

DOI Science Priorities

Integrated Science	1999 Estimate	Uncontrol. & Related Chgs.	Program Redirect	Program Changes	FY 2000 Budget Request	Change from 1999
DOI Science Priorities	0	0	15,000	15,000	30,000	30,000

Note: The Program Redirect column reflects the redirection of funds to the Integrated Science from other program areas.

The USGS contributes to the land and resource management mission of the DOI through our contribution of scientific knowledge and expertise of geological, hydrological, and biologic systems and cycles and their application to the immediate, high priority needs of the Department. Several cross-cutting scientific issues have been identified by DOI land management bureaus as topics for which they currently lack sufficient scientific understanding in a comprehensive ecosystem context to ensure sound decisionmaking.

Cross Cutting Scientific Issues:

- Strategies for ecosystem restoration
- Ecosystem monitoring protocols
- Rangeland and riparian health
- Declining species and species at risk
- Impacts of invasive species
- NRPP/Quick response
- NPS Interpretation
- GAP Analysis
- Cost-share program

These issues are interrelated and need comprehensive integrated data to develop science-based management recommendations. This initiative is directed toward developing key scientific information on resource and land management issues with an ultimate goal of developing predictive models for resource management decisions, identifying problems management may face in the future, and employing adaptive management strategies and evaluations in DOI's management responsibilities.

Current Program Highlights

Strategies for ecosystem restoration — The restoration of ecosystems is an important goal of DOI land and resource managers. There are several essential factors necessary for successful restorations. First, there must be a comprehensive understanding of the status of ecosystem drivers and functions that are to be restored. Second, the limits of the environmental variability of the systems must be known. These two factors provide the basis for studies of the interaction between the abiotic and biotic components of ecosystems. Third, successful restoration requires managers to clearly identify the desired end points and understand the dynamics of the existing systems.

- **Mineral Resources Program (\$2.0 million)** — Successful strategies for ecosystem restoration are built on knowledge of the geologic substrate, understanding of historic changes to the ecosystem, and the effect of variability of the geochemical landscape on habitat. In FY 2000, the USGS will continue work on the geologic characterization

of watersheds which are subject to environmental impacts from abandoned mine lands. Projects are underway in Boulder basin, Montana, and the Animas River, Colorado, in partnership with the Bureau of Land Management, the U.S. Forest Service, the States of Montana and Colorado, and local stakeholders. Specific activities will allow completion of: a geochemical transport model to infer movement of metals through fluid pathways, including fractured rock, into streams; development of a ranking procedure to prioritize dumps based on mine waste pile geochemistry; analyses of geophysical data to aid in selecting suitable repository sites for mine waste; and development of an integrated "tool kit" for the characterization and evaluation of abandoned mine waste sites to assist in ranking and prioritizing mine waste piles for remediation. This work will assist DOI bureaus in developing improved methods to reclaim abandoned mine lands, including ways to improve water quality in selected waters such as the Animas River.

- **Chemical and Drug Registration (\$0.775 million)** — In response to increasing concerns about human food safety, human health, and environmental effects, the Food and Drug Administration (FDA) increased regulation of drugs and chemicals used in the production of fish in hatcheries. Lack of approved drugs has dramatically reduced the effectiveness, and increased the cost of fish production for natural resource managers. The USGS has entered into a cooperative agreement with the Fish and Wildlife Service, the International Association of Fish and Wildlife Agencies and 37 State fish and wildlife agencies to conduct research in support of the new registration requirements. Under the agreement, USGS is conducting innovative research authorized by the FDA to generate data that support approval of priority drugs for public aquaculture production. Included as part of the research is a test of the "crop grouping" concept which will enable tests to be performed on a few surrogate species, reducing data requirements needed to extend drug labels to larger numbers of fish species.

Ecosystem Monitoring Protocols —

Ecosystem monitoring provides land managers with the information they need to evaluate management practices for the resources under their stewardship. Monitoring of environmental parameters is fundamental to answering ecosystem questions that affect management actions.

The cornerstone of a successful monitoring program is development of effective monitoring protocols including consistent methodologies for data collection and analysis. Historically, the USGS has been a leader in large-scale environmental monitoring activities in such areas as remote sensing of land use, collection of long-term water quantity and quality data, changing landforms resulting from geomorphic processes, and changes in animal populations.

