USGS
science for a changing world

A Conversation with Customers

What the USGS Heard

A Summary Report

March–April 2000

U.S. Department of the Interior
U.S. Geological Survey

Note from the Director

Dear Customer:

I would like to thank all of the customers who participated in our listening sessions. The many insightful comments and suggestions have provided much food for thought within the organization. We are committed to serving the needs of our customers, and we can only respond to those needs when they are expressed needs, not needs that we perceive on our own or in a vacuum without input from our customers. We appreciate the time that each of you took from your busy schedules to meet with us. Subsequent to the ***Conversation with Customers***, I have had the opportunity to meet on several occasions with customers who attended, as well as other customers who were not a part of our listening sessions. At each of those meetings, the thoughts expressed and the quality of the dialog have reinforced for me the importance of staying in touch – and in tune – with those whose needs and interests we are here to serve. Thank you again for your participation. If you have had some additional thoughts, or if new issues have arisen that you would like to communicate to us, the email address, conversation@usgs.gov, remains available to you.

Charles G. Groat
Director

Table of Contents

Executive Summary **1-11**

Introduction **12-13**

Synopses of Listening Session Contributions **14-51**

Non-Governmental Organizations and Private Sector 14-36

Air Line Pilots Association, International
American Bird Conservancy
American Fisheries Society
American Geological Institute
American Geophysical Union
American Water Resources Association
American Whitewater
Applied Technology Council
Association for Biodiversity Information and The Nature Conservancy
Association for Women Geoscientists
Association of State and Interstate Water Pollution Control Administrators, Interstate Council on Water Policy, and Western States Water Council
Cambridge Scientific Abstracts
Coastal States Organization
Comso, Inc.
Defenders of Wildlife
Degenkolb Engineers
Ducks Unlimited
EQECAT, Inc.
Geological Society of America
Groundwater Foundation
Houston Advanced Research Center
Information International Association, Inc.
The Leonard Resource Group, Inc.
Management Association for Private Photogrammetric Surveyors
National Council for Science and the Environment
National Federation of Abstracting and Information Services
National Ground Water Association
National Institute of Building Sciences
National Mining Association
Native American Remote Sensing, Inc.
North American Bird Conservation Initiative
OhioView Consortium
The Ornithological Council
Wildlife Management Institute
Individual Statement

Synopses of Listening Session Contributions (cont'd.)

Other U.S. Department of the Interior Bureaus 36-39
- Bureau of Land Management
- U.S. Fish and Wildlife Service
- Minerals Management Service
- National Park Service

Other Federal Agencies 39-44
- U.S. Department of Agriculture
  - Natural Resources Conservation Service
  - U.S. Forest Service
- U.S. Department of Commerce
  - National Oceanic and Atmospheric Administration
    - National Marine Fisheries Services
    - National Marine Sanctuary Program
    - National Ocean Service
    - National Weather Service
- U.S. Department of Energy
  - Yucca Mountain Project

Independent Federal Agencies 44-47
- U.S. Environmental Protection Agency
- Federal Emergency Management Agency
- National Aeronautics and Space Administration
  - Goddard Space Flight Center
- National Science Foundation

Academia and Related Community, Regional, and State Customers 47-51
- California Division of Mines and Geology
- Institute of Marine Sciences, University of California-Santa Cruz
- Missouri Department of Conservation, Missouri River Basin Association, and Missouri River Natural Resources Committee
- National Association of State Universities and Land-Grant Colleges
- National Association of University Fisheries and Wildlife Programs
- National Institutes for Water Resources

Attachments 52-74

References 75-77

Executive Summary

"…there is a need to place such common resources as water, land, and air on a higher plane of value and to assign them a kind of respect…for no one species such as the Homo sapiens is any more deserving, any more entitled to dominate, than other species, for all are part of the total web." *Aldo Leopold*

Future Science Directions

In listening to its customers, the USGS heard an endorsement of the future science directions that it had set forth – but that endorsement poses significant challenges, in that each of the directions is in itself a major effort for which customers see extensive science needs. While it was reassuring to hear the widespread endorsement of the science directions that the USGS sees in its future, it was also sobering to realize the breadth to which the science reaches and the incredible demands that need to be met to serve society's needs.

The future science directions that had been used as the framework for the listening sessions were heard in the conversations of every one of our customers. The majority of them spoke to more than one of these directions as being "right on track," raising issues that needed to be addressed or questions that needed to be answered. The fact that many customers endorsed more than one of these topics – and showed us linkages between them – tells us that these are the "right track" for our science.

In refining our science directions, we have kept the same major themes and have only modified them slightly, to focus chiefly on earthquakes, rather than the broad spectrum of "hazards," and folding flood concerns into "rivers." Additionally, although there is not a separate direction for "environment and human health," issues related to this topic are dealt with in the context of several of the future science directions. Similarly, while "living resources" is not a stand-alone future science direction, the biological issues that were identified by many of our customers are incorporated into the other science directions and, in a sense, embody the reaction of many customers that living resources should be looked at not as a discrete direction but rather as part of every aspect of our scientific investigations.

Customers also agreed that the challenges have never been greater for linking societal and policy questions with scientifically based answers. Many stressed the need to have science, technology, and information in all of their rich linkages employed in the development of sound management decisions and effective public policy.

Landscape as Metaphor

The metaphor of landscape was used frequently by customers as a way in which to frame the science issues that face the Nation. Whether they used watershed, ecosystem, environment, or some other construct of the natural world, each stressed the need to look at the landscape as a whole and to address the myriad possibilities and challenges of the resources, processes, and interactions within. Two interesting uses of this metaphor were the idea of the problems associated with the *fragmented* landscape that we have created as a society – in how we have divided public and private lands, or the encroachment of human habitat on that of non-human communities, or even the disconnects between Federal and non-Federal roles in dealing with the natural world – and the promise of a *functional* landscape in which people, species, and resources interact in ways that ensure the continued – and perhaps improved – functioning of the landscape and that heal the fragmentation. How we view, how we use, how we study, how we manage the landscape can all serve as the context in which the USGS conducts *science for a changing world*. The landscape is the laboratory in which we will answer society's scientific questions.

Customers spoke as well to other types of landscapes in telling us about ourselves. They talked in terms of how we are spread geographically across the landscape of this country, a pattern that we should use to its maximum advantage. Customers endorsed the concept of place-based studies, in which varied scientific expertise is brought to bear on scientific issues and problems "on the ground" where it is needed. We were encouraged to get involved regionally and locally on the landscape and to find mutually beneficial partnerships with States, commissions, communities, and local society chapters. USGS can also bring greater understanding of science and its uses to those in allied professions that need the science but may need assistance in applying the science to their particular field or responsibility. The field of adaptive management was cited as one where land and resource managers and planners may not have scientific expertise and could use the help of USGS in developing science-based protocols for management. Science can also be an aid in those organizations that have an operational focus, which could be made more efficient and effective by having science and data to improve and drive their operations. The USGS should engage as well across the political and organizational landscape. Many customers encouraged us to leverage resources, interests, and assistance with trade associations and professional societies. These organizations see themselves as allies, willing partners, and effective communication links to their memberships and also to the political process at all levels of government.

The USGS also has tremendous potential in its discipline landscape, as many customers told us. The endorsement of a more integrated approach to USGS science, to finding effective ways to build bridges and linkages between and among the many discipline strengths of the USGS, was echoed in almost every customer's comments. Customers see a need to bring the disciplines and the range of expertise in those disciplines together in ways that develop skills in synthesizing scientific data and information and to bring what are currently disparate data and research together in a synergistic fashion that provides the science for livable and sustainable communities. Better integration across the organizational landscape was also addressed by many customers who see disconnects between USGS offices and divisions in how work was handled and costs administered.

Many customers want to know that they are dealing with the USGS as a whole, not with fragmented parts of the organization. Additional comments on issues related to USGS people resources are addressed later in this summary.

Coasts

Looking at comments on specific future science directions, the Nation's coasts were at the top of many people's lists. Interestingly, many people spoke at the same time of coasts and hazards – not only of the disasters of coastal storms and hurricanes, but also hazards to marine life and other resources from development, commercial endeavors, and the threat of pollutants from upstream sources far from the coasts themselves. Several customers raised the issues of beach replenishment and restoration, and it is clear that the question of "restored to what" needs additional scientific attention. Replenishment of coastline beaches is an issue of resource availability as well as societal choice and environmental implications. As populations in coastal areas continue to grow, customers see an ever-increasing role for science in dealing with the consequent impacts on natural and living resources, as well as a need for a better understanding of the processes and influences of coastal environments.

Ecosystems

In some form, all customers addressed the concept of ecosystems, whether they used the exact word or not. Sustainability was a much-used idea: Sustainable habitats that support a healthy diversity of species, sustainable resources that provide for healthy people and healthy economies, and sustainable policies that provide decisions and legislation for a healthy society, were all addressed by customers. The USGS was cautioned to view living resources not as a discrete component, but rather as part of every project undertaken. A new approach was called for in planning, designing, and carrying out human activities on an ecologically sound basis that emphasizes the prevention of impacts on the resource base. The many stresses to ecosystems were another focus for which integrated science was seen as the needed approach. And whatever the approach, the words "multi-species," "commonality," and "systematic" were used to reinforce the integration and synergy that must be addressed within an ecosystem. Health – of organisms, habitats, people, the overall ecosystem – was seen as key to the functionality of the environment. Here again, the integration of USGS disciplines can play an important role. USGS is seen as being in a unique position to articulate the growing knowledge about the interactions between hydrologic systems, the geologic processes, and the biological landscape. USGS should build and communicate the knowledge base that can be used by many customers to help them in their work and to ensure that efforts are not being duplicated.

Land Surface Change

Comments on land-surface changes were often intermingled with those on ecosystems and the call for better integration of data and effort. Ensuring that USGS data and information are being used optimally and are available in appropriately scaled formats was an issue for many customers. Specific examples include: Innovative products like the daily streamflow conditions map, and whether it communicates sufficient information for a municipality to decide to switch from a surface- to a ground-water supply in a

drought; critical data sets, like the 12-digit hydrologic unit code, which is desperately needed by customers, or a national topographic base for flood models used in the building industries, or a soils data base, which is needed by agriculture, building, and emergency communities; and emerging applications, such as wind hazards, remote sensing for biological monitoring, and the next generation of GIS tools for decision-support systems. Customers would like to see management implications iterated in USGS reports and other products.

Public land management needs to be informed by solid science and long-term monitoring. Several customers stressed the important role of USGS in providing science support to the Department of the Interior land management bureaus. Those bureaus want to be seen as priority customers for USGS and stressed that while integrated science is a valuable goal, the real value exists in maintaining discipline expertise and strong program components that then constitute that integrated whole. Non-DOI customers recognized the role of USGS in providing DOI science support but want to be sure that it is coordinated and non-competing: other DOI bureaus should not do the science and monitoring that USGS can better do, and other organizations should not have to deal separately with DOI bureaus.

The need for continued and vigorous monitoring across the scientific spectrum, the integration of the monitoring data, and the application of technology to enhance the data and its utility were all seen as key directions by customers in dealing with issues in ecosystems and land-surface changes. Additional aspects of information, the USGS knowledge base, and technology are dealt with in a later section of the summary.

Changes in land use and land cover, whether it was the fragmented nature of many park holdings, the switch from agricultural to suburban use, or the heightened concerns of urbanization, were all cited as critical areas for scientific research and monitoring. Data on soils and vegetation patterns were called for. Urban issues in particular were seen as pressing, including urban hazards mapping, urban parks or parks that adjoin urban areas, artificial recharge of ground water in growth corridors, and urban coastal stresses of population and changing climate with regard to such issues as water supply and saltwater intrusion on species and crops.

Environment and Human Health

Eloquent testimony was given to the issue of public health, for which more science, conducted in a systematic manner and from which better information is gathered and available, is desperately needed. The happenstance manner in which new drugs are discovered in the natural world, for example, was cited as a call to arms for a more organized and systematic approach to handling scientific information that enables health researchers to ask questions of the data and generate answers. In turn, the health community can be an effective advocate for the value of environmental science in the public health and policy arena. Health-related stressors to the environment were cited by many customers, from animal-feeding operations, to wildlife and water-borne diseases, to emerging pathogens, to the presence of antibiotics in water resources, to new mixtures of chemical pollutants and their implications, to endocrine disruption, and climatic

perturbations. The scientific knowledge that is locked away in ecosystems – for public health, for mitigating wildlife diseases, for promoting a healthy diversity of species – is seen as the key to opening the doorway to a sustainable and healthy future for the changing world in which we live. Early warnings from biological systems and the more sensitive organisms will enable public officials to respond in proactive ways that will be far better for human health than if they wait for problems to appear and then decide that a program was not doing what it should – the reactive approach to human health. Healthy watersheds, healthy habitats, and healthy and diverse species, which have implications for healthy people and healthy economies, were all seen as the beneficiaries of good science.

Living Resources

Customers generally saw living resources not as a separate subject but as an integral component of all scientific investigations. One customer put it very well: "People need to be sensitized to the issue of biocomplexity – it's not just simply the environment." Several repeated the catch phrase that the 21st century will be the "Century of Biology." The bird conservation community, in particular, was especially vocal on the role of USGS and the importance of attention being paid to non-human living resources. The migratory bird initiative is seen as an unparalleled opportunity to address many key issues, and customers felt that the time is right for the success of such an initiative – bird issues are being seen as larger issues of environmental health and as critical biomarkers. Scientific verification and documentation of the effects of pesticides on birds is needed, as well as using that information on mitigation efforts and regulations. Water assessment and monitoring should be brought more into the broader risk assessment process and USGS water-quality information on mixtures of contaminants and metabolites is needed. Increased resources for monitoring and research are needed, especially for migratory birds for which the DOI has a stewardship responsibility. Monitoring was stressed as more than getting the counts of species right; it should also consider issues such as water quality and the effects of chronic exposures to heavy metals or organic pollutants. A second priority set forth was to look at habitat requirements as part of the monitoring effort – using birds to monitor habitat quality and using habitat quality to monitor abundance and distribution of all species, not just birds. There also needs to be renewed partnering and integration of science support with the U.S. Fish and Wildlife Service. The Gap Analysis Program (GAP) was cited as being key to thinking about not just where rare and endangered species are but also where remaining and intact functional landscapes exist. Fisheries issues also span many areas of USGS science, including rivers, ground water, coasts, habitat, and environmental health. Because of the fragmented nature of governmental agencies that have responsibilities related to fish, fish habitat, commercial fisheries, and endangered fish species, partnerships and integration of effort are seen as paramount to success in dealing this these issues. There needs to be a multi-species and systematic approach. All USGS disciplines have important roles to play. The USGS must move beyond a site-by-site approach to looking at the larger regional landscape, as well as how to measure and monitor things on a fragmented landscape. A general and impassioned cry was heard for *science-based* land management, especially on Federal lands; science efforts need to be integrated and coordinated among agencies – the tasks are too critical and the resources too few for

there not to be good cooperation. A strong Endangered Species Act and the protection of those species are high on many agendas. USGS is seen as playing an invaluable role in building new tools for ecological risk assessment. Translating science and its implications into management and conservation programs was cited as a critical need.

Energy

Energy – the adequate supply of resources to meet societal needs and the associated impacts of energy development and use on the environment, species, and health – was discussed by several customers. Effects of oil and gas development on a variety of species; implications on water quality of coal-bed methane use; polluted water and cleanup of abandoned mine lands; hydrocarbon impacts on recreational waters; the continued need for and value of USGS mineral assessments and minerals production information; energy by-products and environmental implications, such as radioactive waste disposal and heavy-metal contamination; remediation approaches that can be tested in one coal-producing area and applied to others; and the environmental information need for the relicensing of hydropower dams show the diversity of issues covered by energy. The recent USGS world energy assessment was cited as an excellent product and a reminder of the important role the USGS plays as an impartial source of information on many issues. The university community raised the issue of USGS efforts that are focused on mineral and energy assessment to the detriment of basic research. The private sector sees mineral commodity and production data as priority and primary products of USGS and an area to which adequate staff should be devoted. The USGS national geologic map data base and its widespread availability was commended and should be expanded to include international mapping data. The energy community is interested to know what USGS is doing in the area of carbon sequestration.

Ground Water

Ground water was on the minds of many customers. USGS is seen as having an important and somewhat unique role in ground water. No one else has the kind and breadth of ground-water data that USGS does. USGS should be doing the ground-water science “up front” before regulations are developed. Concern was expressed that further budget constraints might erode ground-water monitoring, which, in concert with the USGS streamgaging network, is seen as being of vital importance to the well-being of the entire country. The number of USGS monitoring wells should be increased, as should direct, if not real-time, access to that data. Ground water and surface water must be viewed as a system, rather than as separate resources, a concept borne out by the USGS publication on the same subject, which was heralded as setting a new standard. And while we may understand the relationship between surface and ground water, we do not fully understand the implications of that relationship. Using watershed as an approach in monitoring, in management, and in data gathering and presentation was frequently cited. Customers see the value in USGS water quality work, but want to see it balanced with efforts expended on water quantity and supply issues – whether ground or surface water. New remote sensing technologies that can provide a better understanding of subsidence and other ground-water issues should be explored. Science that integrates geology and biology into ground-water issues is needed. Dealing with development issues and population growth would benefit immeasurably from mapping ground water and bedrock.

Reuse of ground water and wastewater and the pathways for emerging contaminants such as pharmaceuticals raises many questions that need to be answered with science. Knowledge about pathways in karst terrains and fractured bedrock is needed, not only for the migration of contaminants but in being able to forecast water yields. More than one customer cited the need for a better understanding of karst terrains and the processes both under the surface and on the surface. Animal feeding operations, ground water in drought, fractured bedrock studies in other locales, recharge zones for well-head protection strategies, the role of wetlands in habitat and species diversity and health – were all mentioned as issues or places where USGS and its ground water science expertise were needed. Socioeconomic issues of the value of water in society, which relates to both ground and surface water, was raised as a potential subject for greater USGS involvement and collaborative investigations.

Rivers

The USGS streamgaging network and its many uses were singled out by many customers as one of the most valuable efforts and products of the USGS. Many expressed concern about any further erosion to the streamgaging network and voiced support for reinstating stations or bringing new stations online. Customers also expressed their wish to be involved in making decisions on the selection of new streamflow-gaging stations and the reactivation of others. Cooperative work on delineation of hydrologic unit codes to the finer scale was cited as critical to having a common set of watersheds to track what is happening on the landscape. Streamflow and river-based information was cited as important to flood and flood mapping efforts, to quantifying water yield from national forests and grasslands, to snow surveys, to riparian issues, to contamination transport, to climate variability studies. The recreational community emphatically endorsed USGS streamflow data as information that saves lives as well as making for a more enjoyable recreational experience, whether it is whitewater rafting, canoeing, or fishing. The recreation community also cited a need for high-quality digital elevation data along riverbanks, combined with hydrologic modeling information as a natural partnership of USGS mapping and water science, National Weather Service forecasting, and Federal Emergency Management Agency flood-plain mapping. At the coastal/land interface, information is needed about freshwater flow to estuaries, saltwater intrusion, how interbasin transfers affect fish habitat, and how changing water quality affects species health. The bird conservation community expressed interest in and a need for water quality information, as well as a better understanding of riverine environments in looking at habitat impacts and species health and diversity. All customers are looking to USGS to provide the science to inform decisionmaking about – combinations of pesticides and their breakdown products, endocrine disruptors, pharmaceuticals, toxic contaminants and the whole broad spectrum of water-quality issues as they impact species, habitat, health, the economy, and public policy. Several customers spoke to issues regarding restoration of the biological health of the Missouri River and to the critical need for science and resources to address and resolve conflicts between environmental concerns and traditional economic activities and uses of the river. The non-governmental and governmental communities alike see rivers as an integrating component of the scientific landscape.

Hazards

If a count were to be made of the number of times any one future science direction was mentioned, hazards would be the definite winner among USGS customers. Whether it is the visibility of the subject, the way in which customers were sought for the listening sessions, or the pervasive nature of the topic, every customer spoke to some notion of hazards. Taken in its broadest definition, hazards includes not only those of geologic and atmospheric processes, such as earthquakes, volcanoes, hurricanes, wildfires, tsunamis, and wind; but also those where human actions and interactions exacerbate hazards such as growth in coastal, urban, and fire-prone areas. Hazards affect safety and economic issues not only of people but of plant and animal species and habitat as well. One customer said that the traditional beneficiaries of USGS hazards studies have been expanded beyond life safety issues of disaster planning and building code development to those of the pocketbooks of many millions of property owners in seismically active areas of the country. Many customers spoke of coasts and hazards in the same breath. Rapid assessments of storm damage, short-term and long-term changes in shorelines, and analyses of relative sea-level rise on shoreline response were coastal engineering issues raised as needing USGS input. Geologic mapping was seen as a critical data set underlying efforts in floods, earthquakes, landslides, volcanoes, and other environmental impacts of hazards. Economic and social impacts of the devastation on both coasts to commercial fisheries, from natural and human-caused hazards were cited. Customers told the USGS that natural hazards present a good opportunity to make the link between science and society. Several customers cited the newly formed Natural Hazards Caucus on Capitol Hill as an effective tool in this regard. Hazards are also seen as having an "advantage" in public policy in that there are hazards in every State. Several customers spoke to the Advanced National Seismic System (ANSS) as an effort that they supported wholeheartedly, and one which would provide critically needed ground-shaking data. An improved understanding of soils, related to ground motion, was requested. Characterizing and mapping wind hazards was cited as a need. USGS should find derivative markets for its hazards information, including the insurance, risk, and even banking industries. New technology applications, including new satellite and remote sensing tools, were called for in post-flood ecological work, hurricane wind damage, beach profiling for hurricane tracking, and impacts of fire on animal populations. Existing USGS hazards-related products and partnerships were endorsed by many customers, often in exclamatory terms, and, again, the credible, scientifically defendable nature of USGS work was cited as an asset. USGS seismic hazards maps are critical to Federal Emergency Management Agency mitigation efforts and are the basis for building codes for the entire country. The airline industry commended USGS efforts in developing systems to alert pilots and air-traffic control centers to hazards from volcanic ash. USGS work with other hazards agencies in a variety of partnership and information-supplying capacities was lauded as essential to the ability of those entities doing their jobs well. Long-term and integrated partnerships of Federal, State, and private sector interests in California related to earthquakes were mentioned in particular. Hazards are clearly seen as a mandatory future science direction of USGS.

Invasive Species

The problem of invasive species was on the mind of several key customers. The National Biological Information Infrastructure (NBII) was seen as a critical tool in dealing with invasive species – the need for accurate information and monitoring data. Invasive weeds and species are particularly high on the list of DOI land management agencies, as well as other Federal agencies that have a role in managing lands or waters. The threats from non-native species that customers identified included detrimental effects to wildlife and grazing animal forage, diminished visual quality, and reduced land value. Scientific information is needed on the dynamics of invasive weed populations, treatment options, site restoration, and management implications of treatment and restoration approaches. Dealing with invasive species is a priority research area in rangeland health. Prescribed fire as a tool for dealing with invasive weeds while not eliminating native species – and whether to immediately re-seed with desirable species – calls for more research and additional data on soils and climate. It is not just an issue of treating the known exotics, but also doing assessment work using an exotic species ranking strategy to maximize the dollars spent on invasives.

Information

Because so many customers spoke to issues related to information and information technology, we have brought these comments together in a single section. The overall topic of information was certainly one that resonated with customers. One customer expressed it as a unifying theme for the USGS. Information, data, maps, and imagery, however, were seen as tools and technology by which to accomplish the work of the major science themes, not as ends in and of themselves. It is with that pervasive and yet utilitarian view of information that customer comments have been summarized.

