

Biological Resources Division Geospatial Technology Strategic Plan 1997–2000

Information and Technology Report
USGS/BRD/ITR--1997-0003

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November 1997

by

Geospatial Technology Strategic Planning Development Team



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Executive Summary

Geospatial technology applications have been identified in many U.S. Geological Survey Biological Resources Division (BRD) proposals for grants awarded through internal and partnership programs. Because geospatial data and tools have become more sophisticated, accessible, and easy to use, BRD scientists frequently are using these tools and capabilities to enhance a broad spectrum of research activities.

Bruce Babbitt, Secretary of the Interior, has acknowledged—and lauded—the important role of geospatial technology in natural resources management. In his keynote address to more than 5,500 people representing 87 countries at the Environmental Systems Research Institute Annual Conference (May 21, 1996), Secretary Babbitt stated, “. . .GIS [geographic information systems], if properly used, can provide a lot more than sets of data. Used effectively, it can help stakeholders to bring consensus out of conflict. And it can, by providing information, empower the participants to find new solutions to their problems.”

This Geospatial Technology Strategic Plan addresses the use and application of geographic information systems, remote sensing, satellite positioning systems, image processing, and telemetry; describes methods of meeting national plans relating to geospatial data development, management, and serving; and provides guidance for sharing expertise and information. Goals are identified along with guidelines that focus on data sharing, training, and technology transfer. To measure success, critical performance indicators are included.

The ability of the BRD to use and apply geospatial technology across all disciplines will greatly depend upon its success in transferring the technology to field biologists and researchers. The Geospatial Technology Strategic Planning Development Team coordinated and produced this document in the spirit of this premise. Individual Center and Program managers have the responsibility to implement the Strategic Plan by working within the policy and guidelines stated herein.

Biological Resources Division Geospatial Technology Strategic Plan 1997–2000

by

Geospatial Technology Strategic Planning Development Team
U.S. Geological Survey Biological Resources Division

Abstract. This Geospatial Technology Strategic Plan addresses the use and applications of geospatial technology in the Biological Resources Division of the U.S. Geological Survey. The Strategic Plan lays the foundation for a long-term strategy to develop standards and protocols and to share and transfer technology within the Biological Resources Division and with other U.S. Geological Survey Divisions. The forum for coordination is the Geospatial Technology Coordinating Group, comprised of representatives from Biological Resources Centers and Programs. The goals, strategies, and objectives included in this document will serve as the guiding policy for geospatial technology activities in the Biological Resources Division of the U.S. Geological Survey. The primary responsibilities of the Geospatial Technology Coordinating Group, Biological Resources Division Headquarters, Regional Offices, Science and Technology Centers, and Programs are clearly defined.

Key words: Biological Resources Division, geographic information systems, geospatial technology, Global Positioning System, metadata, remote sensing, satellite positioning systems, strategic plan, telemetry, U.S. Geological Survey

Introduction

This Geospatial Technology Strategic Plan was developed to correlate geospatial technology activities and initiatives with the mission of the U.S. Geological Survey (USGS) Biological Resources Division (BRD), to identify challenges and opportunities for furthering BRD goals and objectives, and to chart the overall direction of geospatial technology activities within the BRD. As documented in the Biological Resources Division Strategic Science Plan (BRD 1996), the primary responsibility of the BRD is to assist resource and land managers by making sound biological data and information accessible for their use:

The mission of the BRD is to work with others to provide the scientific understanding and technologies needed to support the sound management and conservation of our Nation's biological resources. Fulfilling this mission depends on effectively balancing the immediate need for information to guide management of biological resources with the need for technical assistance and long-range, strategic information to understand and predict emerging patterns and trends in ecological systems. BRD Programs were developed to provide the appropriate depth and breadth of objective science to meet the information needs of resource

managers, who encounter many complex environmental problems driven by an array of biological, physical, social, and economic forces that interact across diverse temporal and spatial scales.

The primary responsibility of the BRD is to assist resource and land managers, particularly in the Department of the Interior (DOI), by providing them with sound biological information and with assistance in applying the information to their needs. The primary means of gathering this information is through the use of scientific methods applied to monitoring resources and conducting experiments. Subsequently, pertinent information must be made available to those who must use it to make important resource management decisions.

The Geospatial Technology Strategic Plan provides the framework for BRD Centers and Programs to provide consistent, standardized, well-documented (through use of metadata) geospatial data and information to partner agencies and others.