Ecosystem questions

- How have environmental changes and human actions affected biological communities on a landscape scale?
- How has animal population distribution changed in response to invasive species or human encroachment?
- What observed changes in water quality, quantity, and flow management are causing declines in freshwater mussel populations?

- Water-Quality Assessment and Monitoring (\$2.5 million)** — In FY 1999, the USGS and the National Park Service initiated water-quality assessment and monitoring activities in 33 parks. Assessments focused on impacts of organic, inorganic, and bacterial contamination to park resources, baseline water-quality and aquatic biological conditions and trends, and technical assistance on current water-quality management issues. In FY 2000, initial activities will continue at 23 of the 33 parks with remaining resources to begin new assessments in additional parks. Information produced will directly assist land and resource managers to evaluate management practices for the resources under their stewardship.
- Vegetation Mapping (\$1.2 million)** — Vegetation mapping is carried out in national parks and coordinated with other Federal agencies. USGS scientists are developing standards and methods, acquiring aerial photographs, classifying vegetation, producing digital data, and providing quality assurance. The resulting information will help park managers and adjacent landowners in making informed resource decisions. Completed vegetation mapping products are now available for 4 national park units with sixteen others underway. Typically, 3-4 years are required to complete a project.

Program reviews

Two reviews of the Vegetation Mapping program were undertaken during the past year, one conducted by the NPS and one by USGS. A positive NPS review recommended continued support of the current mapping products, protocols and processes established for the program. The USGS review which involved experts from outside the two agencies will provide recommendations for the long-term stability of the program as well as reducing the overall time frame for mapping priority parks. USGS findings will be available by the December 1999.

Declining Species and Species at Risk — Reversing the rapid loss of biological diversity remains the greatest challenge to natural resource managers. Reasons for decline of species include habitat loss from development, agriculture, road building, reservoirs, and mining operations; habitat degradation from fire suppression, livestock grazing, damming and other changes in the amount and quality of water, and invasions of exotic species; and health effects such as disease and contaminants. Restoring populations requires an integrated program of research to develop critical information on the biology of individual species and the ecological relationships between those species and their habitats. Through improved data collection and analysis focused on linking physical, chemical and biological factors with others contributing to alterations in species composition and health, the USGS will provide land and resource managers with additional tools for addressing these issues.

- Species at Risk (\$0.750 million)** — Projects focus on species for which there is concern over possible endangerment, where either viable options still exist for long-term protection or additional field evidence is needed to assess the risks to the species. The USGS conducts studies on a wide variety of plant and animal species identified by the FWS. The results of these studies are being used by government agencies and the private sector. For example, the results of a plant species survey on two geologic formations in the area of the new Grand Staircase/Escalante National Monument will contribute to the BLM management of natural resources in the Monument. During a Species at Risk study of 14 rare plants within the Channel Islands National Park, only two of the four plants under consideration by the FWS for listing were endangered. The data from this study have also been used by an

interdisciplinary team developing landscape-scaled conservation strategies for the northern Channel Islands as the basis for a cooperative agreement for rare species management among the NPS, FWS, and the Nature Conservancy.

Natural Resources Preservation Program (NRPP) and Quick Response — The need for tactical research to support DOI science needs outstrips available resources. In answer to this need, the USGS is partnering with DOI to competitively rank and fund high priority tactical research needs. This program provides applied science which DOI managers at the field level use to enhance land and resource management capabilities.