Information – how to access it, how it is handled, how to communicate its availability, how to deal with the immense amounts of it available – were all questions that customers are wrestling with. The need for an overall information infrastructure to handle the increasing amounts and increasing complexity of the data sets and information available, as well as the need for integration, interoperability, standards, metadata, etc., was a frequent appeal. The organization of biological information into a seamless integrated information environment or infrastructure was an absolute necessity for many customers and, in addition to hazards, probably brought the most number of customers to the USGS table to speak. The existing NBII and the next-generation NBII were evoked as critical tools to deal with the many issues of living resources, as well as aspects of disease and human health. Customers across the spectrum talked about information and technology issues, whether it was pulling information together in a GIS approach for a national shoreline study, digitizing museum holdings that are going untapped for lack of access, or improving river forecast models. While many customers see the Internet – and the wonderful access to many holdings of the USGS that it has afforded – as a great trend, they are concerned that too many organizations feel that once they have posted information on the web their job is done. The passive nature of the web – you have to know what you want and where it is – coupled with the vast amounts of data now available, demand that extra attention be paid to communication and information transfer. Many customers stressed that additional energy and resources need to be given to

transferring and translating USGS information to customers and helping them to understand how to use and apply the science in their work. Language – what words are chosen and the import of those words – was given special attention by several customers. On the subject of restoration for example, it was proffered that perhaps "enhancement" would be a better, and less contentious, word. We should be careful about language, one customer said, "it should be the language that is understood by the communities that are involved and information should be distributed to a broader audience than we are accustomed." This is especially true of allied and derivative users of USGS information, who may not be trained in the same scientific disciplines, but who need scientific data to better accomplish their work in land management, in risk assessment, in engineering design, in health-related fields, in insurance, in the social sciences. USGS was cautioned not to view information as only data and technology but to remember the human component as well; information needs to be gotten back down to the ground level where it is needed, and people need help in understanding and using scientific information.

Customers see scientific information as essential to effective public policy. Many stressed the need to have science, technology, and information linked and integrated in order to make the best decisions for society's future. Getting the information into the hands of those who need it was of paramount importance to all customers. Cooperation, partnerships, and outsourcing were all offered as necessary components in dealing with the wealth of data available and the challenges of managing and communicating that wealth. The USGS cannot do it alone, nor should a Federal agency try to do it all, several customers cautioned. The private sector, as well as trade associations and professional societies, can provide value-added services.

Partnerships and Cooperation

Customers attach value to their work with the USGS. There was an almost universal call for more – and better – partnering and cooperation with USGS. Science support to DOI bureaus and how those bureaus are viewed as primary customers of USGS is of issue. The USGS should work to eliminate perceptions of competition with the private sector and focus on its inherently governmental role. The "value added" role of the private sector in enhancing USGS efforts should be explored. Non-government organizations, trade associations, professional societies, and other derivative markets should be investigated more fully for how partnerships and cooperative ventures might be handled. The university community would like to explore additional opportunities for working together with USGS and its workforce. And as the USGS workforce continues to age and becomes smaller, cooperation, partnering, and outsourcing, whether to the private sector or to the universities, will all be pathways to explore. In their work with USGS, cooperators want to have a say in what is done; they want to be at the table in making decisions.

USGS Workforce

The aging of the USGS workforce was raised as an issue by some customers, several of whom are facing the same graying of essential skill holders in their own organizations. The USGS was urged to find ways to take advantage of the skills and expertise of its scientific workforce before it was too late. Hiring and mentoring of young professionals

by experienced staff was encouraged. Other workforce issues raised were how others conduct research grade evaluations and use customer evaluations to judge scientific productivity, rewarding scientists who get involved in planning, an ongoing OPM core competency review [not known of by USGS], and training issues. The exchange of training opportunities was suggested with other scientists coming to USGS training and USGS scientists availing themselves of such training as that in presenting expert witness testimony. Many customers cited the skill, competence, and dedication of USGS employees as being key to our success. The good reputation that USGS enjoys in the eyes of its customers is clearly the result of the day-to-day work and interactions of its workforce.

USGS Organization

The USGS should keep a focus on its core expertise and its core areas. The long-term data available from the USGS is one of its greatest assets. The quality of USGS data is its benchmark. The impartial, unbiased nature of USGS science and its consequent utility in many areas is highly valued. As one customer put it, “In contentious issues, USGS data are one thing that opposing factions can agree on.” Many customers spoke in support of increased integration of the work of the USGS science disciplines. The USGS was encouraged to increase its organizational flexibility to be able to respond quickly when needs arise, such as was done in response to Hurricane Mitch. On more prosaic issues, the cost of working with USGS was echoed in several sectors – charges for data that had been free, the high indirect costs charged to cooperators, and inconsistencies in charges.

Education

While not presented by USGS as a future science direction, several customers spoke to the need for the USGS to have a role in education. Education meant different things to different customers. Some spoke of the need to educate Congress and other policy makers on the uses of science in developing effective legislation and regulations. For others it was ensuring that the general public and the K-12 community know about the earth and life sciences through direct commitments of the USGS. Still others saw the role of USGS as providing for linkages with the educational community, whether it was the interaction of USGS scientists who are housed on university campuses, cooperation with institutes and centers on campuses, grants programs, or providing opportunities for USGS to impact the professional advancement of young scientists. Cooperation with universities, as well as with professional societies, was seen as an effective avenue to accomplishing many of these objectives. The new technologies and the integration of scientific information with other data sets are seen as another opportunity for education, from ensuring that teachers even at the high-school level are skilled in GIS, to remote-sensing applications in innovative areas, to bridging computer sciences with the physical and life sciences.

Introduction

The challenges have never been greater for linking societal and policy questions with scientifically based answers.

Reason

Recognizing the need to ensure that the USGS is in touch with its customers and their interests and concerns, the USGS executive leadership held a series of listening sessions in March and April 2000 to give customers an opportunity to present their views on future directions for USGS science in 2002 and beyond. The listening sessions were a natural outgrowth from other efforts to proactively present the USGS budget for FY 2000 and FY 2001 to the public. Primarily hosted to give USGS leadership feedback on future science directions for the coming decade, the listening sessions also provided an opportunity for a general check-up on the health of the organization in the eyes of its customers and partners. The USGS will use the feedback from these listening sessions in coming months as future science directions are refined and new initiatives are developed. Future listening sessions in the Washington, D.C., area and at locations across the country will be held in coming months and years. The USGS has found these opportunities to be a valuable way in which to keep in touch with their customers. The March-April 2000 listening sessions will not be a single dialog, but rather the beginning of a continuing conversation by the USGS with its customers.

Venues

A listening session was held with water stakeholders on March 15, 2000, in Crystal City, Va., in conjunction with joint meetings being held by several major water organizations. About a dozen representatives attended the USGS listening session, and the conversation with them is summarized as a group synopsis in this report. Two days of listening sessions were held at the USGS National Center in Reston, Va., on March 22 and 23, 2000. The 50 attendees represented 43 different organizations. Most of the attendees presented statements, which are summarized in this report. On April 3, 2000, at the Main Interior Building in Washington, D.C., another dozen customers, representing primarily the bird conservancy community, met with USGS leadership. This session was added to accommodate the schedules of members of that community who had not been able to attend earlier.

Framework

The general framework for the listening sessions was the list of topics that were under discussion by the USGS Executive Leadership Team as future science directions – coastal environments, ecosystems, environment and human health, energy, ground-water resources, rivers, hazards, living resources, invasive species, and land surface change, with additional emphasis on products, tools, and technology in the context of up-to-date maps, imagery, and *Gateway to the Earth*, a portal to USGS earth and life science data. An issue paper on these topics was sent out in advance and formed the structure for the listening sessions. Many customers spoke to more than one issue, and, therefore, the synopses of presentations are presented as a simple alphabetical listing of the organizations who participated, grouped into several broad categories: Non-

governmental organizations and the private sector; other Department of the Interior bureaus; other Federal and independent agencies; and the academic and related community along with regional and State customers. The synopses also include statements provided by customers who were not able to attend but wished to have their views known. Statements provided by customers to support their presentations are included in the attachments as well. Since the listening sessions, refinement of the future science directions has resulted in a reshaping of the topics into: coastal environments, earthquakes, ecosystems, energy, ground water, invasive species, land surface change, and rivers.

Report

The intent of this report is to summarize what the USGS heard from its customers. In summarizing the conversations and ensuing dialog, we have tried to keep the focus on what was presented, not comments or reactions from USGS participants. The Executive Summary brings together the many issues and concerns of our customers, using the future science directions as the framework, as well as subjects that were frequently echoed during the listening sessions.

As the lens through which to read the report, the following paragraph is offered from the issue document on future science directions that was sent to customers in preparing for their conversation with USGS:

> The topics we have set forth highlight the essential role that science plays in many of the most pressing issues facing us as a Nation and as citizens in an increasingly complex and changing world. The challenges have never been greater for linking societal and policy questions with scientifically based answers. Policy makers and managers at all levels of government need sound scientific information on which to base their decisions and on which to judge the outcome of those decisions. We are looking to you, our customers, to help us ensure that our direction for future program growth is on target, will meet your needs, and will serve those greater societal and policy needs well.

Note: The reader is reminded that the following are synopses of what the USGS heard from its customers during the listening sessions, based on transcribed notes or submitted statements, and reflect the views and opinions of the customers.

Non-Governmental Organizations and Private Sector

Air Line Pilots Association, International
http://www.alpa.org

"…success of color-coded alert system led to adoption as an international standard…expertise in interpretation of satellite imagery and remote sensing must be brought to its full potential ."

[*Note: See accompanying statement in Attachments.*] The Air Line Pilots Association, International (ALPA) cited the success of the color-coded system, developed by the USGS as a partner in the Alaska Volcano Observatory, to alert the aviation industry and the community at large to volcanic ash hazards – success that led the International Civil Aviation Organization to adopt a similar code for international use. The expertise that USGS brings to bear in the interpretation of satellite information and remotely sensed imagery at volcano observatories must be brought to its full potential. There are unique aspects to volcano monitoring and scientific response that require dedicated and well-trained staff to be able to monitor pre- and post-eruption activity, to have expertise that spans disciplines of volcanology and seismology, to respond anywhere in the world at a moment's notice, and to provide rational interpretations and effective communication through appropriate emergency managers and to the public. Worldwide, there are significant gaps in technology in being able to read the data and communicate in a timely manner to the airline industry and affected communities. The aircraft industry in the United States gives close attention to the information from the USGS and its volcano observatories to the point of canceling and diverting flights rather than risk flying into volcanic clouds. ALPA encourages the USGS to increase its efforts to secure adequate funding and staffing to mitigate the volcanic ash hazards to aviation operations worldwide.

American Bird Conservancy
http://www.abcbirds.org

"USGS monitoring and research on the effects of contaminants…have continuously produced scientifically sound data – and neutral data – that is important as we bring all of these people to the table…"

[Note: See accompanying statement in Attachments.] The American Bird Conservancy (ABC) addressed pesticides and toxics issues and synergies between heavy metals and between persistent organic pollutants – new classes of chemicals are being introduced for which there is no field-testing and there are no available biomarkers. USGS expertise is integral to conservation science and regulatory efforts – increased resources are needed for monitoring and contaminants research for living resources, especially migratory birds

for which DOI holds explicit stewardship responsibilities. [In discussion, ABC said that water assessment and monitoring should be brought more into the broader risk assessment process and that knowledge from the NAWQA program on pesticides, the mix of contaminants, metabolites, etc., would be helpful, as well as a renewed relationship with the environmental contaminants program at U.S. Fish and Wildlife Service.] USGS provides vital support for investigating wildlife mortalities, understanding viral and bacterial diseases, and the effects of pesticides and other contaminants. More resources need to be committed to the systematic and consistent review of wildlife mortality incidents – to better understand the incidents themselves, locate patterns and trends, anticipate future problems, and seek scientifically informed mitigation and regulation. USGS can play an invaluable role in building new tools for ecological risk assessment. There is a need for Federal cooperation.

American Fisheries Society
http://www.afs.org

"…opportunity for USGS and professional societies to work together in advancing the profession as well as the science… information should be distributed to a broader audience[than we are accustomed]."

The American Fisheries Society (AFS) sees more advances coming in biology in the 21st century than were seen in the previous century, due in large measure to the demands that are being placed on biology, whether it is the environment, human health, or the health of the whole earth system. There is fruitful opportunity for USGS and professional societies to work together in advancing the profession as well as the science, which is becoming increasingly important to natural resources [management]. The approach to fisheries management is changing from a focus on the species to a watershed approach that incorporates water quality, a key driver to sustainable fisheries, and river habitat. Economic drivers include devastation on both coasts to commercial fisheries. Changes in approach will require changes in budgeting and in setting priorities. In a similar customer session held by NOAA several months ago, AFS noted that whatever the approach, it needs to be a multi-species and systematic approach to the issues. Ground water and surface water must be looked at as a system, rather than as separate resources. AFS is planning to introduce legislation called the Fishable Water Act as an amendment to the Clean Water Act, which emphasizes watersheds, watershed councils, and local participation. On the issue of restoration, information transfer and language are key factors – restored to what? Enhancement might be a better word to use in communication. The sciences need to be careful about the language they use, it must be understood by the communities involved – and information should be distributed to a broader audience than we are accustomed. Technology and its tools should not be ends in themselves – just putting it on the web is not enough – the web is passive and scientists are not doing a good job of transferring information to the public or among themselves. AFS is increasing its international role, including a focus on sustainable fisheries, especially in developing countries that rely on fish in the diet and health of many people. Climate is an emerging area; emphasis should be placed on the effects of climate change

on biological resources. The chapter structure of AFS affords opportunities for scientific agendas and positions to be pursued on a local scale.

American Geological Institute
http://www.agiweb.org

"…important role played by the USGS as an impartial source of information on many issues… Congress see[s] great value in the core expertise and the core areas of USGS."

The American Geological Institute (AGI) supports the efforts of USGS on Capitol Hill. AGI efforts include submitting supportive testimony and participation in events on Capitol Hill. Congress has made it clear that they see great value in the core expertise and core areas of USGS. AGI is involved in the new Natural Hazards Caucus on Capitol Hill -- landslides and coastal hazards are critical topics of widespread interest. An important data set underlying USGS efforts in hazards areas – floods, earthquakes, landslides, volcanoes – and the environment is geologic mapping. The recently released USGS world energy assessment is an excellent reminder of the important role played by the USGS as an impartial source of information on many issues. In looking at science support for DOI agencies, AGI would encourage the USGS not to ignore the role of other data (beyond biology) in public lands management. USGS should help land managers to understand the broad role of geoscience information in public land and natural resource management and help them to make strong ties between what they need and what USGS can provide.

American Geophysical Union
http://www.agu.org

"USGS and its products and its people are extremely valuable resources …to get your message heard on the Hill…you have to be able to explain it [geophysical research] in three minutes or less …"

The American Geophysical Union (AGU) said public support for geophysical research continuously increases because of efforts in advocating its relevance to society, informing and educating the public, and influencing the public policy process. The challenges in that advocacy role are great – the enthusiasm that the scientists have for their science does not easily translate to the public or to policymakers on Capitol Hill. This is the same challenge that the USGS faces – how to make science relevant to the Nation. The information, products, and scientists of USGS are extremely valuable resources – once the folks on the Hill know about USGS. USGS needs to make the link between what USGS does and what matters to people and policymakers. Natural hazards present a good opportunity to make the link between the science and society – Congressional Natural Hazards Caucus is an example of capitalizing on this – natural hazards have an advantage in that there is some kind of hazard in every State. Plan ahead – have material ready, prepare one-pagers in advance, plan hearings, take advantage of the next hazard in telling critical audiences what they need to know about USGS and its science.

American Water Resources Association
http://www.awra.org

"…elected leaders need to have the best technical information…presented to them in ways that are understandable…need to go a step further and present results to all potential users…"

The American Water Resources Association (AWRA) expressed its support for the outstanding job of national water resources data gathering done by the USGS and supports continued efforts in these areas. AWRA is concerned that budget constraints might further erode the USGS streamgaging network and the ground-water monitoring network, which are of vital importance to the well-being of the entire country. No more stations should be lost, and stations that have been lost should be put back in [service]. These USGS networks, along with the Federal-State Cooperative Program, are fundamental and should be protected and enhanced, even at the expense of other activities. In the next decade, AWRA feels there should be emphasis on protecting and enhancing habitat for endangered species, with the caveat that this must not damage the economies of the areas where species are found. USGS should enhance coastal zone research, including cost-efficient technology to convert coastal zone water to useable, potable water resources. In the area of contaminants and trace elements – look at combinations of constituents and endocrine disruption. The availability of water resources, particularly in the western United States, and the need to develop sustainable water supplies in light of continued population growth is an enormous issue, which includes the encroachment of suburban areas on agricultural lands, stresses to water supplies, methods development, technology, and the health implications of water banking, recharge, and reuse. An individual opinion of an AWRA member strongly encouraged USGS to establish truly collaborative relationships with universities and stated that funding of such collaboration would enrich the educational experience of students, faculty, and USGS staff. In a polling of the AWRA board of directors and staff on the one issue of greatest personal importance to each of them in the 21st century, a laundry list of topics was presented: training for future professionals, water availability, MTBE (methyl *tert*-butyl ether), TMDLs (Total Maximum Daily Load), water recycling, water conservation, BMPs, small water systems, education, instream flows, long-term water availability, ground-water contamination, cost/benefits, public awareness of water and conservation issues, managed water rights, communication, quality assurance and quality control in water management, and coalition building of partnerships. AWRA stressed that while the identified issues are technical in nature, they go beyond just the technical – the results of water-resources research need to be communicated in an understandable fashion, not only to Congress but also to laypersons and watershed organizations.

American Whitewater
http://www.awa.org/

"USGS provides virtually all the streamflow data published anywhere in the US …they are working on providing real-time streamflow data for every state…when this is complete it will be a thing of beauty." (From American Whitewater web site.)

American Whitewater asserted that USGS had a noticeable gap in its knowledge of who its constituents were and who was using their information and that the gap was the whitewater recreation community, which, along with the recreational fishing community, had been using USGS streamflow information for years to provide for a more enjoyable – and safer – river experience. American Whitewater has for many years had links on its web pages to USGS streamgaging data and is refining its web site to collect information from members and plans to share that customer information with USGS and the National Weather Service. American Whitewater is seeking input from its users, too, as to which gages are most useful to them, and which additional ones might be equipped with satellite telemetry for enhanced information access, as well as gages that have been discontinued that should be reinstated, or where there are no gages and a gage would be helpful. In the conservation arena, American Whitewater is interested in historical flow information with regard to restoring natural flow and in looking at issues around hydropower dams and modeling of releases. [In discussion, data needs were raised as an issue – there is a need for high-quality digital elevation data in the strip along the river and combining that with hydrologic modeling information. This would be a partnership between USGS mapping and water interests, NWS forecasting, and FEMA. USGS and the other partners need to organize discussions and figure out how to get these data and make them available.]

Applied Technology Council
http://www.atcouncil.org

"…the earthquake program and natural hazards mapping is excellent…has significantly advanced the technology that the design communities have…"

The Applied Technology Council (ATC) cited involvement by USGS scientists in hazards-related workshops, seminars, and in the development of engineering standards development, which has also been critical. ATC supports aggressive USGS efforts in the development of the Advanced National Seismic System, which would provide ground-shaking data that are critically needed for improved estimation of seismic shaking hazards. The design community needs Internet access to data, such as suites of earthquake time histories for structural analysis. An improved understanding of soils, including how ground motion works from bedrock up through the various soils, the resulting acceleration impacts on structures, and attenuation relationships as you move away from the fault are all needed. Quantifying the duration of strong ground shaking, especially in areas that have the potential for very large earthquakes, is another area of opportunity. ATC sees a need for a more cohesive and concerted effort in characterizing and mapping wind hazards. In coastal engineering, ATC identified: Conducting rapid

assessments of storm damage; developing statistics on short-term and long-term fluctuations of shoreline change; and conducting analyses of relative sea-level rise on shoreline response.

Association for Biodiversity Information
http://www.abi.org
The Nature Conservancy
http://www.tnc.org

"…uniquely positioned to be the portal for environmental information in the Federal government…[NBII is the]…hub around which biological and ecological information can be centered and flow…"

Representatives from the Nature Conservancy (TNC) spoke primarily to issues related to its collaborative partner, the Association for Biodiversity Information (ABI), and urged the USGS to think about information and its provision as the unifying theme for the organization. USGS needs to ensure that the data coming out of its many and varied research programs is converted into information that people can actually use. As the role of information in society at large increases, the problem will be in distilling useful information out of the mass of information available. The USGS is uniquely suited to be the entity that helps determine quality, what can be trusted, what should be avoided, and what information best suits expressed needs. They see tremendous potential in NBII, which needs to be "ramped up" to realize potential and they support development of the next-generation NBII. They urge USGS to push forward with links to water, geology, and mapping. Mapping, in particular, offers a real cross-cutting approach. Making information available and in a spatial format, which people can then combine with their own datasets for their uses, is the future of information technology – standards, filters for data, modeling, etc. The fast and pervasive changes in the Nation's land cover offer opportunity for continued USGS initiatives. TNC has collaborated with USGS in several land-cover efforts, including the Gap Analysis Program (GAP), which has been key to coherent thinking about not just where rare and endangered species are but also where remaining, intact, functional landscapes exist. If the Nation is ever to get ahead in the rare and endangered species game, it is going to be by focusing on those places that can still be protected now, not when they have reached the critical-care phase. Continuing issues related to GAP are issues with the resolution of data and comparability among States. The customers cited the successful cooperative efforts on standards for vegetation mapping, which have been adopted as a federal interagency standard by the Federal Geographic Data Committee. As emerging issues, they included the processes and functions of ecosystems and identifying these as functional landscapes – how functionality is maintained and what the role is of natural processes, such as fire and flooding. The existing partnership with USGS in developing an aquatic classification framework is providing a crucial data set. The USGS needs greater agility in its mode of operation to respond to emerging issues [cited Hurricane Mitch effort with kudos]. USGS should pay additional attention to opportunities and modes of external collaboration, not just with the Federal government but also with universities and the non-profit sector. USGS should not forget its core monitoring efforts and datasets for

which USGS is the primary collector and repository – water gages and detailed monitoring of species distributions are ones for which USGS has a unique responsibility and upon which many of those in the conservation and natural resources community rely. Over time, the value of these datasets is realized and care must be taken to ensure funding, so that in 10 or 15 years, the Nation has not lost this tremendous resource.

Association for Women Geoscientists
http://www.awg.org

"…[USGS] library and its resources are unparalleled…science directions are important for immediate future…concern that education is a secondary issue…"

The Association for Women Geoscientists (AWG) sees the future science directions identified by the USGS as important directions for the present and immediate future. AWG sees questions about the future health of the land, water and air resources, effects of climate change on society and economics, availability of energy resources, and animal conservation. While these are difficult questions to answer, they are the questions taxpayers are asking; unfortunately, scientists often shy away from them because data are not available to approach the answers in a statistical manner. AWG appreciates the fact that USGS acknowledges diversity issues and the development of diverse voices. AWG perceives that USGS made a decision to leave education as a secondary issue but urges USGS to be part of ensuring that all children are getting quality science education, to remain involved in geoscience standards of learning, and to be committed to communicating USGS information to ordinary people – people who are afraid of hazards like erupting volcanoes, earthquakes, and floods and who need to be taught where it is safe to live. Shifting to the topic of watersheds, AWG cited a successful effort in Australia called Water Watch that began as a federal government effort and has added citizen support and involvement in voluntary efforts toward safe water. In the area of remediation, particularly in the coal-producing States in the Appalachian region, there is an unexploited niche for USGS to make important national contributions – approaches that could be developed in one area and applied to other places in the country.

Association of State and Interstate Water Pollution Control Administrators
http://www.asiwpca.org
Interstate Council on Water Policy
http://www.icwp.org
Western States Water Council
http://www.westgov.org/wswc

"…Data is USGS cornerstone…quality science is your benchmark…costs and especially overhead charges are too high… balance in quality of water issues against quantity and supply issues…more ground-water information is needed…develop plans with the States…look at fundamental processes…keep a focus on research and development…work to inform legislation…"

Common threads in the conversation were that USGS data could be trusted; that it was the cornerstone for many customers of their work; and that when there are contentious issues to be settled, USGS data are one thing that opposing factions agree on. Customers are concerned about the costs of operating streamgaging stations on rivers and streams, particularly the indirect costs that cooperators have to pay. A plan to Federally fund gaging stations met with high approval, but there was also agreement that these organizations – in their individual State capacities – should have a role in choosing the location of stations and in developing the national plan for a core network of stations – and a national network should not translate into a decrease in the Fed-State Coop program. There is need for better communication – States want to know what is going on and want to be more involved in decisions and priority setting. Customers want to see water quantity and supply issues balanced against USGS efforts toward water quality. No one else has the kind and breadth of ground-water data that USGS does. Customers appreciate the diversity of USGS data – mapping, water, geology, and biology – that are available, but want to see good integration between USGS water offices and biology centers. USGS should be more involved in regional and inter-State water issues and in inter-basin compacts and commissions. Understanding the need for the USGS to provide science support to other DOI bureaus, they want to be sure this work supports State interests as well. The various parties involved should work to eliminate any sense of competition, particularly in the West, between USGS and other DOI bureaus doing the same work, which raises issues of costs, funding, and appropriateness of who does the work. States prefer to have the neutral, data-centered USGS do the science and monitoring, rather than the DOI bureau that is the manager of the land on which the science is conducted. USGS should champion water issues with Congress and ensure that legislation is informed by sound science. Creating caucuses and task forces on Capitol Hill focused on water issues should be investigated cooperatively.