The Committee on the Formation of the National Biological Survey (now the BRD) recognized that software tools must be responsive and readily accessible to all users. The Committee recommended active participation in the National Spatial Data Infrastructure (NSDI) and that the agency "should promote greater awareness and use of existing spatial

data and technologies; increase efforts to locate field data spatially; adopt, where appropriate, existing standards for mapping and spatial-data handling; and increase the involvement of biologists in Federal efforts to develop spatial-data and metadata standards” (National Research Council 1993).

The USGS has a long history of using and applying geospatial technology. As one of the primary sponsors of the NSDI, the USGS has been instrumental in the development of national policy guidelines and standards regarding processing and sharing of geospatial data. The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce and share geospatial data, with a vision for current and accurate geospatial data to be readily available (NSDI 1994). With the signing of Executive Order 12906, Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure, on April 11, 1994, the President assigned Federal leadership responsibilities for the NSDI to the Federal Geographic Data Committee (FGDC) and instructed the FGDC to seek the involvement of State, local, and Tribal governments, academia, the private sector, professional societies, and others. The Executive Order calls for development and use of an electronic clearinghouse, documentation of geospatial data, and development of plans for establishing public access to geospatial data. It instructs Federal agencies to document all geospatial datasets developed after January 1995 using the FGDC's Content Standard for Digital Geospatial Metadata (FGDC 1994), to adopt a plan for documenting geospatial datasets developed before January 1995 to the extent practicable, to provide the metadata to a National Geospatial Data Clearinghouse, and to adopt a plan establishing procedures to make geospatial data available to the public to the extent permitted by law and current policy. The goal of the NSDI is to provide information about and access to spatial data and information through an interconnected electronic network.

The National Biological Information Infrastructure (NBII) is a BRD initiative dedicated to the creation of an electronic “federation” of biological data and information sources. The goal of the NBII is to provide access to biological databases and metadata, information products, directories, and guides maintained by Federal, State, and local government agencies, non-government institutions, and private-

sector organizations. By providing the biological component, the NBII supports the Administration's goal to develop a National Information Infrastructure. Both the NSDI and the NBII reflect the ongoing effort by BRD and others to increase access, sharing, and application of data among a broad set of public and private cooperators and partners.

Establishing and maintaining partnerships is essential to successful implementation of the NBII and the NSDI. Many geospatial technology activities carried on by BRD Centers and Programs encompass partnerships with other Federal agencies, State agencies, and non-government organizations.

Geospatial Technology

“Geospatial technology” generally refers to the science and the tools used to acquire, store, analyze, and output data in two or three dimensions, referenced to the earth by some type of real-world coordinate system (e.g., a map projection). The ability to reference a geographic location is an important component in analyses of effects or trends in biological and physical resources. Geospatial technology tools include geographic information systems (GIS), remote sensing, thematic mapping, image processing, satellite positioning systems such as the Global Positioning System (GPS), and telemetry.

- *Geographic information systems* encompass the hardware and software used to develop, store, analyze, and output geospatial data. Database construction, spatial and statistical analysis of themes (layers or coverages), modeling, and soft- or hardcopy outputs are GIS functions. Common database functions such as query and statistical analysis are integrated with the unique visualization and geographic analysis benefits of maps.
- *Remote sensing* is the acquisition of analog (photo) and digital (image) data from platforms ranging from hand-held devices to space-borne systems. Remotely sensed data may be interpreted manually, in analog or digital form, or analyzed digitally via image processing and classification techniques. Access to continuously collected remote sensing data from space provides major benefits to scientists studying

and understanding human impacts on the global environment, managing the earth's natural resources, and planning and conducting many other activities of scientific and social importance.

- *Thematic mapping* refers to interpretation of aerial photography, airborne and satellite imagery; cartography; and plotting of biological data, such as vegetation or species distributions. A remotely sensed satellite image is not a photograph, but is a rendition, or model, of target features described through the use of spectral reflectance. These reflectance values are stored in a quantitative, numerical fashion for input to a computer. Software and hardware specially designed to analyze these images provide a pictorial rendition of target features. The images seen on the computer screen are made up of picture elements called pixels.
- *Satellite positioning system technology* allows direct collection of geospatial data by observers using a GPS receiver on the ground, on the water, or in aircraft. GPS technology has potential application in any situation that requires location of a mappable feature. Not limited to collecting "point" data, kinetic GPS technology collects data as the receiver moves. Software attached to the GPS unit can close polygons and even output the data in a format compatible with a particular GIS.
- *Telemetry* is used by BRD researchers to monitor positions, activity, and physiology of terrestrial and aquatic animals via real-world locational coordinates collected at varying time intervals from implanted or attached transmitters. Transmitters use sonic, radio, and ultra-high-frequency bands. Telemetry receivers may be hand-held or mounted on mobile platforms (ground vehicles, boats, or airplanes), or permanently located on orbiting satellites. Newly developing technology includes GPS receivers attached to collars for wildlife as small as a fox.