- **Natural Resource Preservation Program (NRPP) (\$2.820 million)** — USGS biologists conduct short-term, tactical research to meet natural resource management needs of the National Park Service. NRPP funds help fill gaps in applied biological research in the Nation's national parks and allow USGS to be responsive to regional issues. Annually, NPS provides USGS a list of research needs of priority to park resource management. Park superintendents are provided results that analyze the issue, evaluate management options, and provide a variety of possible solutions. The NPS provides comparable funding that enables them to implement USGS recommended actions. Examples of the research include: study results showing quick recovery of aquatic invertebrates and beginning re-establishment of fish communities after a 5 hundred-year flood at Shenandoah National Park and a study investigating mitigation of acid mine drainage impacts using carbon dioxide pretreatment at Friendship Hill National Historic Site (NHS).
- **Quick Response Program (\$0.530 million)** — This program was established in FY 1994 to provide quick turn around research or technical assistance identified by FWS Regional Directors. Studies undertaken by this program involve scientific research that is short-term and provides critical information required for making credible and effective resource management decisions. The research addresses many issues, including management of public lands, environmental contaminants, threatened and endangered species, anadromous fish and aquatic and terrestrial invasives. Recent projects include: the effects of habitat restoration on grassland birds in the Northern tall grass prairie ecosystem; evaluation of wetland and upland management practices at Grays' Lake NWR; determination of lead exposure in black ducks wintering in Tennessee 10 years after implementation of non-toxic shot; effects on endangered fish of groundwater and surface water contamination by mineral extraction waste piles on the Colorado River; and the impact of an exotic snail and associated parasites on the spring dwelling fishes of west Texas.

Gap Analysis Program (GAP) (\$3.425 million) — This program is a collaborative effort to identify and classify biological diversity at regional and State levels. GAP provides a standardized means to inventory and map the distribution of vegetation communities, the ranges of terrestrial and some aquatic vertebrate species, and the management status of land units. Funds support the operation of GAP projects that include collection, verification, and integration of biological and associated data through activities such as satellite image processing, photo interpretation, use of museum data for development of models of species distributions, and development of analyses and reports using synthesized GAP data. The program involves 48 States and over 500 collaborators from business, academia, and local and Federal Government agencies. Analyses provide a snap-shot of the status of species over large areas and allow the identification of species and habitats needing protection to maintain biological integrity. GAP provides DOI land managers a powerful and scientifically-based tool for identifying areas of biological importance and can assist them in setting land management and conservation priorities.

Applications of GAP data

In FY 1998 there were an estimated 50 major applications of GAP data by Federal, State and local governments and private organizations. For example, GAP Analysis of the Intermountain Semidesert Ecoregion was the first systematic assessment of the conservation status of vegetation communities across a large multi-State region. Twenty community types were identified as vulnerable to elimination or degradation if intervention is not taken. For many of these, Federal land agencies can avoid potential future conservation crises through changes to current land management practices.

Cost-Share Program (\$1.0 million) — The cost-share program is a funding partnership with DOI bureaus to enhance USGS support in the hydrologic sciences to land and water management bureaus within the Department. The program was established as a 1:2 (USGS to DOI bureau) matching program and has demonstrated its ability to successfully share limited resources and effectively provide technical assistance directly to field-based managers.

Most of the work done in the cost-share program for the NPS, FWS, and BLM addresses water quality issues related to ecosystem restoration, monitoring protocols, riparian health, and declining species. For example, a project in the Florida Everglades provides assistance to the NPS in evaluating the influence of freshwater and nutrients on the East Florida Bay ecosystem. Using protocols developed in the National Water-Quality Assessment Program, the USGS provides data collection and training in sampling of bed sediment, benthic algae, and macroinvertebrates for FWS personnel in the Kenai National Wildlife Refuge, Alaska.

Justification for Program Change

An increase of \$15 million in support of Science for DOI Priorities will address research needs developed in concert with bureaus for the following issues:

	FY 2000 Request	Program Change
\$(000)	30,000	+15,000

Strategies for ecosystem restoration — The restoration of ecosystems is an important goal of DOI land and resource managers. The USGS will assist DOI bureaus in providing the scientific basis for management decisions on restoring habitats; expanding current abandoned mine land studies to include a greater variety of geologic settings and aquatic habitats; and initiating studies to develop and evaluate restoration techniques for native vegetation.

Ecosystem Monitoring Protocols — Proposed enhancements to USGS monitoring activities will assist land managers in preparing for and evaluating effects of resource management actions by providing the long-term data at multiple scales needed to measure impacts of management actions and providing scientific rationale for future management decisions. Several areas of focus for enhanced monitoring include the following:

- Working with DOI land managers to determine priority areas and species, the USGS will: provide streamflow and groundwater information for use in water rights determinations; monitor populations of important trust species and water resources, including evaluating invasive vegetation species and their impact on habitat quality for preferred wildlife species; and monitor and study changing fire regimes and develop protocols to assess emergency fire rehabilitation needs.
- To monitor the Nation’s resources and ecosystems requires the development of monitoring protocols for different ecosystems, such as developing stream health assessment protocols, based on biological parameters of riparian habitats and modeling of groundwater flow system in desert ecosystems, increase monitoring associated with national wildlife refuges, migratory birds, and habitat conservation plans.