Cambridge Scientific Abstracts
http://www.csa.com

"…thank the USGS for its service to the country…the concept of an infrastructure is absolutely imperative…critical to identify priorities and to have a vision…take it one step at a time…[like] trying to boil the ocean, but if you stage it correctly, it can be done."

Cambridge Scientific Abstracts (CSA) supports the National Biological Infrastructure (NBII). The amount and variety of USGS scientific information make an infrastructure imperative – abstracts, publications, data, satellite imagery, spatial data, visualizations, even the verbalization of certain data. The academic community, non-governmental organizations, and the private sector can all assist – and serve as nodes – in structuring information, determining metadata, and developing standards using the same techniques and organizational procedures that they have in parallel efforts. In looking at public sector and private sector issues with regard to information access – are people paying twice, first in taxes to acquire the data and then in access to the data – the issues need to be seen in a context where the private sector role adds value in developing software or manipulating data and, in a sense, is a "deficit reducer." How USGS communicates about NBII is important – there are many different marketing strategies that need to be

looked at in how the costs [and profits] associated with data access and delivery of government-created information are dealt with. People need to be sensitized to the issue of biocomplexity – it's not just simply the environment. CSA will voice its support for NBII efforts to elected representatives where it is located across the country.

Coastal States Organization
http://www.sso.org/cso/

"What we need to do is take the information that is out there and bring it together…we need to take a comprehensive overview of the shore and look at in the context of a dynamic shoreline…We need a national shoreline policy…that is an inter-agency effort…"

The Coastal States Organization (CSO) is aggressively pursuing and promoting a national shoreline policy, which views the shoreline as a dynamic system. Coastal issues and hazards are a top priority from the coastal States perspective. As Federal responsibility for shoreline protection has shifted to the States, coastal States are concerned that they do not have the information they need to understand investments in beach renourishment, for example, and effects of human intervention on coastal processes. Good cooperation at the project level needs to be brought up to a higher level. Compounding that is an array of Federal policies that are not entirely consistent and, in some instances, even contradictory. The Corps of Engineers has funded a study, but clarification is needed on how the funding and work would be handled. Federal policy needs to move away from the debate about the retreat and renourishment of beaches and look at the bigger picture. Advances in information management and data integration have allowed us to cross technological thresholds that will allow us to do things we have not been able to do before. What is needed is to take the information that is out there and to bring it together. A national shoreline study would be a great opportunity to pull this information together and to integrate it into a more comprehensive picture of what is going on and what needs to be done. CSO has not pushed for a particular approach to the integration of information or a uniform GIS approach, recognizing that there is no "be all/end all" approach to this, but this should be seen as an opportunity to bring the tools of information together.

Comso, Inc.
http://www.comso.com

"[NBII]…build it, they will come…marketing the intangibles [of science] is something that your association friends can help USGS with…"

Comso, Inc., stressed the need to invest in information infrastructure and to reach out to the trade associations and professional societies for support and to look for ways to leverage that support – NASA and NOAA, as examples, have outsourced a great deal. Bring these partners to the table often and let them know what is going on and how they can help USGS. Investigate links to the value-added data industry – those who can take and use USGS biological [and other scientific] information and capitalize on it. The

USGS should look at derivative markets for its information; for example, it would not have been obvious that hazards and weather disasters would have an impact on the banking industry, i.e. need more cash in ATM machines to be ready to deal with recovery issues. USGS should bring the scientists and engineers from allied efforts together and look for commonalities. USGS is missing the boat in high-performance computing – the meso-scale monitoring needed for biological research is not being addressed. Integrating biological data with chemical, atmospheric, and air-ocean interaction data will make all the difference in its applications in the future. Without available and integrated data, models are sometimes "dumbed down," to the detriment of the science. USGS needs to have a strategic plan for communicating its needs – *ad hoc* efforts lead to inconsistent message delivery.

Defenders of Wildlife
http://www.defenders.org/

"…many issues are already covered with the great programs USGS is engaged in…Better integrate efforts within USGS to deliver science information to land-management agencies…"

Defenders of Wildlife have set a priority on science-based land management, especially of Federal Lands, and better integration of these efforts within USGS to help deliver this information to Federal agencies. They are big advocates of a strong Endangered Species Act and the protection of endangered species. Defenders emphasized: State-based conservation planning programs – support for the GAP program and efforts to complete GAP in all fifty States; delivering more of this information to the State level through decision-support systems; cooperation with Federal agencies – especially with science-based land management; developing protocols, prototypes, and technical assistance for monitoring and research on Federal lands, as well as more coordination of research and monitoring for specific *taxa*, such as the impressive research and monitoring program for amphibians. Develop high-level partnership and national cooperation with the Association for Biodiversity Information, in its role as the national organization for Natural Heritage Programs.

Degenkolb Engineers
http://www.degenkolb.com

"…outstanding contributions to earthquake engineering…seismic maps are a crowning achievement…"

Degenkolb Engineers (DE) benefits and depends daily on the earthquake-related products supplied by the USGS. DE knows the activities of thousands of engineers nationwide have been greatly enhanced by the availability of the credible, scientifically defendable, seismic-hazard maps produced by USGS in the development of guidelines, codes, and standards. DE has worked with USGS and the Applied Technology Council [ATC] in providing advice on how to better meet the needs of the design professional communities. USGS contributions to earthquake engineering have resulted in a massive improvement

in the understanding of seismic hazards nationwide. The new seismic maps produced by the USGS National Earthquake Information Center are a crowning achievement and have been incorporated into most of the significant guidelines, codes, and standards currently available to design professionals nationwide. Those maps have improved understanding of where the hazard is greater than previously thought and, more importantly, where it is significantly lower. DE encourages a renewed focus on strong motion instrumentation, especially as it relates to urban monitoring. The recent earthquakes in Turkey and Taiwan remind society that the largest component of seismic risk the Nation faces is from existing buildings and that the cost of adding seismic resistance is very high. It makes good economic sense to continue to refine the understanding and characterization of seismic hazards and to use it before, during, and after earthquakes. Areas to be emphasized: Full support of the USGS role in NEHRP; support of applied research needed guidelines, codes, and standards; and development of a nationwide, strong motion network, which ANSS (Advanced National Seismic System), is accomplishing. The potential losses from the built environment due to seismic activities is staggering – thousands of lives and hundreds of billions of dollars are at stake. USGS holds the key to refining the hazard characterization and bringing the potential loss to an acceptable level.

Ducks Unlimited
http://www.ducks.org

"…bottom line is that science-based research creates good public policy…getting the best science…makes all of us do a better job for the environment…"

Ducks Unlimited (DU) is interested in research that would help create better public policy. DU expressed 100 percent support for the North American Bird Conservation Initiative and sees this direction as the future of bird conservation on this continent and one in which USGS will play a significant role. DU is working with appropriators on Capitol Hill and is seeing favorable response. DU commended the ongoing joint ventures of the North American Waterfowl Management Plan, which bring together all of the regional habitat needs and act as a sort of "lightning rod" for showing what is needed on the ground at the local level. Look for commonalities of habitat interests [among the four bird plans] to gain economies of scale and interest. There is room to expand these joint ventures into other bird initiatives. Hypoxia is a major issue for birds and for fisheries – how are chemicals getting into the water and the role that wetlands, riparian areas, and grasslands play in filtering out toxins. Carbon sequestration is another big issue that will grow in importance into the next century and is an area where DU could put a lot of resources because it has impacts for waterfowl and migratory birds and would be supported by members. Issues of ocean dynamics and how these affect sea ducks is another issue because it is not certain what is happening to cause serious population declines.

EQECAT, Inc.
http://www.eqecat.com

"…acknowledge the high-quality work carried out by USGS…insurance rates must be established based on state-of-the-art science…

EQECAT, Inc. acknowledges the high-quality work carried out by the USGS in the Earthquake Hazards Program, and that such work needs to be continued and even expanded. EQECAT utilizes USGS earthquake studies in the construction of earthquake risk models that are licensed to property insurance companies and companies providing reinsurance. Insurers are becoming increasingly concerned about the potential severity and frequency of major earthquakes, since these events can have a major financial impact on their operations. Enacting legislation of the California Earthquake Authority (CEA), for example requires that insurance rates must be established based on state-of-the-art science, much of which comes from USGS. The traditional beneficiaries of USGS hazards studies have been expanded beyond life safety issues of disaster planning and building code development to those of the pocketbooks of millions of property owners in California and other seismically active areas in the United States. Uncertainty in estimating earthquake damage and loss is considerable, but improved knowledge about the location, frequency, local soils conditions, and ground motion severity will reduce this uncertainty and perhaps lower the costs that property owners pay for such insurance. EQECAT encourages improved estimates of recurrence rates (and uncertainty in those rates) for faults in urban areas in California, other Western States including the Pacific Northwest, Utah, Alaska, and the New Madrid seismic zone. EQECAT would appreciate obtaining access to the hazard information that is the basis for the USGS seismic-hazard maps in order to improve how uncertainty is dealt with in risk analyses. Access to strong-motion recordings nationwide would help in developing more effective attenuation relations. Finally, EQECAT commends the USGS technical staff – their openness and willingness to share insights beyond the published literature – which permits a better understanding of the science and helps everyone do a better job.

Geological Society of America
http://www.geosociety.org

"…a unique entity scientifically…carries a large leadership responsibility…profoundly affect the intellectual direction of the profession…changing landscape of professional opportunities…"

The Geological Society of America (GSA) reflected on the science leadership role of the USGS, not only in the intellectual direction of the science but also in setting the pace of scientific advances. In taking on a role in human health and geology, the USGS is serving as a role model and will fuel what GSA sees as a growing interest on the part of geoscience professionals to pursue questions about geology and human health and to see the interface between disciplines that are not familiar with one another – microbiology, endocrinology, and geology are not disciplines that would normally see themselves working together. Little has been done in characterizing ground water as a habitat for

organisms and their effects on human health. GSA is partnering with the National Ground Water Association in looking at animal waste issues and emerging contaminants, and leadership from the USGS in this area will accelerate the movement in this direction. There is a legitimizing component to the USGS that has direct and indirect impacts on grants, symposia, workshops, and publications, and the professional advancement of young scientists who want to be on the leading edge of science. There is a dynamically changing landscape of professional opportunities in the geosciences, and GSA welcomes opportunities to work with the USGS. There is also an opportunity to incorporate biology more into the geoscience community, to work toward a common language in understanding the terminology that each uses and in communicating effectively as a bridge across the disciplines, and to foster linkages between geology and health. Universities are in a unique position to help foster that common language and communication and to ensure that young people are being trained to communicate in this new scientific language. There needs to be a new literacy across the sciences. GSA members are dependent on the products of the USGS because they represent a substantial body of the historic science of geology and related disciplines. The sheer volume of scientific information now available requires a responsible stewardship for centralized information management and dissemination. On coastal issues, GSA sees a need for a lay-reader document, designed for Capitol Hill, which would speak in a clear and understandable voice for a national approach that gets from *ad hoc* shoreline management – not just "moving sand around" – and, instead, understands the dynamics of the shoreline system.

Groundwater Foundation
http://www.groundwater.org

"It is important for Congress and other federal and state entities to understand that support for USGS information and outreach services means support for the work of many other organizations as well."

The Groundwater Foundation (GF), a non-profit organization dedicated to educating the public about the nature and value of groundwater, is pleased to offer a brief perspective on the need for USGS data and other scientific resources. USGS scientists and resource personnel, on both the State and Federal levels, have been tremendously important partners in various GF outreach and education programs. One of the important principles of our work is the need for making a connection between the science of ground water and the people who depend on it. USGS maps, studies, and reports have formed the information base of many GF publications, including our journal the AQUIFER, and other booklets and brochures on such topics as groundwater quality, source water protection, and the benefits of public involvement. In addition, USGS support and regular communication with USGS scientists have enabled the GF to produce annual symposia on topics of importance and interest, initiate a wide array of youth programs that have become international models, and develop a community-based groundwater protection program, Groundwater Guardian, that connects local USGS personnel with community-based teams. Given the importance of this partnership to GF programs and our wide-ranging responsibilities towards thousands of diverse constituents and program

participants, GF hopes that USGS will continue to make resources available for engaging the public in events and programs of this kind. The public's knowledge about groundwater, as a hidden but vital resource, is the basis of support for its protection and the continued advance of scientific knowledge about its use and long-term sustainability. It is important for Congress and other Federal and State entities to understand that support for USGS information and outreach services means support for the work of many other organizations as well.

Houston Advanced Research Center
http://www.harc.edu

Examples of LIDAR technology: image 1 || image 2

"USGS can take the lead in these urban problems…use science for liveable cities and sustainable resources."

The Houston Advanced Research Center (HARC) advocated the application of LIDAR (Light Detection and Ranging) technology for a wide range of uses, from earthquakes to salmon. Thousands of square miles can be flown faster, cheaper, and quicker and at a greater degree of accuracy than other methods. LIDAR is not a replacement for surveying or photogrammetry, but it has fabulous application niches, including subsidence from ground-water withdrawal, flood insurance mapping (FEMA's Project Impact), post-flood ecological work, hurricane wind damage, beach profiling for hurricane tracking, impacts of fire on animal populations, ozone pollution in urban areas, deforestation, coastal characterization for fisheries industry, vegetation in the Florida everglades – where are the cattails and sawgrasses – in settling legal disputes. There are applications in urban environments as well with forestry, greenness, and thermal data. New technology applications in merging spectral data with LIDAR data for ecological and habitat characterization, incorporating hydrologic models, and creating visualization tools should be explored. A biological overlay is needed to understand land-use and land-cover changes in terms of habitat and how resource use is impacting the land. Look at an NBII node in Texas – data are there, but the user community cannot get to it – there is a need to learn how to share and integrate data, develop standards, and merge data sets (GIS with NBII) . There is a need for higher resolution digital elevation models, digital terrain models, and other data sets. Good training in GIS is needed, including teachers starting at the high-school level.

Information International Associates, Inc.

"…applaud the work that is currently being done…[the next generation NBII] will be our national resource for biodiversity and ecosystems information…"

The Information International Associations, Inc. (IIa) supports the NBII and its full evolution into the next generation as envisioned in the report, *Teaming with Life.* NBII will bring critical masses of information together, allow people to identify and retrieve what is needed, and then provide tools for processing and repurposing the data for customized needs – scientific, policy, natural resource management, or education. Many museum collections need to be digitized and the content of many collections need to be

brought together and enabled for use. Efforts by the Nature Conservancy's Association for Biodiversity Information and Conservation International were cited as components of NBII, which serves as the framework to bring this information together. Bring biological informatics and remote sensing technology together and expand applications. Also, bring biological information and computer science specialists together. Coalition building would lead to regional nodes for development and applications work and NSF-sponsored research opportunities. Predicated on funding for Community-Federal Information Partnerships, IIa sees the beginnings of support for regional node development. Using efforts in East Tennessee as example, IIa pointed to efforts to build a coalition to address biodiversity and ecosystems activities through a node centered there, one focus of which would be invasive species.

The Leonard Resource Group, Inc.

"The kind of data that the NBII could collect and provide access to is desperately needed…need a more systematic approach…search information in a way that generates answers…save lives…"

The Leonard Resource Group (LRG) affirmed that the kind of data that the NBII could collect and provide access to is desperately needed in order to promote public health and to find cures for diseases. Two examples were cited: Hantavirus – El Niño conditions raised the water table, which led to an increase in production of pine cones on Piñon pines, and the deer mice population, which carried the hantavirus, exploded because of the availability of food, and the larger population of mice were in closer proximity to humans and enabled an increased pathway to transmit the disease to humans. In this case, with NBII-type information, public health officials could track changes in species and would be able to be two or three steps ahead of public health threats. Ovarian cancer – The discovery development of the drug taxol, from yew trees, was a fortuitous happenstance of the random collection and testing of bark, leaves, and grasses in an ecosystem. A more systematic approach to cataloging species that may have substances that are needed to save lives or to understand chemical processes and biological functions that are applicable to disease are needed. The health community is interested in a system of information that is organized in a way that allows them to ask questions and search the information to generate answers. In turn, the health community can offer a highly organized, political, and effective group that can support such efforts and can explain the impact and significance of the availability of biological information in terms that cross political parties, geographic regions, all backgrounds, and appeal at a gut level. [A followup discussion of the West Nile virus pointed to the reality of more viruses and diseases that can be spread by wildlife and the need for information.]

Management Association for Private Photogrammetric Surveyors

"…problem solving requires base cartographic information at the foundation…there is an extraordinary demand out there that is not being met…"

The Management Association for Private Photogrammetric Surveyors (MAPPS) congratulated USGS on transforming itself from being a source of competition with the private sector to being a source of business. MAPPS feels that government should be the demand for geographic information, not the supply. The appropriate partnership has been developed with USGS and the private sector, where there is reliance on the private sector for the creation and generation of geographic information, and the USGS plays its inherently governmental role in helping users apply that information. There is an extraordinary demand out there – for mapping and related data – that is not being met and MAPPS wants to ensure that funds – and priorities – stay where they belong. Much of the problem solving for different issues, different phenomena, different applications, requires base cartographic information at the foundation. MAPPS has remaining concerns about USGS civil applications work that is inappropriate for the Federal Government and should be done by the private sector. Members have also voiced complaint with regard to competition in the biological arena on different types of remote sensing and spatial data collection. Areas that need more attention include map revision, which is an opportunity for partnership; issues about licensing of data versus release in the public domain; and the need to upgrade and update the USGS camera calibration and optical services laboratory to meet the needs of the new spectrum of digital instruments.

National Council for Science and the Environment
http://www.cnie.org/

"…[customers] need very fundamental information that only a science agency can develop… answers to environmental questions…opportunity to educate future scientists, engineers, and managers in a new kind of science."

The National Council for Science in the Environment (NCSE) stressed the need for integration: integration of the science itself – scientists trained, for example, to sample for biotic and abiotic elements; integration of activities – more of the science agenda being driven by assessment of the status of the resource and the needs for science to understand that resource; integration of research and information – not just gathering the data, but getting the information out; and integration of communities – like this conversation and partnerships and working together within the Federal family, within Interior. USGS has a unique role in developing scientific answers to environmental and societal questions. Whether customers are managing a particular habitat or working to influence social policy, they want to know what the science says and they need very fundamental information that only a science agency with a combination of Federal scientists and outside cooperators can develop. Many of those answers are not in the area of hypothesis-driven research but rather in the understanding of how the environment works together, how people work together, and how management affects that relationship. Surveys, inventory, and monitoring may not be "sexy" science, but they are

needed to help managers, many of whom do not have the necessary scientific training in applying adaptive management. NCSE encourages that more be done on a place-based scale. The USGS should take advantage of how its workforce is spread across the landscape – not only the physical landscape of the country, but also the scientific discipline landscape and foster inter-disciplinary team-based science. The USGS should supplement existing scientific personnel resources with some combination of new hires, partnerships, or grants to develop teams that have the appropriate skills mix to answer society's questions. NCSE would be pleased to work with USGS to identify potential partners and to help set up events. And USGS should integrate education, especially where USGS is based on campuses and in summer programs for students. USGS has an opportunity to educate future scientists, engineers, and managers in a new kind of science.

National Federation of Abstracting and Information Services
http://www.pa.utulsa.edu/nfais.html

"Standards and interoperability are important to NBII's future… vision of a seamless integrated information environment…"

The National Federation of Abstracting and Information Services (NFAIS) is in the growing movement to reinvent indexing under the term metadata. NFAIS has worked with USGS to look specifically at how the concept of metadata was being applied to the challenge of biodiversity information management. Taxonomy is regarded as a major key for unlocking that information resource. Data sets are growing and becoming more complex, including genetic data and imaging data. Standards and interoperability are important to NBII's future. There is a vision of a seamless integrated information environment, where scientists sit at workstations, ask questions, network across systems and data, and derive answers rather than a literature reference or a referral to a database. Users want technology to be able to capture metadata in the process of collecting the data. The users need to be consulted – what their needs are, which ones have been met, what is still needed. The private sector also needs to be involved because much information work goes on in that arena and may be copyright protected. Data are stored away in the archives of museums and not easily found. Data and information that are in the content of books, articles, and journals needs to be indexed in a way that the data can become part of the information infrastructure.

National Ground Water Association
http://www.ngwa.org

"…outstanding scientific investigations…USGS reports may not be as readily available as they could be… encourages more cooperative work of USGS, particularly with EPA… artificial recharge…would not oppose the USGS being a player."

[*Note: See accompanying statement in Attachments.*] The National Ground Water Association (NGWA) commented on science issues related to investigative tools for geologic mapping of ground water, geophysics, USGS benchmark network, and

permeability pathways. Future uses of ground water was another science issue, including ground-water recharge, ground-water use and reuse, reclaimed water use, salt accretion, subsidence, surface-water/ground-water interaction, and wastewater facilities. Non-scientific issues were access to USGS work, funding, interagency cooperation, partnering, and a commitment to the future excellence of USGS (expressed as a concern for the aging workforce). NGWA comments tracked closely with the future science directions set by USGS. While the relationship between surface water and ground water is understood, the implications of that relationship are not. NGWA would like to look at ways to work together in areas such as funding for the geologic mapping project in the Great Lakes Basin. More work needs to be done in permeability pathways in karst terrains and fractured bedrock zones. Increased investigation in this area would be useful not only for migration of contaminants but also being able to forecast water yields. On the future uses of ground water, the whole idea of recharge and how it is impacted by climate change and urbanization is an area where the USGS could play an important role. As a Nation, we need to look at the reuse of wastewater and the reuse of ground water and what the implications are – and the incumbent need for public education in this area. The persistent nature of pharmaceuticals in water is another critical area in treated wastewater. There is also the issue of animal feeding operations, on which NGWA held a conference, and in which USGS is involved as well. As a trade association of well drillers, NGWA likes the business that drought produces, but sees it as a serious issue regarding future water supplies and of ground water and surface water interaction. On the non-scientific side, NGWA would like to reinforce the comments by the DOE Yucca Mountain Project regarding access to USGS data and information. The USGS does outstanding scientific investigations and while a lot of USGS reports are available, they may not be as readily available as they could be. Also, respecting that travel budgets for all of us are tight, the participation of USGS scientists at conferences held by organizations such as NGWA and others is a way that those investigations and data are brought to the light of day. NGWA encourages more cooperative work of USGS, particularly strengthened interagency cooperation with EPA. The private sector has expressed concern about the USGS being involved in artificial recharge, which they see as primarily an engineering activity, but NGWA feels there is not enough being done by anyone in this area and would not oppose the USGS being a player.

National Institute of Building Sciences

http://www.nibs.org

"…dual benefit…NIBS uses USGS products…USGS benefits because people see USGS products…"

The National Institute of Building Sciences (NIBS) is expanding HAZUS (a PC-based, GIS software for natural hazard loss estimation) beyond earthquakes to include a system for wind and for flood. NIBS uses USGS products in HAZUS. NIBS focuses on the needs of HAZUS customers and keeps connected with them and giving them what they need, which gives them more power in the program. NIBS uses seismic data in HAZUS and for the wind methodology that is being developed, they are looking at using the latest land-use/land-cover data from USGS. USGS is well represented on many NIBS committees. NIBS views its partnership with USGS as that of using USGS products, but

also making those products available to the public and making them understandable to the user public, essentially a dual benefit. NIBS made two requests to improve HAZUS: soil data in a national data base and a national topographic base for the flood model. Until that topographic base for the flood model is in place, users cannot easily and quickly define the study region and "with a couple of clicks" get to that loss estimate, nor can they take that loss estimate and go to their Chamber of Commerce or State legislator and say, "if we don't do anything about this flood, this is what could happen."

National Mining Association
http://www.nma.org/

"…foremost experts on mineral commodities, both in the United States and internationally…Without this expertise, the Nation would not have the information necessary to make informed policy decisions…USGS is on the right track."