The BRD has established a network of Geospatial Technology Coordinators at Centers and Programs to facilitate technology and information transfer among all BRD facilities.

Scope of Plan

This Strategic Plan covers the years 1997 through 2000 and addresses major BRD geospatial technology issues. Prominent initiatives are outlined and related back to the overall mission of the BRD. The Strategic Plan also provides a framework for the development of more detailed project plans outlining specific initiatives. It will be updated periodically to incorporate new issues, initiatives, and priorities.

Relationship to Other Plans

Strategic Plan for the U.S. Geological Survey 1996–2005

In May 1996, the USGS published a Strategic Plan for 1996–2005 (USGS 1996). According to the USGS Strategic Plan, coordination and collection of geographic and cartographic information will remain a fundamental Federal role and a viable program of the USGS. A goal of the BRD Geospatial Technology Strategic Plan is to promote integration of geospatial technology within all USGS Divisions and components.

Biological Resources Division Strategic Science Plan

The goals and objectives of the BRD Strategic Science Plan (BRD 1996) flow logically from the Division's mission and relate directly to the Division's core science activities. The need to provide access to, disseminate, share, and use data, information, and technology to support sound management of the Nation's biological resources is an integral component of the Strategic Science Plan. In Part V, three areas of communication are highlighted: (1) developing tools and standards for information transfer, (2) disseminating information, and (3) facilitating effective use of information. The objectives are specific, tangible, measurable efforts to achieve goals, including identification, development, adaptation, and implementation of tools and technologies—such as GIS, remote sensing technology, and computer modeling and simulation—for use in gathering, analyzing, integrating, or displaying biological data in support of natural resources management.

BRD Implementation Plan for the Strategic Science Plan. The Implementation Plan for the Strategic Science Plan describes the actions that will be taken at all levels of the organization to implement the general principles of the Science Plan. Guiding principles include comprehensive planning, peer review, competition, assessment, providing information, involving partners, determining highest priority partner needs, and maintaining BRD core capabilities. One area that establishes a broad conceptual framework is the application of scientific information for conservation and management. The need to provide scientists with the means to apply ecological and biological information for the sound management of biological systems is discussed, including the development of innovative tools and technological capabilities.

National Biological Information Infrastructure

The goal of the NBII is to establish a distributed federation of biological data and information sources, relying on a network of partners and cooperators to ensure that the data and information they generate or maintain are available to others. Data and information produced by the BRD constitute only a fraction of the total set of available biological data and information; therefore, partnerships between the USGS BRD and other Federal agencies, State agencies, and non-government organizations are essential to successful implementation of the NBII. The BRD currently has partnership agreements with Federal agencies inside and outside the DOI; with several States; with private organizations such as the Association of Systematics Collections, Champion Paper Corporation, and The Nature Conservancy; and with other nations and international organizations.

The objectives of the NBII are to make it easy for people to find the biological data and information they need, to integrate or combine data and information from different sources, and to apply data and information to actual resource management decisions. In addition to biological data and information, software tools are identified and made available through the NBII to help users analyze, integrate, and display biological data and information. The NBII also points to sources of biological

expertise—the people and organizations users can contact to get advice and assistance in finding and understanding biological data.

National Spatial Data Infrastructure

The BRD Geospatial Technology Strategic Plan fully complies with the NSDI and focuses on use and application of geospatial technology, with an emphasis on data sharing and technology transfer. The NBII is the BRD vehicle for compliance with the NSDI.

The NSDI is conceived to be an umbrella of policies, standards, and procedures under which organizations and technologies interact to foster more efficient use, management, and production of geospatial data. The NSDI requires and will facilitate cooperation and interaction among various levels of government, the private sector, and academia. The major components of the NSDI currently under development include a basic framework of digital geospatial data to act as a foundation for numerous other data collection activities; known quality thematic datasets of critical national importance; standards to facilitate data collection, documentation, access, and transfer; and the means to search, query, find, access, and use geospatial data. Strategies to build the NSDI include establishing forums for communication, facilitating access to data, building framework and thematic datasets, developing educational and training programs, and fostering partnerships or data sharing. Key actions under way are developing and implementing standards for framework and thematic data; producing framework and thematic data; implementing standards for geospatial data documentation and transfer; establishing procedures to use electronic networks to search for, access, and use geospatial data; and cooperating in the development of State and regional councils and private sector agreements to accomplish these actions. The Administration has tasked the Federal Geographic Data Committee to provide the Federal leadership for evolving the NSDI in cooperation with State and local governments and the private sector. The success of the NSDI will hinge upon the ability to build and maintain partnerships among these entities to carry out the actions of this plan (NSDI 1994).

