trends	(-$145,000/0 FTE)
Fisheries Program	(-$172,000/0 FTE)
Wildlife Program	(-$320,000/0 FTE)
Environments Program	(-$283,000/0 FTE)
Invasive Species	(-$59,000/0 FTE)
Cooperative Research Units	(-$132,000/0 FTE)
Climate and Land Use Change	**(-$536,000/0 FTE)**
National Climate Change and Wildlife Science Center/DOI Climate Science Centers (CSC)	(-$89,000/0 FTE)
Climate Research and Development	(-$162,000/0 FTE)
Carbon Sequestration	(-$41,000/0 FTE)
Science Support for DOI Bureaus	(-$8,000/0 FTE)
Land Remote Sensing	(-$153,000/0 FTE)
Land Use Change	(-$83,000/0 FTE)
Energy, Minerals, and Environmental Health	**(-$752,000/0 FTE)**
Mineral Resources Program	(-$439,000/0 FTE)
Energy Resources Program	(-$189,000/0 FTE)
Contaminant Biology	(-$67,000/0 FTE)
Toxic Substances Hydrology	(-$57,000/0 FTE)
Natural Hazards	**(-$861,000/0 FTE)**
Earthquake Hazards	(-$312,000/0 FTE)
Volcano Hazards	(-$188,000/0 FTE)
Landslide Hazards	(-$27,000/0 FTE)
Global Seismographic Network	(-$17,000/0 FTE)
Geomagnetism	(-$17,000/0 FTE)
Coastal and Marine Geology Program	(-$300,000/0 FTE)

Water Resources	**(-$1,589,000/0 FTE)**
Groundwater Resources	(-$69,000/0 FTE)
National Water Quality Assessment	(-$500,000/0 FTE)
National Streamflow Information Program	(-$114,000/0 FTE)
Hydrologic Research and Development	(-$280,000/0 FTE)
Hydrologic Networks and Analysis	(-$219,000/0 FTE)
Cooperative Water Program	(-$403,000/0 FTE)
Water Resources Research Act Program	(-$4,000/0 FTE)
Core Science Systems	**(-$725,000/0 FTE)**
Science Synthesis, Analysis, and Research	(-$100,000/0 FTE)
National Cooperative Geologic Mapping Program	(-$165,000/0 FTE)
National Geospatial Program	(-$460,000/0 FTE)
Administration and Enterprise Information	**(-$187,000/0 FTE)**
Science Support	(-$22,000/0 FTE)
Security and Technology	(-$165,000/0 FTE)
Facilities	**(-$868,000/0 FTE)**
Rental Payments and Operations and Maintenance	(-$868,000/0 FTE)

This page intentionally left blank

Internal Transfers

Ecosystems

Environments **(+$2,358,000/+12 FTE)**

The Science Support for DOI program provides science support for other bureaus within Interior. For example, the USGS provides priority wildlife research related to White-nose Syndrome, golden eagles, bats, condors, desert tortoises and renewable energy. The USGS also provides science support for other Federal, State, tribal, academic, and private eco-regional fish, wildlife and land conservation efforts by providing integrated ecological and population modeling capacity for national efforts, as well as increased capacity for applying models and other scientific information for resource managers.

Climate and Land Use Change

Science Support for DOI Bureaus **(-$2,358,000/-12 FTE)**

In order to more closely align work in the Mission Areas, Ecosystems would receive $2.4 million and 12 FTE from the Climate and Land Use Change Mission Area for Science Support for DOI Bureaus to support Ecosystems research goals.

This page intentionally left blank