The National Mining Association (NMA) appreciates the products that USGS provides, which represent the core science capabilities of the USGS, and which are extremely valuable to NMA and the Nation. NMA identified three categories of need: coal resource information, mineral commodity information, and geologic mapping information. NMA appreciates the 100+ years of USGS coal resource assessment work and the more recent information on the environmental, technological, economic, and societal restrictions placed on mining. The availability of this information has enabled NMA to respond to many industry requests. NMA looks forward to the regional assessments and the national assessment reports that are due out this year. NMA uses mineral commodity information from the Mineral Information Team (MIT), formerly of the U.S. Bureau of Mines, more than any other source for their mineral publications, to answer statistical questions, and in their interactions on Capital Hill. NMA produces three mining publications and a mining statistical web site based on the information that MIT provides. MIT people are probably some of the foremost experts on mineral commodities, both in the United States and internationally. Without this expertise, the Nation would not have the information necessary to make informed policy decisions. NMA is concerned, however, about the late publication of monthly reports on key commodities and the annual mineral commodities summary. NMA is concerned about the decreasing workforce dedicated to these efforts of collecting and reporting this information and hopes that the personnel needed to continue this effort are restored and that information will be provided on a more timely basis. NMA and its member companies are thrilled with the web-based National Geologic Map Database and its widespread availability. NMA encourages USGS to get as many of their maps as possible into the map data base system and then expand to include international maps. Looking to future science, NMA members have a growing interest in carbon sequestration and mineral exploration, where information on mineral deposits, mineral exploration expenditures, and technologies being used, not only in the United States, but internationally, is desired. [In response to USGS-originated question on issues related to restoration of mined lands and what value that has to the mining industry, NMA will talk to members and get feedback.]

Native American Remote Sensing, Inc.
http://www.narsinc.com

"…seeking 'upscale status' for Native Americans…afford them access to all satellite imagery available through USGS."

Native American Remote Sensing, Inc. (NARSINC) is involved in an outreach pilot with the Leach Lake Tribal Government and College, NASA Glen Research Center, and the USGS EROS Data Center, under the auspices of the OhioView Consortium. NARSINC's effort is centered on economic issues and creating jobs through the availability of remote sensing technology and training in its use, for which they are seeking "upscale" status for Native American Tribal governments and Native American educational research institutions, which would afford them access to all satellite imagery available through USGS.

North American Bird Conservation Initiative
http://www.cec.org

"…a golden opportunity for the USGS to demonstrate its leadership… this kind of comprehensive monitoring that currently does not exist and is desperately needed."

The North American Bird Conservation Initiative (NABCI) sees a golden opportunity in the migratory bird initiative for the USGS to demonstrate its leadership and to bring to fulfillment the reason the Biological Resources Division was created – to have an organized and cohesive research program. Although designed for birds, it extends well beyond those populations and across the scientific disciplines as an integrating aspect. Birds use an entire landscape in migration and in breeding, which means you are also looking at issues of water quality in a certain watershed that affect amphibians, that affect all life in that watershed. NABCI encourages USGS to elevate this initiative as a DOI science priority, because much more than birds can be brought into the effort. Monitoring is meant to refer not only to conducting counts but also to looking at issues such as water quality and being able to determine chronic exposures to heavy metals or organic pollutants. A second priority would be to look at habitat requirements as part of the monitoring effort – using birds to monitor habitat quality and using habitat quality to monitor abundance and distribution of all species, not just birds. Standardized, nationwide monitoring would also bring attention to the current lack of resource allocation. What is lacking is the availability and transfer of that information to land managers so that they can design a cohesive program of management and conservation for non-game species. The NABCI non-governmental subcommittee supports this proposal and will continue that support through the budget and appropriations process.

OhioView Consortium
http://ohioview.org

"USGS Landsat 7 data are a scientific bonanza for education and research…the public benefits from a better environment, reduced taxes, and increased productivity…"

[*Note: See accompanying statement in Attachments.]* The OhioView Consortium appreciates the support of USGS in its efforts to expand public access to USGS geospatial information, including Landsat 7, and other satellite data through the Gateway to the Future: OhioView Pilot. The Consortium asks that USGS continue its current policy of acquiring and distributing affordable data and to begin planning for the "Landsat 8" era. The Consortium would like to see the pilot program expanded across the United States. OhioView has focused on getting data to State and local governments and are using the academic community in helping to determine the needs of local and State governments for the data, as well as fostering a surge in undergraduate and graduate education in remote sensing and its broad-reaching applications.

The Ornithological Council
http://nmnhwww.si.edu/BIRDNET/

"The beauty of such an approach [place-based] is that you are bringing all of the disciplines to bear – biology, hydrology, mapping, and geology – in identifying research needs."

The Ornithological Council (OC) feels the list of USGS future science directions is comprehensive, but with such a full plate, it may require better organization and coordination. Living resources should be seen not as a discrete component but rather as part of every ecosystem, environmental, and human health-related project, because all of those projects involve monitoring of the natural world and its inhabitants. OC encourages USGS to ensure that every project encompasses all components of the ecosystem – in looking at water issues, look at the birds who use the resource; in studying minerals under the ground, look at the animals on the land that could be affected by drilling. USGS should reestablish connections lost when resources were taken to establish the Biological Resources Division. These connections could be accomplished based on geographical proximity or based on research needs, along the lines of place-based science, where there are teams of USGS people from all of the divisions at science centers and, more particularly, assigned to different public land units. OC encourages USGS to employ a more integrated infrastructure and to look at whether more people may be needed to enable USGS to meet the needs of the resource and land management agencies. OC identified two reasons why USGS science, as good as it is, does not seem to be matching the research needs of land managers: there need to be more people on the ground to help identify and accurately characterize research needs, and, once completed, there is no process in place to help managers translate that research into land management and conservation programs. USGS needs to continue to build NBII and to build into NBII the ability to help users access and then interpret the information. The sophistication of NBII, its breadth of data, and the spatially referenced nature of much of

it, will make it difficult for many customers in States and other communities to use the information to its best advantage.

Wildlife Management Institute

"…act as a national clearinghouse for all of the monitoring data…USGS needs to be out in front on this…this will sell…"

The Wildlife Management Institute (WMI), as a member of the NABCI/NGO subcommittee, stated that while much good has been accomplished by the many separate and uncoordinated efforts [related to bird conservation], there is frustration over the fact that Federal budget requests do not show very strong continuity from one year to the next. While it is understood that this is a reflection of trying to hit the "right target" in budget requests from year to year, there is not a well-conceived strategy, which is particularly problematic in a research agency, where the results from research take many years to achieve objectives that Congress and OMB will see as meaningful and worthy investments. The NABCI/NGO subcommittee recommends that they and the NABCI/Federal subcommittee coordinate their priorities and that these are readily identifiable, common programs that also meet the needs of State agencies and land managers at every level. The potential of bird conservation efforts will only be realized if it is done in a collaborative way. The USGS could act as a national clearinghouse for all of the monitoring data, so that everything is standardized. The migratory bird initiative is a concept that NABCI can sell to OMB and to congressional appropriators. USGS will have the broad support, not only of the NGO community, but also of other Interior agencies for which USGS provides research needs, as well as State agencies. Beyond biology, the other USGS disciplines have important roles to play – water is an obvious one, with issues of wetlands for habitat and surface-water/ground-water interaction, but also mapping of vegetation and soils. In addition, USGS should move beyond site-by-site approaches to look at the larger regional landscape, as well how to best measure and monitor things on the landscape, especially as much of it is fragmented.

Individual Statement

"…tremendous respect for the USGS Survey and the science that is being done…USGS needs to strengthen their partnerships to maintain that support."

[*Note: The views of this statement are those of Gregory van der Vink and do not necessarily represent the views of any institution with which he is associated.*] The hazards community looks to the USGS for scientific leadership. The USGS cannot work alone, however, and needs to maintain strong partnerships, which are vital to maintaining a strong constituency of supporters. Three areas were cited where the USGS needs to strengthen its role as a partner: Global Seismographic Network (GSN) – in which USGS and the Incorporated Research Institutions for Seismology (IRIS) were to share as partners in long-term operation and maintenance of the network, and for which USGS says funds are inadequate to maintain GSN facilities, and yet National Science Foundation (NSF) funds are being used to maintain USGS equipment and to underwrite

other tasks; Earthquake outreach – where NSF and the USGS have been working together to develop museum displays that make USGS data from the National Earthquake Information Center (NEIC) accessible to the general public, and for which USGS provides no additional funding. In addition, NEIC is being eclipsed in its role as a global seismic information provider. There is an urgent need to improve the NEIC and make it the source of the best global catalog. *EarthScope* – ANSS (Advanced National Seismic System) and *EarthScope* need to work together and there is frustration that USGS did not get funding to support it – constituents would like to launch a similar campaign of support for ANSS as they did for *EarthScope*, but need USGS support and encouragement.

Other U.S. Department of the Interior Bureaus

Bureau of Land Management

http://www.blm.gov

"…doing great work and look forward to more in the future…[land managers] increasingly require assistance from the research community to assist with information exchange…"

The Bureau of Land Management (BLM) depends on the USGS for its science and research needs and has established a national science coordination committee to work on these issues, to which USGS has named a representative. BLM sees a growing trend in its need for the biological and physical sciences, as well as social science, economics, and human dimension issues that surround natural resource programs. BLM advocates integrative research, increased collaboration with multiple partners, and applying technology, such as advances in GIS, as tools to help them. Integrating disciplines adds complexity to these issues and will increasingly require assistance from the research community to assist with information exchange – applying science results for the manager and practitioner on the ground. BLM's strategic science plan, in which the USGS is involved, has three framework modules – the role of science in natural resource decisionmaking, the process for identifying science and research priorities, and marketing those results in applying them to work on the ground. BLM has identified 12 primary areas of need, including rangeland health and restoration for which issues include invasive weeds and species, off-road vehicle use, and over-grazing. Invasive species is the number one need and is identified in 8 of the 12 priorities – detrimental effects to wildlife and grazing animal forage, diminished visual quality, reduced land value – for scientific information on the dynamics of these plant populations, treatment options, site restoration, and management implications are all needed. Prescribed fire is another area, and whether it is a tool in dealing with invasive weeds while not eliminating native species, and whether to immediately re-seed with desirable species. There is much uncertainty in this area, and more information is needed about soil and climate. Managing the wild horse herds under BLM's control is another area where additional scientific and genetic information is needed. Abandoned mine lands are another focus, in dealing with polluted waters and clean-up efforts. Research is needed on the protection and restoration of aquatic habitat, ranging from site-specific to watershed to river-basin

scale. Increasingly there are issues of air quality concerning effects of atmospheric contaminants. Other issues of concern include declining species, species at risk, and habitat issues related to population declines and to rehabilitating habitat are all research issues. The effects of oil and gas development on a variety of species is on the list as is the subject of coal-bed methane and impacts to water quality, whether creating temporary wetland environments is of benefit, and the quality of residual coal. BLM continues to need mineral assessment information from USGS. BLM also needs in hydrological and water quality support from USGS. BLM urges USGS to work with partner agencies to incorporate management implications into its research results and reports.

U.S. Fish and Wildlife Service
http://www.fws.gov

"…management decisions must be based on good science provided by USGS…"

The U.S. Fish and Wildlife Service (F&WS) encouraged USGS to engage in the Lower Mississippi Valley area as much as possible, as this is a priority for them and one that is capturing attention throughout the Department, EPA, the Army, and the White House. Hypoxia and related changes in the Gulf of Mexico are growing by orders of magnitude in their need for scientific information. F&WS expressed concern that there is no emphasis on the effects of contaminants on aquatic populations or ecosystems. Many contaminants are broadly toxic and there is little or no probability that physiological and/or ecological systems will evolve rapidly enough to survive in the face of such toxic contamination. In other comments regarding science support to F&WS, concern was raised that they were not being viewed as a primary partner in being provided with the science support that had originally been envisioned in the creation of the National Biological Service before its transfer to USGS. Integration is a valuable goal, but the real value exists from maintaining the expertise and the focus of the parts that then constitute the whole – need to strengthen program capabilities, which are the delivery mechanism for the integrated approach. USGS should provide management direction and support to the biological labs, particularly those that were F&WS labs, so that they serve the need of the F&WS on a priority basis. Concern was also expressed on the USGS Great Lakes strategic plan and the fact that F&WS interests – and the need to maintain core biological capabilities that the region depends on – were not seen as those of a primary customer in the region, including activities to protect, restore, and enhance coastal wetlands in support of all biological resources.

Minerals Management Service
http://www.mms.gov/

"…USGS can be of especial value because beach restoration issues cut across all the divisions."

MMS stressed the need for long-term planning rather than the present *ad hoc* approach to beach erosion and restoration on a case-by-case basis, which is also local community to local community. Coastal habitat restoration encompasses many issues with regard to the

availability and suitability of sand resources. The continuing severe coastal storms we have had in recent years, concerns about global warming and sea-level rise, as well as the population influx to coastal areas, all argue for the need to have a plan to restore coastal areas. USGS has the expertise to map needed sand resources for beach restoration and to develop GIS systems that take into account the biological as well as the environmental concerns in dredging and moving sand. MMS identified high-priority areas: the East Coast from Florida to New Jersey; Cape Cod National Seashore; Louisiana's barrier islands; and the coasts of California, Oregon, and Washington. The East Coast is the highest priority.

National Park Service
http://www.nps.gov/legacy/index.htm

"…represents objective science without an axe to grind… USGS opens their doors and really welcomes their partners… need timely, tactical support from the USGS…it often comes with a high price tag…"

(*The following represents a compilation of National Park Service input)* The National Park Service (NPS) supports the USGS goal of a seamless organization – continued and enhanced collaboration between the USGS divisions makes the organization more responsive to the needs of other Federal agencies. NPS also hopes that research money that came to the USGS is increased and is willing to support the USGS DOI Science Support Initiative. NPS does not want to lose sight of the BIN process in which they bring issues to the table for funding. The successful USGS-NPS partnership for the Clean Water Action Plan needs to be expanded, because many priority projects are going unfunded. Invasive species is a priority, not only to treat known exotics, but also to do assessment work using an exotic species ranking strategy to maximize dollars spent on invasives. NPS hopes that products of the USGS urban mapping initiative will be centered on National Parks where parks and cities come together. The fragmented landscape of parkland is another issue, and NPS is encouraging park superintendents to view their holdings, whatever the size, as a functioning piece of the ecosystem, and to look at whether or not all components of the ecosystem are present. NPS is also looking at the human dimension on natural resources – the impact of more people using trails and parks, including exhaust emissions of recreational vehicles, such as boat motors and the impacts of hydrocarbons on water. An urban park is one of NPS' five pilots for this year – as a laboratory for accelerated change by people. NPS needs a baseline of natural resources monitoring data and to have USGS scientists help design these monitoring programs and to avoid duplication of effort. NPS sees value in having USGS in on planning efforts and to reward research scientists who participate in planning – to define research needs, frame the correct questions, and design research methodologies. NPS and other Federal land managers need USGS information that meets the timeframes that drive management decisionmaking. NPS has tremendous water resources issues, and while they have good relationships with many of the USGS State offices in getting work done, it is expensive. A top priority for NPS is USGS technical support to the NPS water-rights program. NPS and USGS shared a successful water quality program through the National Water Quality Assessment Program that was well-targeted towards park

needs and is a good model to build on. The need for better coordination was cited in the example of having to review several disparate Great Lakes plans – each of which called for collaboration. The public should be involved at the planning level to understand their expectations [for public lands] and provide them a perspective on long-term benefits of new park areas and wildlife conservation. USGS geological work in mapping projects in the parks has been a very successful effort. NPS also benefits from the research science and communications from other USGS geology programs: coastal and marine, volcano hazards, and surface processes. NPS has put out a call for joint proposals from parks and from USGS – noted that it is better to send up a single budget proposal, rather than to have both agencies seeking funding for the work. NPS is working with USGS to look at the impacts of human activities on geologic processes in the parks and in areas beyond the parks, such as along coastlines in protecting certain structures from loss to erosion. NPS is looking for USGS participation in the National Cave and Karst Research Institute, which will be a center for the study of various cave and karst issues ranging from biology, hydrology, geology, even into economics and other social sciences, and will be an effective partnership with Federal and and university partners. Microbial studies will be a major part of the effort. NPS is finding fascinating organisms that have learned to exploit chemical processes and develop competitive fighting techniques that the antibiotics industry is very interested in. NPS is looking at topographic coverage of National Parks and have invited USGS to take an integrated look at mapping needs in Great Smoky Mountains NP, both in connection with geologic mapping and in connection with the biodiversity inventory that Park is getting started. USGS web pages are tremendous and NPS sees potential to use web tools to coordinate better and provide improved, more visual access to natural resource data. As government agencies, we often think about providing information to the public, but there is another twist to interpretation that may be as, if not more, important and that is interpreting the information for use by a tangible [targeted] customer who needs to be helped to see how they can use the information. Learning centers at selected parks are another way to provide access to researchers in the park and as a means for presentation of science programs to special communities or special populations.

Other Federal Agencies

U.S. Department of Agriculture

Natural Resources Conservation Service

http://www.nrcs.usda.gov

"…watershed is a practical and scientifically appropriate approach to organizing information – it is the future…turn to the USGS and State water-quality agencies to do the monitoring…"

The Natural Resources Conservation Service (NRCS) thanked the USGS for its support of the National Water Quality Monitoring Council, which they feel is right on track. Appreciation was also expressed for the USGS river streamgaging program, which actively supports the water forecasting efforts of the NRCS snow survey program. NRCS

expressed support in partnering to make it [streamgaging] a better program. NRCS is involved in land-surface change programs in working with ranchers and farmers in the non-point source arena, for example, and invites USGS to participate. NRCS has developed several institutes, focused on specific technical expertise and geographic locations, which the USGS may want to investigate. This focus area approach has worked well and is linked through the web. NRCS is producing farm-field level digital maps and photography. USGS has been helpful in delineating watersheds to the 14-digit hydrologic unit code, which a practical and scientifically appropriate approach to organizing information – it is the future; people want to know what is going on in their watershed. NRCS sees three major issues: hypoxia in the Gulf of Mexico – not just nitrogen loading, but phosphorus as well; animal waste – developing and implementing regional animal waste management plans in agricultural and forestry areas; and Total Maximum Daily Loads (TMDLs) – need science-based information to provide to the States to make the right decision at the right time. Within USDA, there is a Working Group on Water Quality that directs the multi-agency USDA Water Quality Initiative, which is the Department's voice on water quality and water quantity issues, and which would be a good vehicle for the USGS to use in penetrating USDA. Because NRCS is neither a research nor a monitoring agency, it turns to USGS and State water-quality agencies to do the monitoring. There is little information on the impacts [on water quality] of what is done on the land surface.

U.S. Forest Service
http://www.fs.fed.us/

"…the loss of many key USGS gages has hurt…USGS should be commended for its excellent publication on ground water/surface water as a single resource…it has set a new standard."

[*Note: See accompanying statement in Attachments*.] The U.S. Forest Service (USFS) and the USGS have had a good cooperative relationship that goes back almost a hundred years and includes geomorphology studies and USGS expert witnesses in water-rights adjudication; estimating water use in the western states for the Western Water Policy Review Commission; effects of forest and rangeland management practices and urbanization of rural areas on drinking-water quality and human health; fractured bedrock studies; and mineral assessments. USFS and BLM match needs in future science directions. Interagency assessments of watershed conditions are needed to make decisions about watershed health and the state of aquatic resources, including TMDL calculations and modeling. Cooperative work on delineation of hydrologic unit codes to the finer scales is critical to having a common set of watersheds to track what is happening on the landscape. USFS supports a stable network of streamgaging stations to quantify water yield from the national forests and grasslands, including annual fluctuations, and the loss of many key USGS gages has hurt their ability to do that. The USGS ground-water resources inventory needs to be greatly improved and simplified. USFS has a national initiative on hydropower, which is trying to increase capability to do the relicensing job properly. The USFS has been devoting effort to socioeconomic research on the value of water with the USDA Economic Research Service, and it might

be time to look at a partnership with USGS. Fire effects on watersheds and watershed stabilization measures are needed [Note: As followup, the USGS multidisciplinary fire group will be made known to USFS.] Exchange of training opportunities – at USGS training center and at USFS expert witness training, identifying core competencies, and dealing with impending retirement of many hydrologists are mutual topics. USFS, BLM and NASA contracted with OPM for a core competency review [expressed disappointment at lack of USGS participation—effort not known to USGS]. Investigate joint "State of the Knowledge" reviews to get scientific knowledge into the hands of land managers and ordinary citizens for problem solving. USFS would like to see USGS include management implications in major scientific water-supply papers. USFS uses customer evaluations to judge scientific productivity, which counts for about a third of the research grade evaluation score and is used as input to research grade evaluation panel and provides direct feedback to project scientist on what users think of their research [Note: USGS requested contacts on research grade evaluation and the customer/user component.] A complaint was raised about the high costs of getting flow-frequency data and analysis from USGS water offices; data that had been available free as a professional courtesy to a cooperating agency is now excessively costly.

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

National Marine Fisheries Service
http://www.nmfs.gov/habitat/index.html

"USGS is a vital partner in helping NOAA…We have really enjoyed the responsiveness and the enthusiasm that the USGS has shown in working with us…joint initiative on seafloor habitats and fishery resources is timely and important."

[*Note: See accompanying statement in Attachments*.] NOAA and the National Marine Fisheries Service (NMFS) have enjoyed a productive relationship with USGS, primarily in the geologic and biologic programs. NOAA has relatively new coastal requirements regarding fish habitat in which they see joint work with USGS on effects of fishing activities on benthic habitat that focuses on two themes: determine the effects of fishing gear on seabed habitats and identify and map benthic habitat characteristics and the extent of fishing impacts. NOAA identified four areas – seafloor characterization, effects of fishing activities, natural and non-fishing related change and the stability of the seabed, and data uses. There needs to be good mapping of fish habitat to understand change. Understanding habitat provides a baseline for a lot of what needs to be done at the coastal/estuarine interface and upstream. Information is also needed about quantity and quality of freshwater flow and saltwater intrusion. Issues include whether freshwater flow to estuaries has decreased over time and if that decrease is localized; how interbasin transfers affect fish habitat in principal anadromous fishery streams; and how changes in the quality of the habitat are affecting fish stocks – may know if numbers are up or down, but why? NOAA is hearing from its constituents that habitat plans developed thus far are extremely broad and need to be refined with additional information. In looking at these and other issues, it would be a significant leap forward if we [NOAA and USGS] could

promote our joint interest within OMB and to approach coordination and cooperation for projects from a strategic initiative standpoint. The following statement of support was included in the NMFS handout: The proposed NOAA/USGS Joint Initiative on seafloor habitats and fishery resources is timely and important. The joint initiative will leverage the strengths of NOAA and USGS and ultimately product a better understanding of the relationships between benthic habitats and fisheries. The resulting information will be directly applicable to management of fisheries in the U.S. Exclusive Economic Zone.

National Marine Sanctuary Program
http://www.sanctuaries.nos.noaa.gov/natprogram/natprogram.html

"… probably missing out on what a lot of USGS capabilities are inside our whole program…and we would be anxious to talk with other parts of USGS to show those gaps."

[*Note: See accompanying statement in Attachments*.] The National Marine Sanctuaries Program (NMSP) of the National Ocean Service said that the science information needs with regard to marine sanctuaries are much the same as those expressed by other customers of coastal environment issues, especially concerning habitat for both commercial and protected species. There is potential for much more interaction and to fill information gaps. The NMSP has developed a research prospectus that sets out their science plan and seeks to explore research links with other organizations. Overall goals of the science plan are focused on infrastructure, resource assessment, and resource monitoring and research.

National Ocean Service
http://www.nos.noaa.gov/

"…need to come together on budget initiatives that are common to both and to think more about some of the big issues…"

[*Note: See accompanying statement in Attachments*.] The National Ocean Service (NOS) spoke about four of NOAA's strategic goals in which there is strong connection with the USGS: Build Sustainable Fisheries, Advanced Short-Term Warning and Forecast Services, Sustain Healthy Coasts, and Promote Safe Navigation. Within these, NOS sees improved tsunami warnings and continued work on seismic monitoring associated with those improved warnings as strong candidates for interaction in coastal environments. NOS supports USGS efforts on the Advanced National Seismic Network in increasing instrumentation and information, as well as increases in the national streamgaging network. NOS has expressed a need for more precise resolution of sea-bottom movement for input into their wave-generation models. The USGS is also working with NOAA on coral reef issues. Improved flood forecasting is part of NOAA's FY 2002 initiative, and the National Weather Service (see entry below) relies heavily on USGS streamflow-gaging information. There is also a need for near-shore wave forecasts for navigation and for impacts on coastal communities, but there is poor near-shore bathymetry available to put into models for those forecasts. NOAA has a coastal

initiative for FY 2002 focused on three geographic areas (northeast Florida and the St. Johns River; Southern California; and the Pacific Northwest) but looking at different issues in each. The initiative involves several NOAA offices and has ongoing opportunities for partnerships with USGS in several areas including accurate navigation charts, such as the joint topographic/bathymetric shoreline mapping effort in Tampa Bay, Fla., and coastal erosion issues with the geologic and coastal marine programs. NOS is working with USGS to establish a joint office to better coordinate coastal efforts.