Committees have been established to address the NSDI and other geospatial technology and data issues, including the USGS Geographic Data Committee (GSGDC), the FGDC, and the Interior Geographic Data Committee (IGDC). BRD representatives who serve on these committees and their working groups are listed in Appendix A.

National Biological Service Information Resources Management Strategic Plan 1995–1999

The developers of geospatial data work closely with the information resources management (IRM) community to share data via the Internet. The IRM Strategic Plan (National Biological Service 1995) recognizes the importance of geospatial data management and compliance with the NBII, NSDI, and Executive Order No. 12906 and will play a key role in the development of policy, guidelines, and procedures in serving geospatial data. One of the goals of this Geospatial Technology Strategic Plan is the management of geospatial data and information as valuable resources and incorporation of their development as an integral part of the research and data sharing process.

Government Performance and Results Act (1993)

The Government Performance and Results Act (GPRA) requires that no later than September 30, 1997, all Federal agencies must submit a strategic plan for program activities to both the Director of the Office of Management and Budget and to the Congress. This Geospatial Technology Strategic Plan includes the objective statements, performance measures, and other information mandated by the GPRA.

Paperwork Reduction Act (1980)

The Paperwork Reduction Act requires Federal agencies to develop and implement 5-year strategic plans to meet information needs and stipulates that such plans must be revised annually. This Geospatial Technology Strategic Plan addresses that requirement.

Geospatial Technology Basic Tenets

The following basic tenets are fundamental to managing the geospatial technology resources of the BRD and form the foundation upon which this Strategic Plan has been formulated.

- Biological science will continue to be an integral part of the DOI mission.
- The BRD will continue to adhere to NBII and NSDI requirements.
- Geospatial technology activities are guided by user requirements combined with available technology.
- Originators of geospatial datasets are responsible for accuracy, integrity, documentation, updating, metadata, and adherence to standards.
- The BRD was established with—and is expected to continue with—a distributed and decentral-ized geospatial technology capability, including equipment, data, software, and support.
- The BRD will continue to provide training resources in geospatial technology.
- Geospatial technology activities within the BRD operate within a comprehensive Strategic Plan.
- Current geospatial technology is used where practical.

Current Situation and Planning Assumptions

Funding

Expenditures for information and technology are expected to form a substantial portion of the BRD budget. The Fiscal Year (FY) 1997 Information Technology Budget (ITB) (Appendix B) allocated \$6.351 million for information technology activities, including implementation of the NBII. Funds for software and hardware are allocated under the IRM Program (National Biological Service 1995); no separate funds are allocated specifically for geospatial technology activities. If the BRD, as anticipated, further delineates the ITB, subsequent Strategic Plans will provide details of how the ITB is used for geospatial technology activities. The following figure contains a breakdown of the FY 1997 ITB.

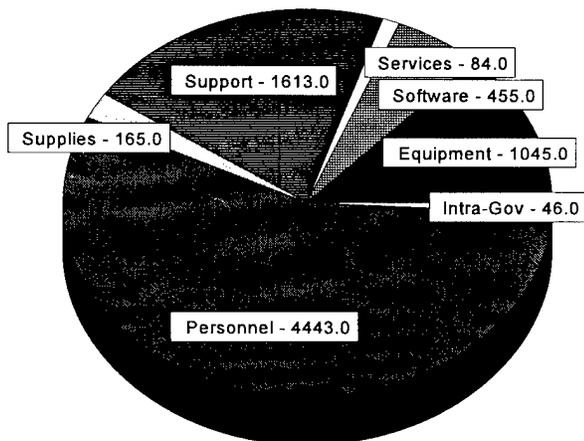


Figure. Fiscal Year 1997 Information and Technology Budget (*in thousands of dollars*).

Individual Science and Technology Centers, Programs, and Field Stations maintain inventories of their capitalized hardware and software, updated annually in accordance with standard Federal property procedures. Information on geospatial technology and data holdings varies widely among locations. Efforts must focus on sharing information to prevent redundancies in data development.