Rangeland and Riparian Health — Rangeland ecosystems, because they exist in arid and semi-arid environments, are often limited in their ability to adjust to ecological stresses such as grazing and fire. Assessment methods needed to determine rangeland ecosystem health in these environments are currently inadequate. USGS will assist land managers of western rangelands by developing scientific information they need to determine the most important factors influencing the health of rangeland ecosystems, that could include the following activities:

- evaluate the effects of rangeland water developments on habitats for native wildlife species, including the effectiveness of such developments specifically designed for wildlife habitat enhancement
- determine optimal size and demographics of populations;
- investigate the use of remote sensing to efficiently and accurately determine the health of rangelands;
- investigate the role of fire in rangeland ecosystems, including understanding the effects and ecological consequences of fire and post-fire treatments on ecosystem response;

- determine threshold levels of invading weeds and levels of subsequent change which leads to irreversible habitat degradation, and
- investigate the role of cryptogamic soil crusts on soil stability, water infiltration, and fertility of soils.

Declining Species and Species at Risk — Reversing the rapid loss of biological diversity remains the greatest challenge to natural resource managers. Reasons for species' decline include habitat loss, habitat degradation, and health effects such as disease and contaminants. Through improved data collection and analysis focused on linking physical, chemical and biological factors with others contributing to alterations in species composition and health, the USGS will provide land and resource managers with additional tools for addressing these issues.

- New methods will be developed to determine population viability, identify key limiting factors, evaluate management actions and restoration alternatives, and assess the influence of habitats on biological processes for declining species.
- USGS will develop methods for assessing population densities, determining optimum habitat and nutritional requirements, evaluating effects of disease and competition with domestic species, and developing decision support tools for evaluating management alternatives for declining populations of western species, such as desert tortoise, sage grouse, and bighorn sheep.

Impacts of Invasive Species — The effects of invasive alien species on native species and ecosystem functions, resource-based economic activities, and public recreation have emerged as a major management issue nationally and on DOI lands. Research capabilities in developing basic understanding of the ecology and population dynamics of invasive species and ecosystem-based management methods are available and encompass all major taxonomic and functional groups of invasive species.

Research will focus primarily on ecosystems most threatened by established invasive species (i.e., tropical islands, wetlands, western riparian systems, the Great Lakes, grasslands and western rangelands), and address a limited number of highly invasive species, such as salt cedar, Chinese tallow, Johnson grass, and non-native gamebirds in the Southwest, of priority concern to managers. Additional work is needed to develop a predictive model to evaluate the potential for weed invasion and characterize the nature of susceptible lands.

Natural Resources Preservation Program and Quick Response — The need for tactical research to support DOI science needs outstrips available resources. In answer to this need, the USGS partners with DOI to competitively rank and fund high priority tactical research needs. This program provides applied science for DOI managers which is used at the field level to enhance land and resource management capabilities.

Tactical research projects will be identified through a proposal process that will be initiated later this year. For example, in the case of the Natural Resources Preservation Program, projects are selected based on: significance of the resource or issue to NPS, severity of resource threat, problem, or need, problem definition and information base, feasibility, problem resolution, transferability of results, cost effectiveness, and project support. Issues that could

be addressed include conducting baseline and trend analyses to establish potential threats to ground and surface waters and resources on public lands in areas facing imminent commercial development in the Southwest.

National Park Service Interpretation — The NPS seeks a collaborative working relationship with USGS that focuses on incorporating geoscience information into park-specific interpretive products.

Collaborative projects create an awareness of the geologic themes that connect Parks, and support the interpretation of geologic science throughout the NPS. Specific activities include further development of geologic themes on the Worldwide Web, developing and implementing geology training programs for NPS personnel, and promoting and facilitating geologic field trips in NPS units that are tailored to NPS staff needs. NPS is also working with other agencies on Partners in Resource Education to educate the public on the economic and environmental effects of invasive plants and enlists partners at the local and national levels to work together to minimize the spread of invasive plants in communities across the Nation.