National Weather Service
http://www.nws.noaa.gov/

"…this partnership is crucial not just to our individual agencies, but to the people of this Nation… thank the USGS for advancing the use of the Internet, which has made the data more accessible, more quickly…"

[*Note: See accompanying statement in Attachments*.] The National Weather Service has shared a very productive relationship with the USGS for more than 30 years. The NWS is a small agency and it relies heavily on the data that is collected by the USGS. NWS, as a service agency, requires and depends on the research of other agencies and the universities, which NWS then turns into operations. There is a need to infuse new science into the NWS hydrologic services program and its operations, a need recognized by the NOAA Science Advisory Board. Looking at floods and river predictions, the NWS Advanced Hydrologic Prediction Services (AHPS) is a new program, which is tied to NOAA's key strategic element on advanced forecasting and warnings. Snow information is also important to NWS, particularly in the West, where 80 percent of the water supply comes from snow, and they will be collecting more data in the late spring as part of AHPS. NWS provides real-time forecasts at more than 4,000 locations across the country, which are critical for many uses, from immediate for recreation or disasters, to preparedness for disaster mitigation. While presently the NWS provides forecasts three days out, AHPS would enable NWS to forecast out two weeks and longer. NWS demonstrated this new capability with USGS in 1997 with the USGS in the Iowa District to extremely positive reaction – with longer-term forecasts, the USGS can conserve staff resources by scheduling and planning in advance when to send field technicians out to gage the streams. NWS wants to provide more complete information graphically, using USGS topographic data, and to provide joint links on web pages. The USGS has responsibility for maintaining rating curves for streams – NWS forecasts rely heavily on those data because NWS needs to know not just the stage, but how much water is associated with that stage, and how much water is flowing past that point. The NWS would like to encourage the USGS to continue to move forward with the following budgetary efforts: reactivate closed gaging stations in flood-prone locations; expand telemetry capability; harden gages against severe flooding; build new gages in flood-prone areas; extend rating curves above historic flows; provide updated ratings in real time. NWS would also like to explore a new partnership in flood-forecast inundation mapping, where forecasts would provide enhanced topographic detail to make smarter decisions based on these predictions. NWS encourages continued partnership with USGS

on where to reestablish gages and keep good interaction not only at headquarters, but also with USGS district offices and NWS river forecast centers.

U.S. Department of Energy
Yucca Mountain Project
http://www.ymp.gov

"The USGS is respected for its high-quality, technically sound work…publish more in peer-reviewed literature…"

The Department of Energy enjoys a good partnership with USGS on Yucca Mountain. The USGS review of the Viability Assessment was a masterpiece in terms of timing and in getting the information out before things got contentious and showed where some of the weak points were scientifically. DOE echoes USGS comments regarding getting the body of scientific knowledge about Yucca Mountain into the peer-reviewed literature, which had not been viewed positively at DOE, and it is good to see this change. More information that makes the "safety case" should get into peer-reviewed journals, as well as showcasing pioneering USGS work on age dating. The timing would be good now to develop funding mechanisms for documentation and publication, as funds for the assessment work decreases. Getting ahead of the curve in preparing expert witnesses and in training scientists who are involved to portray science accurately and precisely, but also clearly, to lay audiences is needed. In 2001, the Secretary of Energy will make the decision whether to recommend Yucca Mountain to the President as the repository site for highly radioactive materials. In standing behind its scientific work, DOE would anticipate that USGS scientists who were principal investigators will be called as expert witnesses during the licensing process.

Independent Federal Agencies

U.S. Environmental Protection Agency
Office of Environmental Information
http://www.epa.gov/oei/

"… very interested in the information and knowledge that USGS can help provide… information about environmental conditions is key to understanding the outcomes of programs."

The U.S. Environmental Protection Agency (EPA) added its endorsement to the importance of the National Biological Information Infrastructure (NBII) and in calling this century the "century of biology." At EPA, biology is extremely important in understanding the environment. While EPA pays much of its attention to human health concerns and rightly so, it also uses other organisms as surrogates to help understand potential threats to human health. Ecosystems are key to the functioning of the environment and human health ultimately relies on there being healthy ecosystems. EPA has learned a lot about the integrated nature of geology, hydrology, and biology. The USGS is in a unique position to articulate what is being learned about the interactions

between the hydrologic systems, geology, and biology, and to focus on building the knowledge base of information that can be used by many customers. Human health problems should not be the way to learn that programs are not meeting objectives. Early warnings from biological systems and more sensitive organisms will enable EPA to respond, which will be far better for human health. A particularly critical area for NBII is in taxonomy. Those who put databases together struggle with the lack of a catalog of the names of known organisms. Under NBII, the USGS is a key player in the Integrated Taxonomic Information System (ITIS), which would catalog standardized names. EPA would like to apply remote sensing data operationally on a routine basis to aid in environmental programs. USGS could be helpful to EPA helping to assess the new generation of remote sensing capabilities and identifying how such information can be used to help understand the environment. EPA is committed to the citizens' right to know, and would like to work with USGS and other Federal, State, and local agencies to aid in community understanding of environmental conditions – and biological information clearly is an important part of what interests people. Through Project EMPACT, EPA is working with USGS to bring to the real-time environmental information to the public. EPA has a long and effective history of working together with USGS on water issues, particularly with the National Water Quality Assessment Program [which was not addressed by the presenter].

Federal Emergency Management Agency
http://www.fema.gov

"…[building code] a huge victory for us and for the USGS…would not have been possible without the commitment of the USGS to keeping that mapping information current…"

The Federal Emergency Management Agency (FEMA) uses much of the data from USGS seismic monitoring systems, which is fed automatically into FEMA's disaster response system, HAZUS, which is able to automatically take USGS data as they are collected through the monitoring system and tell immediately, in areas where data have been established, what the potential risk is from that earthquake, and to effectively deploy resources into those communities. Seismic coverage is spotty in some areas, and for that reason, FEMA has gone on record in supporting the Advanced National Seismic System, in order to have data to better identify the earthquake hazards throughout the United States HAZUS is not only a quick-response program after a disaster, but it is also a pre-disaster program that allows FEMA to better assess the risk in different areas and pass along that risk assessment to the State and local officials in an attempt to "sell" the idea of mitigation – to get them to address their risk prior to a disaster. FEMA also uses the hazard identification data to allocate resources at State and local levels. USGS seismic hazard maps are important products for mitigation and are the basis for FEMA publications on new building construction and design, as well as retrofitting of existing buildings. Those products also serve as the basis for the building codes, or the seismic portions of the building codes, throughout the United States. Building codes are evolving – a single building code, the International Building Code, was recently produced for the entire country, and is based on USGS hazards maps. The USGS CD-ROM of data are

copied and distributed with the Code. USGS ground-shaking maps were commended for having application to the building design community. FEMA, as the lead agency for the National Earthquake Hazard Reduction Program, works closely with USGS in reporting to Congress on how funding is used and will continue that communication. [In a discussion of FAA facilities and hazards risk, two executive orders were cited, one that ensures that any new facility that involves Federal funding needs to be built to FEMA seismic standards, which incorporate USGS maps, and one that deals with existing facilities and as a first phase provides an inventory of Federal facilities and what the risks are and then identifies most-critical facilities for retrofitting – and air-traffic control facilities are on the top of the list.]

National Aeronautics and Space Administration
Goddard Space Flight Center
http://www.gsfc.nasa.gov/

"…need for a coordinated biological information infrastructure… is increasing quickly as we move forward into what many are calling the age of biology…"

The National Aeronautics and Space Administration's Goddard Space Flight Center (GSFC) spoke in strong support of the NBII. The essential linkage between the U.S. economy and the environment are being recognized – the Nation's land and waters and its native plant and animal communities are the natural capital on which the economy is founded and biodiversity and ecosystem services literally contribute trillions of dollars to the national and global economies. To protect this natural capital and to use it wisely and to make wise decisions about it, there must be an extensive and frequently updated environmental knowledge base that has a coherent infrastructure. In the U.S., NBII is becoming the primary mechanism whereby biodiversity and ecosystem information is made available to all sectors of society, and it is building a network of partners who are sharing information in useful ways. NBII is promoting the development of standards for information delivery and contributing to the development of new tools for analyzing and understanding biological information. The next-generation capabilities for the NBII are urgently needed – NASA is bringing online an entirely new generation of satellite technology that is going to provide rich data about the functioning of global climates and ecosystems. NBII will be working to link United States activities to worldwide programs, such as GBITH, the global biodiversity information facility that is coming online. Continued and increased support for NBII is critical to those working in the biodiversity enterprise and a successful NBII program is absolutely essential to helping protect and manage the Nation's natural capital.

National Science Foundation
http://www.nsf.gov

"…if you're trying to spread what is going on in USGS, it really pays to see how this [DLESE] is being organized…preparing from 'womb to tomb' education in the geosciences…"

The National Science Foundation (NSF) spoke to geoscience education and the opportunity available through the Digital Library for Earth System Education (DLESE), which is an online, interdisciplinary education resource that allows users to rapidly discover instructional resources and connects teachers and students to real-time or archived Earth data bases. NSF questioned whether or not geoscientists, as a community, had taken full advantage of the establishment of K-12 geoscience standards as part of the National Research Council's National Science Education Standards. These standards are finding their way into post-secondary education as well. NSF struck a "blow for technology" in encouraging exploration of the potential of the DLESE. The idea of DLESE is to ensure that a teacher, starting at the kindergarten level, can go to the web and be assured that this will be maintained and sustained, peer-reviewed-quality material, whether it is modules to help that teacher, or a researcher in education looking at data bases that deal, not just with the geosciences, but with biology as well, and how they integrate.

Academic and Related Community, Regional, and State Customers

California Division of Mines and Geology
http://www.consrv.ca.gov/dmg/index.htm

"the opportunity to collaborate has brought both of us closer to accomplishing our mission…demonstrate the value of a mutually beneficial relationship…there are other areas where we can collaborate."

The California Division of Mines and Geology (CDMG) presented positive outcomes from its collaboration with USGS: Public information – providing information on USGS activities and products to the public through CMDG State offices in major California cities, mineral resources activities – collaborating in the collection of mineral production information that follows on from former arrangements with the U.S. Bureau of Mines and a digital geologic map of western mineral resources. Geologic hazards – jointly preparing the ground-motion hazard map for California. CDMG has integrated real-time and near-real-time monitoring of strong ground motion from its Strong Motion Instrumentation Program with the Southern California Seismic Network that is operated jointly by CalTech and the USGS, a partnership known as TriNet. The partners have created *ShakeMap*, a worldwide, web-based map display of ground shaking in southern California, which will disseminate information a few minutes after important earthquakes. CDMG is also exploring working in a similar fashion with the USGS and UC-Berkeley in northern California to create a northern version of *ShakeMap*; CDMG looks forward to participating in the ANSS and the National Landslide Initiative

– CDMG has had the opportunity to have input into both of these programs as they are being planned. CDMG is entering into an MOU with the USGS to work together to provide background information on the 1:24,000 landslide maps that have been produced over the last 35 years in the San Francisco Bay region, which are being digitized to provide greater availability to emergency response users, land use regulators, decisionmakers, and to residents in general. Geologic mapping – CDMG collaborates with USGS in State Map and Ed Map activities and is working with other State geological surveys in establishing national standards for geologic mapping, including the creation of standards for digital products.

Institute of Marine Sciences
University of California, Santa Cruz
http://natsci.ucsc.edu/ims/

"…USGS is on the right track… critical earth sciences and related biological sciences issues have been included…"

[*Note: This is a summary of a written statement, attached*.] The Institute of Marine Sciences recommends that the USGS expand meaningful partnerships with university scientists and co-locate USGS integrated science centers in areas that benefit public/private partnerships. Specifically, the Institute would like to see USGS increase the presence and integration of USGS people and programs in emerging scientific centers such as theirs, representing the Monterey Bay research community, as a Pacific Science Center in Santa Cruz. The institute sees a focus on coastal environments as an appropriate one for the USGS in the 21st century. The land-sea interface represents a dynamic and important natural system where a new research approach is needed that looks at how the processes at that interface are resolved, modeled, and understood in terms of how and why they occur, and, ultimately, how they impact society. In order to be healthy and productive over the long term, coastal oceans and the industries that depend on them need to be healthy and sustainable.

Missouri Department of Conservation
Missouri River Basin Association
Missouri River Natural Resources Committee

"Science and resources are critically needed to address and resolve these conflicts… significant gaps in our knowledge remain."

[*Note: The statements submitted by these three customers paralleled one another in their issues regarding the Missouri River and are summarized as a group*.] The Missouri Department of Conservation, Missouri River Basin Association, and Missouri River Natural Resources Committee provided input on how USGS can assist State natural resource agencies in their efforts to restore the biological health of the Missouri River. If Lewis and Clark were to make their voyage today, they would see a much altered river, one altered to serve a number of needs including flood control, commercial navigation, power generation, water supply, and irrigation; meeting these needs has caused

significant loss of terrestrial and aquatic habitats and a subsequent decline in fish and wildlife species dependent upon these habitats. A number of programs and management initiatives are underway to address these problems such as altering upper basin reservoir operations and restoring flood plain and in-channel habitats. These efforts will fall short of their objectives unless sound scientific data for evaluation and decision-making are undertaken. The basin faces conflicts between environmental concerns and traditional economic activities and uses of the river such as navigation, recreation, bank stabilization, agriculture, and municipal and industry water supply, for which science and resources are critically needed to address and resolve these conflicts. Existing USGS scientific work on the Missouri River should be expanded and accelerated to provide cost-effective restoration solutions that have minimal conflicts with other river uses. Specific areas for increased USGS involvement include biological, hydrological, and water quality research emphasis on the Missouri River. Management of the Missouri River to accommodate and sustain multiple uses requires improvements in the scientific understanding of how water, sediment, plants, and animals are linked in the river corridor. In particular, there is a critical need to develop a scientific basis for increasing the river corridor's capability to sustain natural ecosystems while maintaining traditional economic values. As the Nation's science agency for natural resources and the environment, USGS is positioned to provide the scientific basis for balanced, multiple use management of the Missouri River and its flood plain. The Corps of Engineers is considering changes to its management of the Missouri River through its review of the Master Water Control Manual of the Missouri River Main Stem Dams, and this is the ideal time for USGS to significantly increase its funding for the Missouri River basin.

National Association of State Universities and Land Grant Colleges
http://www.nasulgc.org

"…retain the conduct of science as a core value… science conducted at USGS is indispensable to the Nation…partnership will be the key to keep its science at the highest level…"

[Note: See accompanying statement in Attachments.] The National Association of State Universities and Land Grant Colleges (NASULGC) is concerned that the energy and mineral programs of USGS are now primarily focused on assessment, and USGS should develop plans to implement basic research in these programs. A major obstacle in addressing coastal watershed problems lies in the absence of a common medium for information – USGS could develop pilot projects as partnerships with universities to demonstrate that an integrated systems approach can be adapted for coastal watersheds that will address scientific research, resource management and public concerns. NASULGC cited the Cooperative Fish and Wildlife Units as a model for strengthened relationships with universities and to work through NASULGC, which can be supportive in many ways, such as the science advisory board they helped NOAA to create. Future science directions identified by NASULGC: coastal watersheds, including the multidisciplinary nature of hurricanes, floods, pollution, biocomplexity and reducing vulnerability to coastal storms; GIS/remote-sensing decision-support tools – not just in mapmaking, but in the natural resources/environmental management arena; animal

feeding operations, including downstream pollution and a whole host of secondary problems; and integrated science – are USGS and university interests aligned? [NASULGC is encouraging its universities to provide incentives and awards for faculty and administrators who engage in interdisciplinary research].

National Association of University Fisheries and Wildlife Programs
http://www.ag.iastate.edu/departments/aecl/naufwp/

"…USGS can really offer a tremendous contribution to the public and the resources of this country…all USGS divisions are constrained financially…there is no question about it in the minds of the university system…avian initiative…a unique opportunity…don't blow it…

The National Association of University Fisheries and Wildlife Programs (NAUFWP) addressed these points: Cooperative Fish and Wildlife Research Units – as a model that should be strengthened and improved; education – many disciplines are undergoing reevaluations of how to educate people who are going to be out at the grassroots level; government agency coordination – the university community was shocked that USGS was left out of the National Science Foundation (NSF) biocomplexity initiative, which should be revisited, and there should be strengthened working relationships between the Department of the Interior, USGS, and NSF; inadequate budget – USGS cannot respond effectively to ecological, biological, hydrologic, economic, and social issues needing scientific attention, and the avian initiative is a unique opportunity that the USGS should capitalize on and on which support can be built on the Hill; science and data management – more than a thousand watersheds in the United States need plans to restore and sustain their health, and USGS could contribute immensely; partnerships – USGS should explore contracts with universities to enlist the services of well-qualified individuals to meet staffing shortfalls; living resources and ecosystems – a new ecological approach is needed that emphasizes the prevention of impacts on the resource base from human activity; coastal resources –strengthen USGS coastal and marine geology programs; North American Bird Conservation Initiative – a unique opportunity that the USGS cannot miss; water and human population growth – surface-water/ground-water interactions and the critical relationships of water, wetlands, rivers, estuaries, watersheds, whatever unit is used to frame the landscape.

National Institute for Water Resources
http://wrri.nmsu.edu/niwr/

"…excellent job in data acquisition and quality…People trust the data – we know it is reliable…"

[*Note: See accompanying statement in Attachments*.] The National Institute for Water Resources (NIWR) sees systems and partnerships as a major theme for how USGS and its partners can work together to benefit society. USGS does an excellent job in data acquisition and the quality of its data – there is continuity and the data span long periods of record. Early work by USGS on nitrates, both in ground water and surface water, was

a wake-up call to the agricultural community that we needed to be more aware of nitrate utilization and what was happening. Pesticides and their breakdown products was another early USGS study that was extremely valuable and helped set the stage for the research agendas of other partners. USGS reports and peer-reviewed literature are important, and it is helpful that more and more are available on the Internet. Partners can help in making data and information beneficial to society in ensuring that data are converted into information and that the information is used in policy and by decisionmakers. The USGS daily streamflow map from last summer's drought is an excellent product and an excellent example for partnering. Questions that need to be answered are: whether there is there enough information captured that a local watershed planner, a municipality, or an agricultural provider could use this information? Could this be a tool for a municipality to switch from surface water to ground water during a drought? How to deal with riparian issues, where anyone from agriculture can throw a line in that stream and pull water out? Can this information not only show when an area is getting into drought conditions but also be used in a predictive mode, which could allow better policies to be put in place and enable the agriculture community to have some pre-notice of pending economic losses? And how can we use information about low flows predictively to deal with environmental impacts that could help preclude restoration later on to the natural ecosystem? Looking at land use and GIS applications, NIWR has a vision to develop a method in cooperation with USGS to allow users the ability to dynamically overlay digital orthoquad imagery on GIS data layers through their browsers. NIWR wants to ensure that GIS layers, such as roads, water, land cover, land use, and geology, along with economic, social, and ecological layers, can be integrated for local information delivery. Data must be at the level of detail needed, such as the 14-digit hydrologic unit codes for watershed management, which is the level at which most communities want to look at their watersheds. For local communities, which are developing wellhead protection programs, information is needed about recharge areas. Proactive, cooperative approaches can be taken in partnering on data gathering and utilization – ensuring that the right kinds of data at the right level of detail are available. Water-use data are a critical need – not just for the data, but also in partnering in the multiple sets of data needed. The Michigan Water Resources Institute has pioneered a virtual course in watershed management, which emphasizes partnerships with stakeholders affected by resource management decisions, a geographic focus for management activities, and management techniques based on strong science and data. Course material is linked to EPA and USGS web sites. Priorities of the NIWR institutes are set cooperatively with State advisory boards, made of up State and local organizations across many disciplines, Federal input, and the USGS, through the external grants program, which represents a good cross-section of university, community, and USGS needs.

Attachments

The following statements supplement comments made by customers at the listening sessions, and are presented in alphabetical order:

Air Line Pilots Association, International

The Air Line Pilots Association representing 55,000 pilots flying for 56 airlines in the US and Canada, has had a productive twenty year association with USGS. This Association began its involvement with the eruption of Mt. St. Helens.

The Cascades Volcano Observatory (CVO) readily included the Air Traffic Control Center in their call down list, after the Mt. St. Helens eruption. When volcanic activity moved to Alaska with the eruption of Mt. Redoubt, the Alaska Volcano Observatory (AVO) continued USGS cooperation with the aviation community. AVO developed the color code that gave aviation and the community at large the present status of active volcanoes. The success of the Alaska code led to the International Civilian Aviation Organization (ICAO) adoption of a similar code for international use.

The AVO and CVO have, through the Volcano Disaster Assistance Program (VDAP) teams, met the needs of foreign countries and US airlines. Again ALPA along with ICAO has been able to assist teams in the education of foreign volcanologists to the needs of aviation – no small task.

Satellites have been a great help in both remote and not so remote areas. The expertise that USGS brings to bear in the interpretation of satellite information and imagery by volcano observatories must be brought to full potential. Case in point – a Russian volcano showed a thermal anomaly. Based on the history of the volcano, Kamchatka Volcanic Event Reporting Team (KVERT) was alerted by AVO and the subsequent eruption was reported.

Research Partners and hazards communications contacts for the USGS Volcano Hazards Program is a national issue, especially for the nation's complexly integrated air traffic operations. Important partners (e.g., DOD, NASA, FAA, NOAA, air carrier industry interests), including funding sources, are located in the Reston-Washington DC area.

Each of the USGS volcano observatories (Alaska, Cascades, Hawaii, and Long Valley) and the Volcano Disaster Assistance Program, has unique issues for monitoring volcanic activity and addressing potential hazards in the geographic areas of those observatories, and for the sake of efficiency in funding and personnel. The Volcano Hazards Team is intentionally designed to exchange personnel and disciplines (physical volcanology, seismology, satellite remote sensing, gas geochemistry, geodesy) as needed throughout the team so that when a volcanic unrest is detected at any volcano, team members at all localities can be called upon to participate in response activities as needed. These scientists must have skills for rapid assimilation of a variety of real-time information, rational interpretation, and rapid communication to appropriate emergency managers and the public. Unlike response to earthquakes which are unpredictable, volcanic eruptions can take months to years of 24-hr duty to monitor pre-eruption buildup and post-eruption activity, thus the importance of having uniquely trained staff that can be rotated and refreshed.

Ash clouds from explosive volcanic eruptions can transit the entire US because ash gets into the atmosphere and the prevailing winds and jet streams move west to east. Examples include Augustine (AK) 1976, Mt. St. Helens 1980, Redoubt (AK) 1989-90, and Spurr 1992. Ash from the Spurr eruption in 1992 was the only one of these ash clouds that did not cause jet aircraft damage over the conterminous US because research on past eruptions and communications efforts by USGS volcanologists and their partners followed the path of the Spurr ash clouds and gave timely warnings. The air carrier industry in the US gives close attention to information from the volcano observatories to the point of canceling and diverting flights rather than risk flying into a volcanic cloud.

ALPA encourages USGS to increase its efforts to acquire adequate funds and staffing that will mitigate the volcanic ash hazards to aviation operations worldwide. The last twenty years have shown the strengths and

weaknesses of the USGS volcanic ash mitigation efforts. The future will sorely test the present system as air traffic and volcanic activity increases.

American Bird Conservancy

The biology/ecology role of USGS – research in the laboratory and field – is more important than ever today given the number of stressors in the environment and their complex interactions. USGS-BRD research expertise is integral to conservation, scientific, and regulatory efforts to gather information to make sound management decisions.

I want in particular to focus on the need for increased resources for BRD contaminant research and monitoring for living resources, especially migratory birds, for which DOI holds explicit stewardship responsibilities.