In developing this Geospatial Technology Strategic Plan, several assumptions were made concerning the critical factors in our internal and external environments. Significant changes in either environment could force changes in our ability to implement this Strategic Plan. The Strategic Plan is based on these key assumptions:

- The BRD budget is not expected to be substantially increased in real terms for the foreseeable future except for allowances for new initiatives.
- The BRD was organized as a lean workforce and supporting infrastructure to meet current and future customer and mission requirements at the lowest possible cost and will continue to develop and acquire new capabilities in this way.
- Understanding the Nation's biological environment will continue to be an important issue, requiring USGS BRD leadership in biological research.

- Partnerships will continue to be important in achieving the BRD mission.
- The USGS BRD will work closely with other Federal agencies to ensure coordinated efforts in the areas of biological research and technology development.
- The Geospatial Technology Coordinating Group (GTCG) will continue to provide guidance and expertise in sharing geospatial technology at BRD Science and Technology Centers, Programs, and Field Stations.

Policy and Guidance

The Office of Biological Informatics and Outreach (OBIO) Assistant Chief Biologist provides policy, standards, direction, management, and oversight of geospatial technology activities in the BRD. The OBIO is the BRD's focal point for geospatial technology planning, policy development, coordination, direction, review, and budget formulation. Functional areas include GIS, remote sensing, thematic mapping, satellite positioning system technology, and telemetry.

One objective of the OBIO is to establish and manage a comprehensive Geospatial Technology Program for the BRD. This responsibility includes policy and planning to define the Program, standards and guidelines to guide implementation, technical assistance to help carry out the Program, and review and evaluation to recommend changes to the Program.

Consistent with the National Performance Review and streamlining initiatives, BRD Headquarters has been established with minimal staffing. It is the intent of the BRD to accomplish the mission requirements identified herein by working in a "virtual" mode to provide extended geospatial technology resources from BRD offices and partners to work on specific Program needs.

The GTCG provides recommendations to the OBIO on geospatial technology issues. Self-directed teams of specialists have been and will continue to be formed to address identified problems (Appendix C). Teams are dissolved when their mission is accomplished. This mode of operation will allow the Program to match limited resources with a particular issue. Self-directed teams can be

formed and dissolved as needed at the recommendation of the Geospatial Technology Coordinators and with approval of the Geospatial Technology Council or the OBIO Assistant Chief Biologist.

Data Administration and Standards

In collaboration with the GTCG, the OBIO provides leadership in developing databases such as the NBII data dictionary and an inventory of biological data stored as metadata. Geospatial technology experts provide training in developing metadata for geospatial data.

Documentation and sharing of standards and guidelines developed for geospatial software, data and metadata, tools, and analytical models are critical factors in providing effective technical support to BRD activities. In collaboration with the GTCG, the OBIO will adopt and implement standards in accordance with Geospatial Technology Council recommendations to meet the needs of BRD Science and Technology Centers, Programs, field locations, and partners.

Geospatial Technology Activities and the Biological Resources Division Mission

Strategic Science Plan Goals

The mission of the BRD is to work with others to provide the scientific understanding and technology needed to support the sound management and conservation of our Nation's biological resources. The following science goals identified in the BRD Strategic Science Plan (BRD 1996) guide implementation of the BRD mission and form the basis for the Geospatial Technology Strategic Plan.

GOAL 1. Assess and report the condition of the Nation's biological resources.

GOAL 2. Characterize natural processes and identify factors that influence the quality or quantity of the Nation's biological resources at all levels of biological organization.

GOAL 3. Facilitate sound management of the Nation's biological resources by collaborating with partners in all phases of our work.

GOAL 4. Provide national and international leadership for the development of a biological information infrastructure to provide access to, disseminate, share, and use biological data, information, and technology.

GOAL 5. Integrate biological resources research, inventory, and monitoring efforts with those directed at other natural resources, throughout the USGS.

Implementation of Geospatial Technology Program

The OBIO Assistant Chief Biologist is responsible for BRD-wide coordination and support of geospatial technology activities. Global partnerships are established by the OBIO to identify, access, manage, and disseminate information and data related to the biological sciences. The OBIO provides leadership in the development and use of computer and geospatial technology, disseminates and maintains BRD geospatial technology policies and guidelines, and provides operational support. OBIO staff members work with all BRD Programs and with BRD partners to implement geospatial technology and to provide the tools needed to accomplish BRD goals. They are responsible for developing and managing the NBII and major information systems; for developing information and geospatial data policies; and for distributing information to BRD staff, partners, and customers. They also assist in the design and implementation of data acquisitions, database development, and database construction, and provide support to spatial data analysis activities. Staff members supporting OBIO are located at Reston Headquarters, at the Center for Biological Informatics in Denver, at BRD Regional Offices, Science Centers, and Programs, and at other agencies.