USGS-BRD provides vital support for investigating wildlife mortalities. This includes both field investigations and laboratory diagnostic work to identify causes and strategies for minimizing or mitigating impacts. Information from this work (especially when informed by and coordinated with work of USFWS DEC and USEPA) is critical to understanding not only (1) viral and bacterial diseases and (2) the effects of pesticides and other contaminants, but instances where these two areas of concern interact. One example: exposure to contaminants may contribute to Avian Vacuolar Myelinopathy the disease that has caused the deaths of over 60 Bald Eagles and many more waterfowl in recent years.

USGS-BRD laboratory resources are sorely in need as many birds who are victims of contaminants poisoning go undiagnosed because of limited capacity for necropsy and chemical testing. Laboratory research not only provides answers for individual incidents, but provides an understanding of the mechanics behind toxic effects that allows extrapolation of such effects to populations and communities.

USGS BRD monitoring and research on the effects of contaminants (including pesticides) on fish and wildlife have continuously produced scientifically sound data, but this tradition seems imperiled by decreasing funding, personnel shifts away from laboratory and field work, and lack of coordination with also diminishing USFWS EC resources.

More resources need to be committed to the systematic and consistent review of wildlife mortality incidents not only to better understand the incidents themselves but also to locate patterns and trends, anticipate further problems and seek scientifically informed mitigation and regulation. These are all areas where USGS-BRD scientists can make significant contributions.

Right now we are working with a generation of pesticides rapidly becoming obsolete. As we speak, new classes of chemicals are being introduced. Pesticides with no field testing, unusual modes of action and many with no available biomarkers. We need a firmer grasp of what current ecological effects are; and we need to organize our scientific resources on the ground to understand and respond to future issues effectively.

American Bird Conservancy is working with NGO, government and industry partners to gather comprehensive scientific information on the ecological impacts of currently used pesticides on birds better to inform advocacy, mitigation efforts and legislation, and to define the scientific network that can effectively document and verify the effects of changing pesticide use.

USEPA, urged by its independent SAP mandated by FIFRA to consult on toxics issues, has begun to call for an intensification of information gathering on the basic ecology of birds and the mechanisms and variance of toxic effects based on variables in the field.

USGS-BRD expertise is needed and can play an invaluable role in these efforts to make scientifically sound regulatory and management decisions.

National Ground Water Association

Scientific Issues—Investigative Tools

Geologic Mapping of Ground Water Resources
At the present time, aquifers are not mapped well throughout the Nation, particularly in the Great Lakes Basin. The states of Illinois, Indiana, Ohio and Michigan have joined with the United States Geological Survey USGS) in an effort to map these four glaciated states to bedrock at a scale of 1:24,000. Availability of ground water must be known for potential future resource development, as well as for on-going assessment of current uses. Unfortunately, aquifers in the area are not mapped well because the glacial cove limits the number of good outcrops and makes such mapping very expensive. While the USGS has been enthusiastically involved, funding remains inadequate.

Geophysics
The USGS could benefit the Nation by conducting more research and evaluation of the application of both surface and borehole geophysics to shallow ground water problems, both water supply and water quality, including development of better methods to detect and map the presence of dense non-aqueous phase liquids (DNAPLs) in the shallow subsurface. Additional work in the application of geophysics to contaminant hydrogeology, particularly non-intrusive site assessment and monitoring is needed.

Ground Water & Well Benchmark Network
While the USGS currently utilizes a national network of ground water observation wells, it would be useful to either expand this network and/or to make this water level and water quality data available in both tabular and graphical form on a near-real-time basis through the Internet. The current network could be expanded through a state cooperative program. One idea would be to include weighted reported based on data QA/QC.

Permeability Pathways
Better methods are needed to predict or measure permeability pathways in highly heterogeneous environments, such as karst terrains or fractured rock aquifers. This is critical both for predicting and understanding well yields and also predicting and understanding contaminant migration in these common, but complex hydrogeological settings. This would be an excellent opportunity for further collaborative research with the U.S. Environmental Protection Agency regarding what treatment technologies are effective in these settings.

Science Issues—Future Uses of Ground Water
Ground Water Recharge
The USGS could do more to measure ground water recharge and predict how recharge will change in the future tin response to climatic change, urbanization, or other non-hydrologic stresses.

Ground Water Reuse
An investigation into the use of reusing ground water as a supplement to natural or untreated waters would be of benefit to the Nation. Further research, followed by public educations, should be conducted to establish if the use of reused ground water is an acceptable alternative for replenishing ground water supplies. (See Reclaimed Wastewater Reuse below.)

Ground Water Usage
As perhaps could be anticipated from several issues raised above, the National Ground Water Association (NGWA) believes there is value to the Nation for the USGS to conduct in-depth studies, technical analyses and forecasts of water quality and water quantity in order to meet existing and future water supply requirements.

Reclaimed Water Use
An investigation into the use of reclaimed wastewater as a supplement to natural or untreated waters would be of benefit to the Nation. Further research, followed by public education, should be conducted to establish if the use of reclaimed water is an acceptable alternative for replenishing ground water supplies.

Salt Accretion in Ground Water
While this is a long-studied problem, the problem appears to becoming more serious in geographic areas which are struggling to transfer water, extract from different aquifers, and blend surface and ground waters in order to maintain existing land uses. At the same time, it appears that ground water quality commonly worsens in these settings because the total water budget is not being evaluated.

Subsidence
Again, a long-term area of scientific investigation, but further research and monitoring are justified for geographic areas that are looking to implement or expand water transfers so as to prevent loss or reduction in ground water storage.

Surface Water/Ground Water Interaction
While this subject has been explored to establish the relationship, it now calls for greater understanding of the implications of the interaction for use in water management of basins.

Wastewater Facilities
There is a need for the USGS, perhaps in cooperation with he U.S. Environmental Protection Agency and the private sector, to investigate the magnitude of impact from evaporation/percolation facilities and the infiltration of wastewater to ground water.

Non-Scientific Issues
Access to the Work of the U.S. Geological Survey
Although significant strides have been made in making USGS water-resources data, reports and software available through the Internet, more effort is needed to do this more extensively, more consistently, and more timely. Perhaps it will be worthwhile for the USGS to examine how it shares its works in progress or completed works with other employees of the USGS, as well as with non-Survey sources, such as other Federal agencies, state and local governments, colleges and universities, and relevant professional societies/associations.

Commitment to the USGS's Future Excellence
Like with other Federal agencies, the scientific staff of the USGS appears to be aging. The USGS may benefit from conducting an assessment of its human resources and examine its need to recruit talented and visionary young scientists and engineers to its workforce now so as to benefit from mentoring with the current workforce.

Funding
Many important research projects are either unfunded or are inadequately funded. Funding for the Water Resources Division and for ground water research could be increased to levels more commensurate with the magnitude of the Nation's dependence upon the resource, and the costs associated with maintaining a safe ground water source. While current congressional practices may limit this, it may be worthwhile for the USGS to advocate for indexing long-term funding of projects to the cost-of-living in order5o sustain the viability of projects over the long-term.

Interagency Cooperation
The National Ground Water Association would like to see a strengthening of interagency cooperation, particularly between the USS and the U.S. Environmental Protection Agency, for example the Toxic Substances Research Program that works to increase the understanding of fate and transport of contaminants in the subsurface.

Partnering
USGS should look to partnering more frequently with state governments, non-governmental organizations, such as the National Ground Water Association, and private consulting firms to maximize the utilization of professionals and to minimize the costs for intrastate and interstate projects. For example, the National Ground Water Association is cooperating with USGS to host a congressional staff briefing on southwestern U.S. ground water issues later this year.

OhioView Consortium

Gateway to the Future: OhioView Pilot

Blueprint for a National Satellite and Geographic Information System

Summary: Plan for the National Expansion of Gateway to the Future—Ohio View Pilot

Satellite and related geographic information are crucial for many aspects of education, research, government and industry. Accordingly we ask the USGS to help us expand the pilot program across the United States. From our experience with Gateway to the Future: OhioView Pilot, we have identified the following key elements for the success of the National Gateway to the Future satellite and geospatial data access and applications program.

1. Continued reasonable data prices for non-commercial users.
2. Continued balanced satellite data policy, which allows data and cost sharing by non-commercial users.
3. Stable, long-term supply of consistent moderate resolution, Landsat specification satellite data.
4. Continued support for a satellite data archive and distribution system at the USGS EROS Data Center.
5. Continued USGS/NASA cooperation via EROS and local NASA Research Centers with the establishment of the first of several joint USGS/NASA applications research offices at the NASA Glenn Research Center. Other likely sites include NASA Stennis, NASA Ames, NASA Goddard and/or NASA Langley.
6. Continued consultation, involvement, support and expansion of potential and current users through establishment of a superconsortium of non-commercial users based at the University of Cincinnati given that we have done most of the development work and succeeded in establishing a very successful, very low-cost pilot with approximately 7% of the total project funding.
7. We do need a modest level of stable multi-year funding from USGS headquarters to manage and develop the Gateway to the Future pilot project into a national program and to facilitate educational, research, state and local government applications.
8. We request that the national expansion of the OhioView pilot be managed under the direction of Barbara Wainman as she has been instrumental in its development since its earliest phases and knows the program well. We would appreciate designation of a member of her staff as the USGS headquarters point of contact for the Gateway to the Future Consortium.

Progress Report on the OhioView Pilot

Despite their value, satellite data have been underutilized largely because of policy barriers, the cost of computer hardware, the cost of satellite data, the cost of remote sensing software, and logistical barriers to timely data access. The last issue is important to resolve because satellite and other geospatial data are most valuable at the moment they are acquired as many applications such as agriculture, disaster management and defense are time sensitive.

Congress removed the barrier to Landsat data access in 1992 with Public Law 102-555. Recent explosive growth in computer technology has removed the price barrier to computer hardware. OhioView was started in 1996 to remove the last three barriers to the widespread application of satellite data to everyday life, namely, high data cost, expensive software and slow data access.

OhioView is a grass-roots effort by Ohio universities, state and local government to make USGS Landsat-7 and NASA MODIS and ASTER data available to the general public, education and research as well as local, state and federal government users in near-real time, primarily for non-commercial purposes. The system was designed so that taxpayers will receive maximum benefit at minimum cost through a partnership of the USGS, NASA, state and local government industry and academia. For less than $5 million per year, the public is finally receiving a significant return on its multi-billion dollar investment in USGS and NASA remote sensing research, development and satellites. The low cost of the system was made possible by cooperation between the USGS, NASA, Ohio governments and academia. Of necessity, any and all existing resources were leveraged. Infrastructure investments were focused on the USGS EROS Data Center in order to take full advantage of network economies of scale. Approximately 7% of

total funding during the first three years was used at the state and local level for applications research and implementation.

Academic, local, state and federal agency cooperation coupled with focused investments in USGS and NASA infrastructure represents a lean and efficient model for the national expansion of the Gateway to the Future satellite and geospatial information access network. The State of Ohio purchases routine Landsat-7 coverage on a subscription basis. **This data *purchase* is possible because non-commercial users are allowed to share data and the cost of the data**.

Ironically, the success of the OhioView model for Landsat-7 data and cost sharing between consortia of non-commercial users has lead one progressive high-resolution commercial satellite data supplier to offer similar terms for its commercial data. The result is **a new and viable market for high-resolution commercial satellite data**. In this model publicly funded (but commercially operated) facilities such as the USGS EROS Data Center act as intermediaries and the long-term deep archive for public purchases of commercial as well as government satellite data. NASA Research Centers provide much needed technical and logistical support for "bleeding edge" ultrahigh bandwidth information technologies while the USGS supplies scientific expertise for applications research.

Routine Landsat-7 data are then transmitted within hours of acquisition from the USGS EROS Data Center in Sioux Falls, South Dakota to the NASA Glenn Research Center in Cleveland, Ohio via high-speed terrestrial and communications satellite links. Landsat-7 satellite data are then transmitted to 85 Ohio colleges, universities via the Ohio academic network. State and local governments users may access Landsat-7 data via servers located in Columbus and Akron or via the state academic library system. A sample of the OhioView pilot's accomplishments to data follows.

OhioView Pilot Data Specifications
A complete set of Ohio View Pilot data specifications have been developed and forwarded to the USGS EROS Data Center.

OhioView Pilot Legal Agreements
A memorandum of agreement was drafted and signed by the OhioView charter members and later amended to allow for expansion of the consortium. The agreement includes USGAU restrictions that limit the use of Landsat-5 data to non-commercial purposes. We seek USGAU status for Native American governmental and educational institutions to help us collaborate with them in our distance education and cooperative research efforts with regard to land use change on tribal lands.

OhioView Pilot Operations Concept Documentation
The USGS EROS Data Center, NASA Glenn Research Center, the NASA Ames Research Center and the OhioView consortium contributed to a detailed operations concept document, which serves as a technical blueprint for the pilot project and its national expansion.

OhioView Pilot Plan for State and Local Government Use of Satellite and Geospatial Data
An extensive and detailed plan for access to and application of satellite and related geospatial data to state and local government issues has been developed by the Ohio Geographically Referenced Information Program (OGRIP), the Ohio GIS Support Center and the OhioView universities.

OhioView Public Access to Remote Sensing Data Pilots
Proof-of-concept satellite data servers at NASA Glenn and OhioLINK are now operational and provide internet access to pre-processed natural color and vegetative health images of sample Landsat data sets. These servers will be upgraded during FY2000 to display near-real-time Landsat-7 imagery as part of an agricultural early warning and land use information system for the state of Ohio.

OhioView K-12 Multidisciplinary Education Pilot
The OhioView pilot has developed a fully operational program of K-12 workshops and a complete set of multimedia teaching materials created by elementary, junior high school and high school teachers and made

available to all via the internet. These on-line materials cover subjects as diverse as physics, math, business, geography, earth science and music.

OhioView Undergraduate Remote Sensing Education Pilot
More than two thousand Ohio undergraduate students in geography and geology course benefit from teaching materials derived from Landsat data each year. We expect student awareness of the value of satellite remote sensing to increase rapidly as the number of faculty using and teaching remote sensing increases in Ohio. The number of faculty actively teaching remote sensing in Ohio has risen from approximately 8 to more than 25 since OhioView data cost sharing began in 1997. Four Ohio university faculty members have been hired with the educational and research opportunities afforded by the OhioView pilot project in mind.

More than two hundred undergraduate students at eight Ohio universities receive instruction in introductory remote sensing each year. Although the consortium was organized primarily to share the cost of satellite data, the consortium is currently in the process of selecting a vendor for a $100,000 state-wide site license for remote sensing software to expand our undergraduate remote sensing education program. The state-wide remote sensing software license will compliment our state-wide GIS software license. OhioView is already producing new opportunities for students and new profits for the remote sensing software industry. The market for remote sensing software and commercial satellite data will continue to grow as our students graduate with an awareness of the utility of satellite imagery.

The Ohioview pilot has also developed the first draft of an on-line set of instructional materials for undergraduate remote sensing education. These materials will be upgraded and place on-line during the summer of FY2000.

OhioView Graduate Remote Sensing Education Pilot
The number of Ohio graduate students active in remote sensing research has increased by a factor of approximately five since 1997. This is a direct response to the ability to share the cost of satellite data among members of the consortium. We expect this number to increase now that we are receiving near-real-time Landsat-7 data on a regular basis and are able to address time-sensitive research issues. Naturally, as soon as our graduate students receive Landsat-7 data, they ask us to provide high-resolution commercial satellite data as well. These undergraduate and graduate students represent the future customers and work force of the commercial remote sensing industry.

OhioView Native American Outreach Pilot
OhioView has partnered with the Leech Lake Tribal Government, the NASA Glenn Research Center and the USGS EROS Data Center to develop a hands-on teaching laboratory for remote sensing education on the Leech Lake Reservation. Technical support including a high-bandwidth internet-via-satellite link is provided by NASA Glenn to carry distance education course, teaching materials and research data between Minnesota and Ohio.

OhioView Farmland Loss Land Cover Change Pilot
Eight OhioView universities are collaborating with the Governor's Task Force on Farmland Loss to provide a quantitative analysis of the farmland loss. The logistics with regard to the data required for the analysis are almost complete. During the remainder of FY2000, we will provide quantitative input for "what if" policy models to evaluate alternatives in collaboration with the task force. Detailed descriptions of these pilot project elements have been provided to Congress, USGS EDC and NASA Glenn.

Ohioview Pilot Benefits to Industry
For example, students trained in remote sensing and GIS expand the market for high-resolution satellite data, software and hardware. Similarly, affordable moderate resolution USGS data products expand the market for high-resolution commercial data and value added services by making students, researchers, small businesses, federal, state and local government aware of the utility of geospatial information.

Far-sighted corporations such as Apple Computer, Microsoft, ESRI and others have understood the synergy between education, research and increased market share for many years and continue to reap the long-term

benefits of cooperation through market growth created by college graduates. As the pilot project for Gateway to the Future, OhioView seeks USGS assistance with regard to forming a similar partnership between education, research, government and industry for the application of geospatial information in general and satellite data and information technology in particular to local and national opportunities and challenges.

Need for the USGS as the Federal Agency Responsible for Geospatial Data Coordination and Distribution

USGS-contracted air photographs, topographic maps, digital orthophotoquadrangles, digital elevation models and satellite imagery are the foundation of geographic information systems in the United States. USGS oversight assures that these contracted data sets conform to consistent national accuracy standards and are available in consistent geographic parameters and scales. These accuracy standards and consistent formats facilitate the seamless use of geographic information and imagery by the educational, research, governmental and industrial communities across the nation.

Industry benefits from USGS geospatial information through contracting, value-added and retail opportunities, increased public awareness (leading to market expansion) and from the information itself through informed management that increases profits and decreases cost and risk. The K-12, undergraduate and graduate educational communities benefit from affordable, high-quality teaching materials for geography, geology, physics, mathematics and the humanities. Researchers benefit from affordable, accurate and consistent geographically referenced information and imagery.

These same quality USGS data sets enable federal, state and local government to increase the efficiency of government (reducing taxes), protect our environment, manage natural hazards, improve agriculture, monitor land use, plan for development and prepare for climate change. The public benefits from a better environment, reduced taxes, and increased productivity.

Future USGS Satellite Data Policy – The Need for a Balance of Public and Private Interests

We ask that the USGS continue its current policy of acquiring and distributing affordable moderate resolution geospatial information with minor modifications. Most USGS geospatial data work is currently contracted out to the private sector for the sake of efficiency. High-resolution geospatial data products at scales larger (finer) than 1:24,000 are usually left completely to the private sector.

Landsat-7 Era

Moderate spatial and temporal resolution USGS Landsat-7 data are a scientific bonanza for education and research and provide a stepping stone for state and local government into the world of high-resolution satellite imagery. We request that the USGS continue to operate Landsat-7, to keep its data in the public domain and to distribute it in accordance with its COFUR policy via the EROS Data Center. We ask that the USGS modify its current data policy to allow the acquisition and distribution of amount of commercial high-resolution (sub-15-meter) data for educational and research use via the USGS EROS Data Center.

Landsat-8 Era

We ask that the USG begin planning for the “Landsat-8” era by either contracting for a successor Landsat-8 satellite or by preparing a long-term contract to purchase routine national moderate resolution commercial satellite data with Landsat specifications. Regardless of their source, Landsat-8 era satellite data must be spatially and radiometrically consistent with previous Landsat-7 and earlier Thematic Mapper data for internal consistency as this data set is one of the key elements for the monitoring and management of climate change. We ask that Landsat-8 era data, regardless of source, be archived at and distributed from the USGS EROS Data Center for use by educational, research and federal, state, local and tribal governmental institutions including Native American tribal governments, schools and colleges because we are building high-bandwidth educational and research networks focused on EDC.

If commercial data are purchased with public funds in lieu of Landsat-8, we ask that the non-commercial communities listed above be allowed to purchase the data from the USGS EROS Data Center in accordance with USGS COFUR policy and to share the data and the cost of the data for non-commercial purposes

including but not limited to distance education and collaborative research, and federal, state and local government research and land management issues.

In preparation for the post-Lansat-7 era, we would like to work with the USGS EROS Data Center, NASA and the private sector to provide continued routine national satellite data sets and annual global snap shots with Landsat-specification data. To do this we plan to form a superconsortium of educational, research and other non-commercial users in support of the Gateway to the Future Program.

U.S. Forest Service

Introduction

The USDA Forest Service administers 8 percent of the land area of this country, in 155 national forests and 20 national grasslands located in 33 states covering almost 192 million acres. Over 60 million people living in 3,400 communities get their drinking water from these lands. The Forest Service is essential the largest and most important provider in the Nation. To carry out this role, the Forest Service is the second largest employer of hydrologists in the Nation – only the U.S. Geological Survey employs more water scientists.

To understand how we carry out our mission of "Caring for the Land and Serving People," we are organized into three major branches – National Forest System; Research and Development; and State and Private Forestry – each of which operates various water-related programs.

National Forest System

We are a decentralized, line-staff organization that attempts to leave decision-making at the lowest possible level. There are 4 levels: 600 Ranger Districts, 155 National Forests, 9 Regional Offices, and D.C. headquarters. The Ranger Districts cover from about 100,000 acres to over 1 million acres each and is where most of the work is done, such as measuring precipitation and streamflows, taking water-quality samples, meeting with forest users and permittees. About one-quarter are staffed with hydrologists. About two-thirds of the 155 national forest supervisor offices are staffed with journey-level hydrologists that also perform field sampling and data analysis, participate in technical advisory committees with other Federal, State, tribal, and non-profit organizations. All 9 regional offices are staffed with teams of hydrologists that provide technical, tactical guidance to the forests.

Needs and Issues

1. Stable network of streamgaging stations. We often need to quantify water yield from the national forests and grasslands, including annual fluctuations. Loss of many key USGS gages has hurt our ability to do this.
2. The USGS ground-water resources inventory needs to be greatly improved and simplified if possible. The RASA reports were a good start, but the need for more detailed data and time trends in water table depths in mountainous areas is growing fast.
3. Quantification of water quality constituents for TMDC calculations and modeling is an important need virtually everywhere as long as the courts require TMDL assessments.
4. Interagency assessments of watershed conditions, such that judgments about "watershed health" and the state of aquatic resources are rapidly growing in importance to all segments of society. Implementation of the Montreal protocols for soils, water and air quality is starting and there are many unresolved questions about how to do it effectively.
5. Economic research on the value of water for various uses.

Research and Development

Our 70 research hydrologists carry out intensive data collection activities in support of small watershed studies over long time periods. Cooperation with USGS scientists is ongoing at our 32 research study sites, and a national MOU between the two agencies provides for transfer of funds. While this has been productive, more can be done.

Needs and Issues

1. Research on the effects of outdoor recreation and wildlife pathogens upon drinking water quality and human health needs to be greatly increased.
2. How to accurately predict the toxicity risk of blue-green algae blooms in lakes and reservoirs.
3. Development of cost-effective procedures for mitigating acid mine drainage in remote locations.
4. How to measure cumulative effects of past and current management practices upon water quantity and water quality at different spatial and temporal scales.
5. Effects of nitrogen deposition upon forest soils and waterbodies. The existing NADP network needs to be funded by all partners.
6. Cooperative instream flow studies, including both flow frequency analysis and bedload transport measurements, need to continue in support of Federal water right claims in ongoing litigation.
7. Research on predictive models for landslides, floods, droughts and other natural disasters should continue in an interagency, interdisciplinary manner.

State & Private Forestry

This is primarily technical assistance, with some financial assistance, to States, tribes, cities, and private forest landowners on ways to improve management of non-Federal forest lands in more sustainable ways. It includes cooperative fire assistance, forest stewardship, urban and community forestry, insect, disease and invasive weeds programs, and $9 million for economic action program grants.

Needs and Issues

1. Public outreach and conservation education of target groups through various media needs to become a more important focus by many government agencies, including USGS.

National Marine Fisheries Service

Joint Ongoing Activities

C&MG (J. Williams & P. Barnes) presentation at EFH workshop – winter '97

USGS/NOAA Workshop, Relating Biological Resources to the Geology of Benthic Habitats (research topics identified) – May '98

Joint initiative development, Effects of Fishing Activities on Benthic Habitat – May '98-June '99

NOAA/USGS Coordination Group briefing on joint initiative – May '99

Joint initiative briefing for USGS Associate Director – June '99

Joint initiative briefings for NOAA Assistant Administrator and Deputy Assistant Administrator for Fisheries, NOAA Assistant Administrator for Office of Oceanic and Atmospheric Research, and Chief Scientist of NOAA National Ocean Service – July '99

Regional workshops to develop 5 year plans for activities under the joint initiative – May '99-present

Now planning joint symposium to present results of joint activities – winter 2001

NOAA Committing Dollars

FY 1999: Base program approx. $1million/yr
FY 2000: +$.375M
FY 2001: +$1.000M
FY 2002: +$3.000M
FY 2003+: Ramp to $10million/yr

Figure 1. Fishery Management Plans (included map, only text shown here; *designates joint plans)

Secretarial Plans
- Atlantic Tunas, Swordfish & Sharks
- Atlantic Billfish

Pacific
- Groundfish
- Northern Anchovy
- Commercial & Recreational Salmon

North Pacific
- Groundfish Gulf of Alaska
- Groundfish Bering Sea

- High Seas Salmon
- Bering Sea & Aleutian Is. King & Tanner Crab
- Scallop

Western Pacific

- Crustaceans
- Precious Corals
- Bottomfish/Seamount Groundfish
- Pelagics

Gulf of Mexico

- Spiny Lobster*
- Coastal Migratory Pelagic*
- Coral & Coral Reefs
- Stone Crab
- Shrimp
- Reef Fish
- Red Drum

Caribbean

- Spiny Lobster
- Shallow Water Reef Fish
- Corals & Reef Assoc. Invertebrates
- Queen Conch

South Atlantic

- Snapper-Grouper
- Atl. Coast Red Drum
- Coral, Live/Hard Bottom
- Shrimp
- Golden Crab
- Coastal Migratory Pelagic*
- Spiny Lobster*

Mid Atlantic

- Mackerel, Squid, Butterfish
- Surf Clam & Ocean Quahog
- Atlantic Bluefish
- Summer Flounder, Scup, Bass
- Spiny Dogfish

New England

- Atl. Herring
- NE Multispecies
- Atl. Sea Scallops
- Atl. Salmon
- Monkfish

Magnuson-Stevens Act

Sec. 303

"Any fishery management plan…prepared by any Council or by the Secretary [of Commerce], with respect to any fishery, shall –

"(7)…minimize to the extent practicable adverse effects on [essential fish] habitat caused by fishing…"

NOAA/USGS Joint Initiative

Effects of Fishing Activities on Benthic Habitat

Two Themes

A) Determine the Effects of Fishing Gear on Seabed Habitats
B) Identify & Map Benthic Habitat Characteristics & Extent of Fishing Impacts

Projects

<u>Georges Bank</u>

<u>Hudson Canyon South</u>

Gulf of Mexico, South Atlantic Bight, Caribbean

Oculina Bank
U.S. West Coast
Eastern Bering Sea (EBS)
EBS Gear Dump Areas
Aleutian Islands
NW Hawaiian Islands
Main Hawaiian Islands
Stellwegen Bank
NY Bight/Southern New England Shelf & Slope
West Florida Shelf
Shelf/Slope Along US West Coast
Central Gulf of Alaska
Nearshore Southeast Alaska
NW Hawaiian Islands

Partners

USGS: Geologic Division (Coastal & Marine Geology), Biological Resources Division
OAR/National Undersea Research Program, Environmental Research Laboratories, Sea Grant
NMFS: Fisheries Science Centers, Regional Offices
NOS: Coast Survey, National Centers for Coastal Ocean Science, Center for Coastal Fisheries & Habitat Research (Beaufort), Coastal Services Center, Office of Ocean & Coastal Resource Management

Regional Workshops

[prioritize, select area(s), scope details]
NE – May 3-4, 1999, Narragansett, RI
SE – Dec. 7, 1999, Miami; Follow-on TBD
AK – Jan. 25-27, 2000, Juneau, AK
SW & NW – Jan. 21, 2000, Monterey, CA

SEFSC Workshop

Held Dec. 7, 1999 – Miami, FL
In-house only
Issues addressed:
What is known?
- What are the gaps?
- What are the priorities?

Draft report Feb. 17, 2000 + bibliography
Follow-on workshop with USGS *et al* TBD

SW/NWFSC Workshop

Held Jan. 21, 2000 – Monterey, CA
NMFS, NOS, OAR, USGS, UNH
Issues addressed:
- Review of ongoing & planned activities
- Coordination between groups
- Development of 5 year plan

Report being drafted

AKFSC Workshop

Held Jan. 25-27, 2000 – Juneau, AK
NMFS, NOS, OAR, USGS, ADFG
Issues addressed:
- Review of past & ongoing research activities
- Presentation of RO management needs
- Coordination between groups
- Development of 5 year plan

Five-year plan completed Feb. 25, 2000

WHAT'S NEEDED

Seafloor Characterization
USGS collect, analyze, & georeference digital backscatter & bathymetry data for:
1) Priority areas within each NOAA/NMFS Region (TBD via joint workshops)
2) Entire Continental Shelf and Slop
3) Entire U.S. EEZ
4) Estuarine areas

Desired products (suitable for GIS ArcView or ArcInfo)
1) Digital mosaic backscatter imagery
2) Full-bottom bathymetry

Effects of Fishing Activities
1) Determine spatial extent of fishing induced disturbances on the seabed
2) Collect & analyze high resolution (small areal coverage) data to determine effects of fishing on specific habitat types.
3) Develop methods to extrapolate data from site specific study to shelf-wide application (area of Fisher Management Plan).

Natural & Non-Fishing Related Change & Stability of Seabed
1) Determine natural & non-fishing (e.g., cable laying, mining) induced rates of change on the seabed by repeatedly collecting & analyzing data over time for both representative areas & areas of particular interest.
2) Interpret these data for particular areas, depths, & habitats.

Data Uses
USGS is a vital partner in helping NOAA/NMFS do the following:
1) Identify & describe effects of fishing activities on bottom habitat of U.S. Continental Shelf & Slope
2) Determine extent of anthropogenic impacts on seabed
3) Monitor change in seabed habitat
4) Link biota to seabed habitat
5) Identify & describe essential fish habitat
6) Identify Habitat Areas of Particular Concern (HAPC)
7) Manage resources

STATEMENT OF SUPPORT
Science Director NEFSC – The proposed NOAA/USGS Joint Initiative on seafloor habitats and fishery resources is **timely and important**. The joint initiative will **leverage the strengths of NOAA and USGS** and ultimately product a better understanding of the relationships between benthic habitats and fisheries. The resulting information will be **directly applicable to management of fisheries** in the EEZ.

National Marine Sanctuaries

Discover the National Marine Sanctuaries
A Research Prospectus – February 2000
Science Plan for the National Marine Sanctuary System [*Note: Abbreviated version;* a *detailed listing of research efforts and needs in each of the National Marine Sanctuaries is included in the plan, but is not transcribed here*.]

GOALS
Infrastructure
Strengthen the quality and focus of marine research by ensuring that the national system of sanctuaries ahs adequate, qualified research staff, effective research and information management programs, and productive inter- and intra-agency partnerships.

Resource Assessment
Profile the structural and functional elements of Sanctuary ecosystems. This will include delineation of biological community dynamics, identifying links with abiotic processes, and evaluation the social, cultural and economic aspects of marine sanctuaries, and effects of human activities on natural systems.

Resource Monitoring and Research
Improve resource management decisions and strategies by implementing a quality research and monitoring program to document trends and produce information or data to guide day-to-day operations. The objective is to create a strong conservation science and monitoring program to support management of marine protected areas.

APPROACH
Principal functions of the NMSP are resource management, conservation policy development, resource protection, public education and outreach, and conservation science. Each contributes to and is guided by the others. Monitoring, site assessment, and research address the conservation science needs of the NMSP. These elements provide scientific information to: understand ecosystem function and change; ensure objective decision-making in responding to emerging management issues; allow for effective intervention, when appropriate, to mitigate damage and enhance the ability of natural communities to recover from human-caused injury; and form the basis of national policy. Effectiveness of these elements can only be assured by the development of strategic linkages with appropriate partnering organizations and plans. A variety of communication mechanisms will enhance the contributions of conservation science to other functions of the NMSP, and vice versa.

INFRASTRUCTURE
Staffing – Permanent scientific staff at each site is essential to carry out and direct research and monitoring to meet management objectives.
Data and Information Management – A well-designed information management and dissemination system will facilitate conservation science-based management.
Strategic Linkages – Partnerships will be used to expand federal, state, and local support for the NMSP, increase resource leveraging, and improve national ocean governance structure.

RESOURCE ASSESSMENT
Site assessment and characterization data will allow managers to better understand the protected natural and cultural resources and important environmental processes and threats in the NMSs. This will enable effective policy development, risk management, and threat reduction, as well as enhance education and outreach programs of the NMSs.

RESOURCE MONITORING AND RESEARCH
Monitoring – Monitoring data will be acquired and compiled, allowing managers to establish baseline conditions and discern trends so they may effectively conserve, enhance, and restore habitats and ecosystems.
Research – Research results will demonstrate linkages between nature and human activities, and contribute to effective resource management by facilitating information-based decision-making.

FUNCTIONAL INTEGRATION
The Science Plan is designed to provide information required for the development of informed conservation policy and resource management decisions, but also actively contributes to Marine Sanctuaries Division (MSD) education and outreach efforts. The MSD will integrate natural sciences with socioeconomic and cultural sciences to provide the foundation upon which successful protection, maintenance, and restoration of species and ecosystems can be accomplished. Feedback from these functional elements of the NMSP, in turn, bears on annual and longer-term science priorities and efforts. In combination, the MSD can address the diverse needs of its resource protection mandate.

National Ocean Service

Opportunities for USGS/NOAA Collaboration to Address NOAA Strategic Goals (Primarily based on GD and NMD. Expect similar opportunities with BRD and WRD) [**FY 02***Note: **X-N** = Known NOAA Initiative with potential for Joint; **X-J** = Known Joint Initiative; **X** = Opportunity for Joint Initiative]

NOAA Strategic Goal	Management Issue	USGS Contribution	Geographic Scope	Ongoing	FY 02*
Build Sustainable Fisheries	Fishery Habitat Preservation, and Restoration	High-Resolution Mapping of Coastal Ocean Seafloor Sediment Dynamics Geochemistry of Coral Reefs	Site Specific	X	**X-J**
	Geologic Controls on Habitat Gains and Losses (seagrasses, corals, marshes)		National/Regional	X	**X-N**
Advanced Short-Term Warning and	Improved Tsunami Warnings	Tsunami Generation (Observations and Predictions	US West Coast, Hawaii, Alaska	X	**X-N**

Forecast Services		Stream Gage Data		X	**X-N**
	Improved Flood Forecasts	Storm Beach Erosion Predictions	National		
	Coastal Erosion Warnings	Nearshore Bathymetry	National		
	Nearshore Wave Forecasts		National		
Sustain Healthy Coasts	Contaminated Sediments (Sources, Sinks, Transport)	Sediment Dynamics Geochemical Binding Process	National Problem Site-Specific Solutions		
	Eutrophication/Hypoxia	Role of Geology in Coastal Eutrophication and Hypoxia	National Problem Site-Specific Solutions		**X-N**
	Harmful Algal Blooms	Role of Geology in Harmful Algal Bloom Occurrences	National Problem Site-Specific Solutions		
		Seasonal, Interannual, and Climate-Scale Erosion Rates			
		Habitat Delineation/Mapping			**X**
	Coastal Erosion		National	X	
	National Marine Sanctuaries		National/Site-Specific	X	
Promote Safe Navigation	Accurate Navigation Charts	Topographic/Bathymetric/Shoreline Mapping	National Problem	X	**X-J**
		Shoaling Rates/Processes in Navigation Channels	National Problem Site-Specific Solutions		

National Weather Service

[***Note***: *Text only of handout provided, which contains several maps and graphics*]

Advanced Hydrologic Prediction Services – Water Predictions for Life Decisions

What?

Improved flood and river predictions to affect life's decisions (longer lead times; information for risk-based decisions)

Why?

75 percent of Presidentially declared disasters are associated with flooding events
Need to infuse new science into operations
Limited snow water equivalent data

Expected Results

Fast national delivery of web-ready graphical products (predicted river levels)
Extend existing 3-day river forecasts out to 2 weeks or longer
Provide information for risk-based decisions
Infuse science into operations
Refresh operational software
Collect snow water equivalent data nationwide

Program Services Rollout

ƒUse existing NWS resources for full model implementation at 60% of forecast locations
ƒFund full model implementation at remaining 40% high-risk locations
ƒGraphical products available when initial model implementation is ready
ƒPredictions with confidence level available when full model implementation is ready for a basin
ƒInundation maps available at all forecast sites when partners provide topographic data

Program Activities

ƒScience Infusion, ƒSoftware Refresh, ƒSnow Surveys, ƒTraining/Outreach, ƒVerification
Life Decisions
Flood and Drought Action Planning, Water Supply, Irrigation, Power Generation Scheduling, Evacuation
Customers
Federal/State Agencies, Non-Federal Officials, Emergency Managers, Industry, Hydropower, Navigation, Recreation, and Heads of Households
Š**Existing USGS/NWS Water Resources Partnership**
NWS mission is to provide river forecasts and warnings for
- The protection of life and property
- The nation's economic and environmental well-being

USGS activities critical to river and flood forecasting
- Collect water resources data including
  - Stream gage data
  - Precipitation data
- Maintain river-level versus river-discharge relationships (rating curves)
- Provide data via cooperative data bases and internet
- **Continue and expand special national USGS budget initiative**
  - Re-activate closed gaging sites in flood-prone locations
  - Expand telemetry capability of gaged data
  - Harden gages (install to withstand major flow events)
  - Open new sites to provide critical services to flood-prone areas
  - Extend rating curves beyond historical flows
  - Provide updated ratings in near real-time

Š**Potential new partnership – Flood-forecast inundation mapping**
> NWS can provide flood-forecast raster (overlay)
> USGS can obtain/coordinate the collection of enhanced topographic data

Institute of Marine Sciences, University of California, Santa Cruz

The USGS review of programmatic directions comes at an important time in the evolution and development of the marine science community around the Monterey Bay Research Crescent. As you strategize about your future directions and priorities I hope you will seriously consider how to increase the presence and integration of your people and programs in emerging scientific centers such as ours. The Monterey Bay research community is now home to 21 marine research and educational institutions or facilities employing about 1850 scientists and staff and with an annual budget in excess of $150 million. In recent years the institutions have joined together to form the Monterey Bay Crescent Ocean Research Consortium (MBCORC) to help further our collective interests related to the ocean and coastal zone. This concentration of marine related education, science, technology and policy is one of the world's most comprehensive and collaborative marine focused communities. In 1998 this uniqueness attracted President Clinton and Vice President Gore and other national leaders to hold the country's first National Ocean Summit along the shoreline of the bay. Although the USGS is an important member of our regional community (the cooperative agreements with both the Biological Resources Division and Coastal and Marine Team at the University of California, Santa Cruz), compared to other expanding programs, the USGS does not yet have a strong and visible regional presence. The USGS could become one of the Monterey Bay region's anchor institutions, joining NOAA, the University of California, and others. I urge you to be aggressive in strategizing how to expand your partnerships with communities such as ours to better leverage your strengths, expand your base of scientific colleagues and cooperative agreements, and increase you benefits to society.

Recommended Future Directions for USGS:
• Expand meaningful partnerships with University scientists.

Scientific collaborations between University scientists and USGS scientists can benefit both communities by building on individual strengths, resources, facilities and experience. Tangible examples of expanded partnerships would include: collocation of USGS integrated science units

on University campuses, funded cooperative agreements that engage universities in the agenda setting and research projects.

• *Co-located USGS integrated science centers in areas that benefit public/private partnerships.* Distributed science centers can provide increased access to and awareness of the unique contributions that the USGS can bring to everyday issues facing society. As USGS makes future plans for expansion and/or relocation, they should look carefully at how a reorganization of existing operations can enhance both the USGS and also specific regions.

Earth and marine scientists at the University of California, Santa Cruz are in general agreement with the summary of USGS future directions as presented in the Conference Announcement. We feel that the USGS is on track, that the critical earth sciences and related biological sciences issues have been included in their agenda and look forward to continuing to collaborate with the USGS of the 21st century.

The University of California at Santa Cruz has a 30 year history of close interaction and collaboration with the Menlo Park Center of the USGS which includes:

• teaching of occasional courses by USGS scientists,
• accepting USGS scientists as MA and Ph.D. students in our graduate programs,
• summer and part time employment of UCSC undergraduate and graduate students,
• a jointly operated research vessel,
• a 20 year cooperative agreement and housing sea otter recovery program of the Biological Resources Division (formerly USF&WS)
• a co-located group of coastal and marine team scientists through cooperative agreement on UCSC campus
•jointly developed and operated coastal imaging/GIS lab
• current plans to cooperatively develop a USGS Pacific Science Center at the University's coastal marine research center in Santa Cruz

Scientists within the Institute of Marine Sciences, the Earth Sciences, Ocean Sciences, and Biology departments have active research programs underway in a number of the areas identified by the USGS in Conversations with Customers including:

a. Coastal environments
b. Ecosystems
c. Environment and human health
d. Ground water resources
e. Hazards
f. Living resources
g. Land surface changes
h. Up-to-date maps and imagery

It is because of the parallel and overlapping nature of past and future research directions between the USGS in Menlo Park and UC Santa Cruz that we have developed a collaborative and complimentary relationship that has persisted for three decades. This culminated in a major effort to relocate the entire Branch of Pacific Marine Geology to UC Santa Cruz in the mid-1990's. Although national politics intervened at the last minute, we have successfully moved forward with a very productive but smaller scale collaborative relationship focused on coastal hazards and processes, coral reefs and marine habitats, contaminated sediments and sediment transport, hydrogeology of coastal aquifers, and the ongoing sea otter recovery project (Biological Resources Division). Because of the success of these efforts, however, and the synergism provided by this cooperative relationship, we have again embarked on a plan to develop a Pacific Science Center in Santa Cruz to accommodate a USGS integrated sciences program.

A focus on coastal environments is altogether appropriate for the USGS of the 21st century. In order to be healthy and productive over the long term, coastal oceans and the industries which depend on them need to be healthy and sustainable. It is apparent in California and elsewhere, however, that human activities have led to significant modifications of the earth's ecological systems, in particular those of the coastal oceans, threatening or seriously impacting the ability of these physical and biological systems to sustain themselves. Rapid population growth with all if its attendant impacts, particularly in coastal counties, has

created a number of well-documented problems. Estuarine and nearshore waters receive the wastewater and terrestrial runoff from both domestic, industrial and agricultural drainage. Contaminated sediments have increasingly begun to restrict dredging of ports through which 95% of our foreign trade must pass. Nearly 90% of California's once productive wetlands have been filled, and many of the state's coastal streams have been dammed for flood control and water supply. These impoundments upon which our agricultural base has developed has significantly impacted migratory fish populations such as salmon, and also reduced the supply of sand necessary to nourish beaches that support the state's large tourist industry and provide for the resident's recreational needs. Rising sea level and a higher frequency of El Niño driven coastal storms over the past two decades are eroding the state's intensively developed shoreline.

We are working cooperatively with the USGS on a number of these coastal problems and are developing good relationships with local and state government agencies and user groups for the collected information, a critical final step necessary if policies are to be influenced and changed or developed.

Investigations of Earth's atmosphere, oceans, and continents and the biota that inhabit these environments are at a crossroads. The traditional approach of measuring and documenting the nature of environmental change is rapidly being augmented by a new approach wherein dynamic processes are resolved, modeled, and understood in terms of how and why they occur, and, ultimately, how they impact society. The shift in research approach has resulted largely from the recognition that 1) the Earth's climate and natural environments are dynamic systems with high spatial and temporal variability, 2) they are changing as a result of human induced climate modification, 3) environmental systems are dynamically linked via physical, geochemical, and biological processes, with perturbations in one system often impacting others, and 4) climatic and ecological change pose economic, health, and political risks to society as a whole.

One of the most dynamic and important system interfaces is where the continent meets ocean, on the land-sea interface. This is a region where atmospheric and fluvial processes effectively couple marine and terrestrial systems. California's land-sea interface is one of the world's most dynamic. It is characterized by active uplift and shoreline erosion, intense coastal upwelling, monsoonal rainfall, and is also one of the world's most heavily populated and economically fertile coastal regions. With a goal of focusing efforts on this region and these sorts of issues, the University of California, Santa Cruz has recently developed a Center for the Dynamics and Evolution of the Land-Sea Interface (DELSI). The primary focus of this new center will be on marine and terrestrial systems that constitute the land-sea interface and the processes that modify and couple these systems. These include climate processes, such as atmospheric circulation, geologic processes that help shape the margin of the continents and transport water and sediment from the mountains to the coastal ocean, and biogeochemical and biological processes that influence the cycling of carbon, nutrients, and other elements in this system. Emphasis will be on understanding the dynamics (actions, interactions, controls, limits, future potential for change) of these systems over time scales (~10 Kyr) exceeding those of modern instrumental monitoring (i.e., 50-100 yrs). Through studies of climate records held in sediments and the organisms they contain, researchers may evaluate how the frequency and intensity of El Niño and other climatic phenomena have varied over the past and examine the responses of the biosphere to these changes.

The Center will also be unique in that the focus on the land-sea interface will allow development of techniques and technologies for solutions to a wide range of basic research problems as well as applied, regional problems. For example, studies of climate dynamics should result in development and testing of models for the state of California. On a regional basis, studies of coastal hydrologic patterns could help coastal communities that are dependent on aquifers and coastal surface waters with fresh-water resource planning.

National Association of State Universities and Land Grant Colleges

Introduction

The National Association of State Universities and Land Grant Colleges welcomes the opportunity to participate in the USGS Listening Session and commends the Agency Director for his leadership in fulfilling his pledge to reach out to the constituent community. NASULGC is the nation's oldest higher education association. Currently the association has over 200 member institutions -- including the historically black Land Grant institutions -- located in all fifty states. Member institutions represent the

leading public research institutions of the nation. The Association's overriding mission is to support high quality public education through efforts that enhance the capacity of member institutions to perform their traditional teaching, research, and public service roles. NASULGC universities have worked closely with USGS over the years in an array of formal and informal partnerships and have competence to engage in a constructive dialogue via the Listening Session mechanism. This document represents a consensus view of leading environment and natural resource scholars at NASULGC universities. What follows are some of the major themes important to NASULGC institutions.

Strategic Plan

Ideally, the Strategic Plan should explain what the agency does and lay out a clear and unambiguous plan for the future. It should serve as the foundation for the Agency's activities and programs. In reviewing the revised strategic plan last year, NASULGC forwarded a number of suggestions. First the plan should contain a bold and challenging vision, rather than a modest statement of improvements to current processes. Second, the plan needs to identify a process for developing new goals and programs. Third, the plan should highlight the value of partnerships, and identify strategies for engaging in increased partnerships as a means to meet dramatically increasing demands with uncertain budgets.

The agency clearly has rightfully earned a reputation for stellar science, while being a bureaucratic black hole. In the past, the management shortcomings could be overlooked, but today's world requires new and innovative management regimes to maximize efficiency and ensure relevance. The agency was founded on the need to conduct science; it earned respect for the conduct of science; and it needs to retain the conduct of science as a core value. USGS has served its constituents by acquiring and disseminating information in a timely and quality manner; it must continue to do so. Perhaps there is need to give some emphasis to dissemination of information so it is useful for decision-makers and managers.

General Science and Data Management

One of the areas in which USGS should strive to become THE world leader is the development and application of remote sensing/GIS decision-support tools, i.e., tools to aid decision making in the natural resources/environmental management arena (not just map making). The emerging area of bioregional planning, in which a wide array of natural resources are considered, might provide a context for developing this capability. While the bioregional planning concept might not be fully embraced throughout the Agency, there are several USGS personnel who already are heavily engaged in this work.

Another major area of strength on which the USGS could capitalize is risk analysis and decision making under uncertainty. This may seem like an obscure area but in fact it is emerging as a unifying theme in the environmental sciences, for challenges as diverse as earthquake prediction, groundwater supply forecasts, climate forecasting, wildlife population predictions and endangered species recovery. The USGS already has major strength in this area in several divisions. Again, this is an area in which could become THE world leader.

A national assessment of watersheds in the late 1990s shows that about 1,000 of more than 2,000 watersheds in the United States need plans and actions to restore and sustain their health and flow of services, products and values. For example, 40 percent of the nation's waterways are unsafe for fishing and swimming and need attention immediately. USGS could contribute immensely by developing fundamental information on those 1,000 watersheds. This would assist state and federal agencies, such as the EPA, and local communities in designing plans and actions to enhance management of those watersheds.

The need for regional and local information management (including databases of all sorts, geographic and non) is already critical. What is required is a cooperative effort of federal and state offices to join together and develop the appropriate hardware and software with a team of technicians that keep the system running. Such an undertaking should be complemented by a group of professionals who can provide data to clients and can do analyses that will develop meaningful information from the data.

The federal government now spends millions of dollars every year on research, the data from which ends up on shelves or on computer disks or otherwise is lost to society. USGS should be working more aggressively in the arena of information management so that the dollars that are spent on research are not as wasted in the future as they have been in the past.

In a changing world of data, USGS offers the greatest opportunity for data continuity. An example of the importance of this concern is where the National Weather Service has shifted from land-based, human weather observations to satellite and automated data gathering. As a result, all of the instruments have been completely changed in the last 20 years. Even if climate change has occurred it is now more difficult to establish because we aren't measuring temperature with the same instrument any more. USGS is very conscientious about making sure how instrumentation outputs compare and in the future it may be one of the few agencies which has that level of ability too make long-term comparisons.

Living Resources/Ecosystems

The USGS science centers would benefit from closer university affiliation. Some of the existing centers truly are world centers for their area of expertise (Patuxent Wildlife is one example), but others are marginally effective. The best centers have a long tradition of interaction with academic scientists. While there has been some movement already on center responsibilities and alignments, more would be beneficial.

The USGS has found it somewhat difficult to integrate the biotic and abiotic elements of its organizational structure and must do so to be successful. The division themes based on the physical sciences should not be allowed to dominate and the integration of BRD with the other elements must become more seamless than it is. Also, the USGS should endeavor to develop a process that truly incorporates a landscape level ecological approach to how they do business. In this regard, the Agency should strive to clearly define its role and avoid redundancy with other agencies (especially EPA and FWS). We support the new Director in his efforts to make USGS the science provider for Interior agencies, and to develop the means to be more efficient and responsive toward that end.

It is important to fully fund the existing Coop Units, both in terms of staff and operational resources. Also, the science centers could form the heart of integrated and cooperative science and need to be fully funded. The Agency should give serious consideration to initiating a modest competitive grant program (perhaps with a cost-share component) that would support proposals from Science Centers and university partners. This could be a mechanism to promote partnerships between science centers and universities. There are various models in other federal agencies to follow, most of which have been fruitful and rewarding for both the agencies and the grantees.

There is strong support within the NASULGC community for the Agency's reorganization. Nevertheless, since the Coop Units function well, they probably should remain administered through a national office, as opposed to regional administration. Key to meeting research and informational needs, particularly of the states, are the Coordinating Committees that function at each Unit. Those important Committees should continue carrying out their responsibilities, as they have for more than six decades.

After undergoing several reductions in recent years, the USGS budget is inadequate to permit effective USGS responses to ecological, biological, hydrologic, economic and social situations needing attention. All four USGS Divisions are constrained, but especially the Biological Resources Division. Research needs identified by federal and state agencies are being addressed only in small part. State biological and ecological needs, in particular, are largely going unmet. USGS, in concert with its University and other partners, should develop an attractive proposal to fund programs and projects to meet ecological, biological, hydrologic, economic and social needs. Unless such an initiative is launched, USGS will, in all likelihood, continue to struggle on inadequate budgets. Only through stronger working relations with partners on new initiatives can USGS hope to improve its financial status and strengthen its capabilities to help respond more effectively to ecological, biological, hydrologic, economic and social needs.

In the 1960s through the 1990s, new concepts and procedures to maintain and manage habitats for wild living resources were emphasized through a number of new national laws and policies. Both the Endangered Species Act and the Marine Mammal Protection Act call for conservation recovery of ecosystems to benefit wild living resources. Similarly, in 1992, the USDA Forest Service established a new policy calling for ecosystem management on the 192 million acres in the national forest system. Other

federal agencies and some state fish and wildlife agencies also have moved to an ecosystem framework and approach for planning their field activities and managing fish, wildlife and other natural resources.

These efforts and others demonstrate that a new approach is needed in planning, designing and carrying out human activities on an ecologically sound basis. Polls show that people want sound consideration and management of natural resources.

USGS should be focusing its work on providing information to prevent adverse impacts on the resource base. Attention and actions must focus, in sequence, on ensuring (1) ecological integrity or soundness, (2) economic compatibility and (3)social acceptance. USGS could be instrumental in providing information required to meet these three conditions to help meet public obligations to prevent and minimize soil erosion, meet clean water standards, perpetuate fish, wildlife and plants held in trust for all people, manage forests to achieve forest health and sustainability, store carbon, and, where possible, provide opportunities for outdoor recreation. Likewise, they will help avoid costly restoration and enhance the quality of life for people.

Partnerships

The Agency has been very slow to engage in meaningful and substantive partnerships to accomplish its goals in science. A first step would be to increase exploitation of the current relationships and successes. We are confident that the new Director appreciates and fully understands the importance of partnerships, and is attempting to enhance the Agency's efforts in this regard. To the best of our knowledge, however, there is no system by which he can get an annual update on the level of USGS interaction with universities. Such a systematic effort would be very valuable. In addition, the agency should undertake an inventory of programs and activities for the explicit purpose of identifying areas where partnerships could leverage additional resources and expertise to bring the necessary forces to bear to resolve, and not simply address, real and compelling problems. Partnerships are also vital in building the necessary coalitions to keep the public informed of the value of earth science and ensure support for USGS programs. Universities constitute a vast technical and scientific reservoir for the Agency and they should be considered natural partners in many areas of interest to USGS.

The Cooperative Research Units represent one of the best USGS models for partnerships in which NASULGC is involved. However, this model that serves fish and wildlife so well is limited to a restricted number of universities because of fiscal and political constraints. We believe that mechanisms for cooperative agreements could be put in place to facilitate joint ventures, cooperative research, contract research, etc. with virtually any university program that has resources and expertise to complement those of USGS and that can provide science-based information to serve the public interest.

The Agency also needs to assert itself in the Federal process on issues where its interests are obvious. For example, leaving USGS out of the new MOU on biocomplexity, developed by the National Science Foundation, is a major weakness. The well-grounded scientists in USGS, particularly those in the Science Centers administered through the Biological Resources Division and those in the Water Division, should participate in emerging studies and not continue to be overlooked. Working relations among the Department of the Interior, USGS and the NSF need to be strengthened.

USGS has a long-standing problem in having sufficient positions (FTEs) to respond to its workload. It should explore several approaches, such as contracts with Universities, to enlist the services of well-qualified individuals to help meet those needs without influencing FTE ceilings. Such approaches deserve special exploration to identify new acceptable solutions to current limits on staff capabilities.

In the past, when a university met with USGS there was a common refrain: "We are not a grant-giving agency, we are a grant-getting agency." Other agencies, such as USDA's Agricultural Research Service, of whom the same is true, is nonetheless very active in partnerships, which have proven quite valuable. Rather than just closing that door, USGS should develop a set of methods by which these partnerships occur.

Environment and Natural Resources

Some areas USGS may want to consider addressing include the following: 1) find mechanisms to inventory, manage, and use renewable natural resources without adverse impact on biodiversity; (2) couple land use planning with hazard risk assessment to reduce ecological and human costs; and (3) minimize environmental impacts associated with exploitation of non-renewable natural resources. These challenges can be broadly lumped under the banner of timely inventory, cost-benefit analyses, and risk assessment to maximize societal benefit with minimizing irreversible ecological damage.

Water Resources

The Water Institutes also comprise a successful and important partnership between USGS and universities. We have several practical suggestions that would improve this program for the benefit of the entire nation.

Specifically we would urge that the Agency request a budget for the Institutes more in line with their Congressional authorization. The base (104-B) should be expanded to $100,000 per Institute per year, then grow the 104G program to $3-4M per year. In addition, there should be some sort of combined enhancement of monitoring programs, whereby USGS improves both its level of monitoring and its early availability (important progress has been made here) while the universities are tasked with utilization of these data to produce high-demand analyses. USGS provides stream flow data that the university turns into more site-specific data such as reservoir holding calculations, base flow for fish, etc.

Both the 104-B and 104-G programs could be improved by setting aside a pot of USGS money specifically for the use of the Agency people working in collaboration with universities. In addition, use of the Internship program with the Institutes should be expanded. The Internship program is a long-term relationship builder as more students have projects with both university and USGS personnel.

State-level cosponsorship of symposia and conferences could be enhanced by providing incentives to Agency staff who successfully plan such events. There should be more models of activities, which are planned for joint USGS/University proposals for larger programs. The experience would help resolve some of the difficulties of universities and USGS working together. For example, USGS tends to assume that in any partnership they will purchase and own all equipment in the project. Universities don't allow this.

Coastal Environments and Marine Geology

A recent report by the National Research Council's Ocean Studies Board, "Science for Decisionmaking: Coastal and Marine Geology at the U.S. Geological Survey," provides some useful recommendations for the Agency. We would encourage USGS to give this report close consideration. The general thrust of the report is consistent with what we have been advocating, that the Coastal and Marine Geology Program needs to develop a strategic plan with a vision statement and defined goals, to expand its partnerships, to consolidate and strengthen its leadership, and to employ a long-term, robust, focused research strategy.

One of the most urgent resource problems confronting coastal states concerns the conflict between economic and sustainable use of coastal watersheds, water resources and ecosystems of their recipient estuaries. A major obstacle in addressing these problems lies in the absence of a common medium for the information that must pass through the scientific, economic and political sectors before appropriate remedial action can be taken. In partnership with universities, USGS could develop pilot projects to demonstrate that the systems approach can be adapted as a common medium for assessing the cause-and-effect relationships within a coastal watershed system in a manner useful to scientific research, resource management and public concerns. The systems-analysis approach devises holistic strategies to extract information on the functioning of these coastal watersheds that could not be garnered from a sequence of independent, stand alone, subsystem scale studies. The pilot projects could show the applicability of an integrated systems approach as a tool for addressing watershed scale issues and for establishing a watershed management capability, accomplished through the development and use of a new generation of simulation modeling linked to economic risk assessment.

Energy and Geology

There is some concern within the university community regarding the future of the Geologic Division. It appears its programs are being increasingly short-changed and staff positions are not being filled. In the

Science Strategy of the Geologic Division for 2000-2010, enhancement of cooperative efforts with universities is stated as a priority. A specific plan discussing at what scale and on what timetable it is anticipated that this enhancement will be effectuated would instill confidence in the Division's commitment to partnership with universities.

There is also concern that the Energy and Mineral Resources programs of the Geologic Division are now primarily assessment programs. This view seems to be supported in the 1998 NRC Report. The Agency should develop plans to implement some basic research programs in the mineral and energy areas, such as basin analysis, petroleum system modeling, facies analysis, depositional modeling, integrated geoscientific and engineering reservoir studies, 3-D and 4-D seismic modeling, seismic attribute analysis, rock-fluid interaction studies, and diagenetic and pore system analysis. Such studies provide an excellent mechanism for collaboration with universities.

To maintain our Nation's competitive edge in the geosciences, USGS needs to ensure it retains the highest quality research knowledge base. Yet the level of USGS staff expertise in the geosciences appears to be declining each year. Cooperative efforts with universities could reverse this trend, and vastly improve the diversity of expertise available to the USGS for solving the Nation's earth system's problems.

Conclusion

We appreciate the opportunity to provide these comments. The science conducted at USGS is indispensable to the nation. However, partnerships with universities will be the key for the agency to keep its science at the highest level, to make sure it is addressing the real needs of the nation, and to give decision-makers and managers the type of information necessary for informed policy choices.

National Institutes for Water Resources

Michigan State University – Institute of Water Research

DOQ Backdropping

Vision

Develop a method in cooperation with USGS to allow users the ability to dynamically overlay digital orthoquad imagery on GIS data layers through their browsers.

Current Registration Process

A multiple step process must occur before DOQ imagery can be used in a GIS. Upon opening TerraServer, one must choose a location. Once the location is determined and a DOG has been presented, it can be downloaded in JPG format. After downloading, the coordinate information must be collected. These point locations are then manually fed into a small conversion program that creates the world file associated with the DOQ allowing the image to be registered properly.

Envisioned Registration Process

1.) The envisioned registration process would allow a user to select an area of interest on a web-based GIS.
2.) Then using the USGS database format (meaning the request parameters that need to be sent in order to receive a particular image) the DOQ request for that area would be sent from the Institute of Water Research (IWR) server.
3.) The image would be sent from the TerraServer in JPG format to the IWR server with an additional text file that contained the real world coordinate information (such as lat/long, or UTM) of the four corner points and image size, i.e. 800x600.
4.) With the additional text file the IWR server can register and project the DOQ then send it to the user as a GIS backdrop.

[***Note**: A 4-step Process Diagram was included, which is not replicated here.]*

References

Several customers made reference to online resources or reports as part of their comments. Links and references are provided:

Online Resources

Federal Emergency Management Agency referenced **HAZUS** software:
http://www.fema.gov/hazus/

Federal Geographic Data Committee standard on national vegetation classification:
http://biology.usgs.gov/fgdc.veg/standards/vegstd.htm

U.S. Forest Service referenced the need for science to implement the Montreal Protocol (on Substances that Deplete the Ozone Layer):
http://www.unep.org/ozone/montreal.htm

National Association of State Universities and Land Grant Colleges referenced concern about the mineral assessment focus of USGS minerals programs as discussed in:
http://books.nap.edu/catalog/6297.html

National Association of University Fish and Wildlife Programs referenced the National Research Council's Ocean Studies Board's recent report on science for decision-making:
http://books.nap.edu/books/0309053390/html/index.html

National Association of University Fish and Wildlife Programs referenced the National Science Foundation biocomplexity initiative:
http://www.nsf.gov/home/crssprgm/be/start.htm

National Association of University Fish and Wildlife Programs recommended stronger working relationships be developed with the National Sea Grant program:
http://www.nsgo.seagrant.org/

National Association of University Fish and Wildlife Programs referenced a report by the Pinchot Institute on the evolution of training for foresters (in the context of many disciplines undergoing reevaluations of how to educate people who are going to be out at the grassroots level:
http://www.pinchot.org/pic/pic_edsummary.html

National Ground Water Association referenced a June 2000 conference in Minneapolis on emerging issues and pharmaceuticals in which USGS is involved:
http://www.ngwa.org/education/mnconf.html

National Institutes of Building Sciences referenced its Multi- Hazard Loss Estimation Program, which produces **HAZUS** under cooperative agreement with the Federal Emergency Management Agency
http://www.nibs.org/hazus.HTM

National Institutes for Water Resources referenced the virtual course in watershed management that the Michigan Water Resources Institute has pioneered:
http://www.iwr.msu.edu/watershed/module-1.html
National Science Foundation referenced the Digital Library for Earth System Education:
http://www.dlese.org

Natural Resources Conservation Service referenced its Natural Resources Inventory:
http://www.nhq.nrcs.usda.gov/CCS/NRIrlse.html

Natural Resources Conservation Service cited two of its institutes:
National Water Management Center in Arkansas
http://wmc.ar.nrcs.usda.gov/
National Water and Climate Center in Oregon
http://www.wcc.nrcs.usda.gov/wcc.html

OhioView referenced its K-12 education and teacher-training program:
http://www.learnfast.org
OhioView also referenced availability of pre-processed natural color and vegetative health images of sample Landsat data sets as part of an agricultural early warning and land use information system for the state of Ohio:
http://cosmo.lerc.nasa.gov/ohioview/

President's Committee of Advisers on Science and Technology (PCAST) report, Teaming with Life (referred to by several customers in the context of NBII):
http://www.whitehouse.gov/WH/EOP/OSTP/Environment/html/teamingcover.html

Yucca Mountain Project referenced the USGS review of DOE's Viability Assessment, which is linked from their web site under "OCRWM Highlights":
http://www.rw.doe.gov/homejava/homejava.htm

Reports

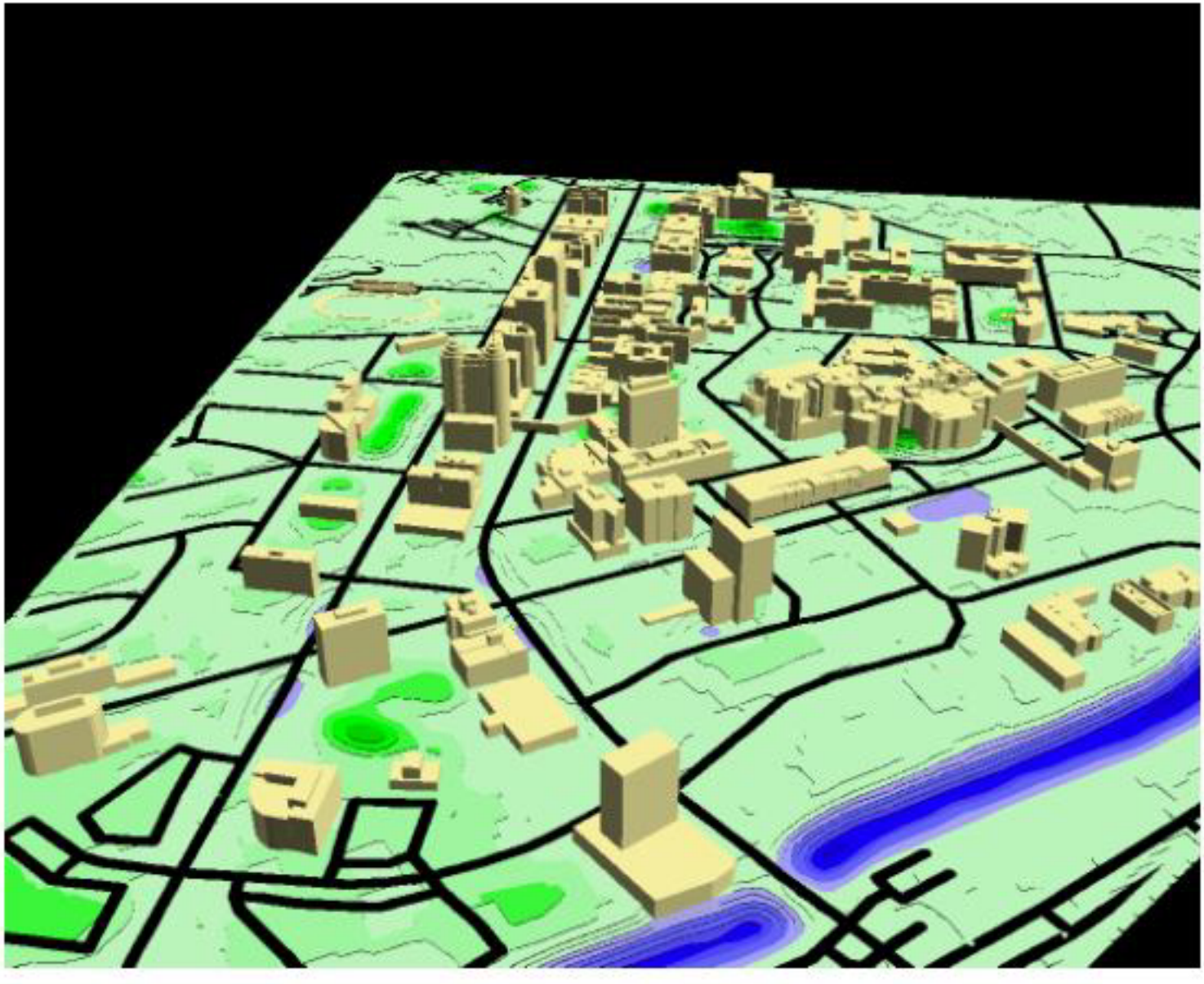
Applied Technology Council brought a copy of:
Proceedings: Workshop on improved characterization of strong ground shaking for seismic design (ATC 35-3)

U.S. Forest Service brought two water-related publications:
Water & the Forest Service (FS-660) and *Past and Future Freshwater Use in the United States: A Technical Document Supporting the 2000 USDA Forest Service RPA Assessment* (General Technical Report RMRS-GTR-39)

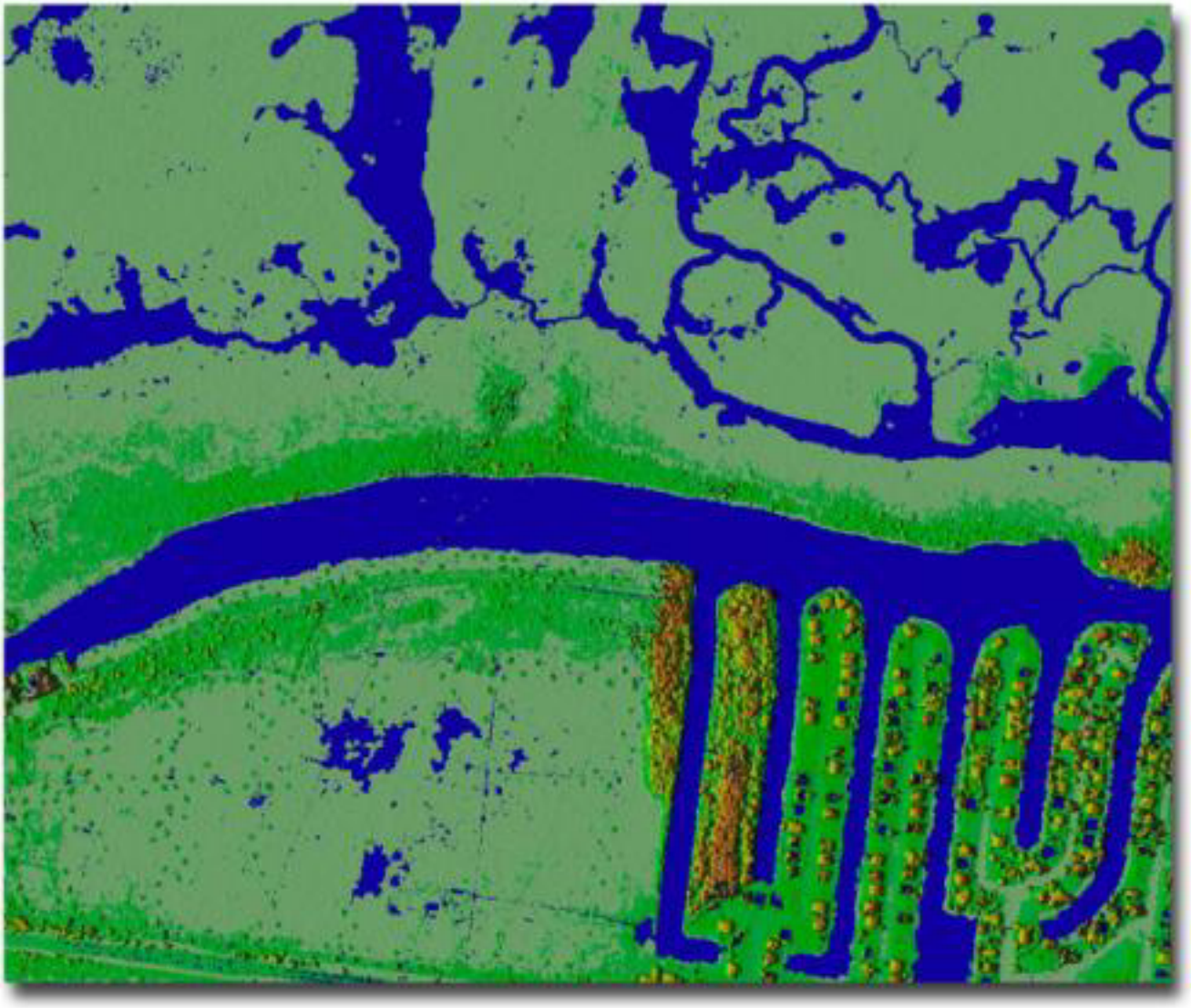
National Association of State Universities and Land Grant Colleges referenced its upcoming annual report: *Footprints on the Landscape: Reducing the Effects of Nature on Human Populations*

National Science Foundation brought two publications: *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and*

Technology (NSF 96-141) and *Undergraduate Education: Science, Mathematics, Engineering & Technology – Program Announcement and Guidelines* (NSF 99-53)



LIDAR generated elevation data of the Houston Medical Center, Brays Bayou, and road network.



LIDAR generated wetland vegetation and levee elevations in east New Orleans, Parish, LA.