Technical expertise and leadership in geospatial technology activities can be found at BRD Science and Technology Centers, Programs, and field locations (Appendix D). Center and Program activities address various aspects of the BRD mission, often employing geospatial technology and performing information and technology transfer functions.

Geospatial Technology Coordinators and other technical personnel have significant responsibilities in their respective areas for systems development, networking, user support, and data management to facilitate collection, storage, retrieval, analysis, use, and dissemination of scientific data and information. Researchers, planners, managers, and others use this information to help communicate the status of the Nation's biological resources and ecological processes.

To achieve the goals and responsibilities of this Geospatial Technology Strategic Plan, the cooperation and expertise of Centers and Programs will be heavily relied upon.

Geospatial Technology Activities and Capabilities

Geospatial technology activities, projects, expertise, capabilities, and resources are summarized by Center or Program in a companion document, Prospectus 1: Geospatial Technology Activities in the Biological Resources Division (in review). Additional BRD Center and Program information, including specific geospatial technology activities, may be accessed through the BRD Geospatial Technology Web site. This and other pertinent Web site addresses are provided in Appendix E.

Planning for Success

Goals, Strategies, and Objectives

The following goals of this Strategic Plan are designed to support the overall BRD mission.

GOAL 1. Provide leadership in geospatial technology activities.

GOAL 2. Promote integration of geospatial technology within the biological research and resource management communities.

GOAL 3. Develop and maintain cooperative efforts and partnerships to effectively access and disseminate geospatial information, data, and technological resources.

GOAL 4. Facilitate development, use, and application of geospatial technology and expertise that support the biological research and resource management communities.

GOAL 5. Ensure availability and accessibility of geospatial technology and expertise to the biological research and resource management communities.

GOAL 6. Manage geospatial data and information as valuable resources and incorporate their development as an integral part of the research and data sharing process.

GOAL 7. Develop and implement a geospatial technology training program.

Strategies and objectives further define planned geospatial technology efforts in support of the BRD mission. Modifications will be made periodically to incorporate new priorities and their accompanying initiatives. Consistent with BRD Program budget allocations, geospatial technology resources and funding will be applied to work efforts supporting the stated goals, strategies, and objectives.

GOAL 1: Provide leadership in geospatial technology activities.

Strategy 1.1 Provide a clear vision of the role of geospatial technology in the BRD.

Objectives:

- Ensure that geospatial technology goals are consistent with and support BRD mission and Program goals.
- Establish and support an effective means of communication on geospatial technology issues and activities among the GTCG, OBIO, the Science and Technology Centers, and major Programs.

Strategy 1.2 Strengthen the organization of the GTCG.

Objectives:

- Define the roles and responsibilities of the GTCG, its representatives, the Science and Technology Centers, major Programs, and Headquarters.

- Organize the GTCG through regular meetings and teams, elect a council, and develop a charter.
- Maintain the Geospatial Technology Home Page and links to related sites of interest.

Strategy 1.3 Establish policy recommendations and guidelines for geospatial technology activities.

Objectives:

- Promote compliance with Executive Order 12906 and other existing policies and guidelines related to geospatial data management.
- Provide constructive guidance in project planning and activities related to geospatial applications.
- Document and share procedures related to geospatial technology activities.

Strategy 1.4 Promote the role of geospatial technology in support of better science.

Objectives:

- Promote appropriate levels of fiscal and human resources to accomplish geospatial technology goals.
- Foster development and use of suitable geospatial technology to support the BRD mission.
- Encourage sound geospatial data development and management practices.

GOAL 2: Promote integration of geospatial technology within the biological research and resource management communities.

Strategy 2.1 Collaborate with USGS Divisions and Programs on geospatial activities.

Objectives:

- Participate in collaborative efforts to identify needs for data and develop cooperative strategies for meeting those needs.
- Use integrated approaches across USGS Divisions to implement geospatial activities.

Strategy 2.2 Develop new approaches to integrating geospatial data into a wide range of applications.

Objectives:

- Participate in research and development Programs focused on interpretation and application of geospatial data.
- Encourage the development of advanced geospatial data handling, analysis, and models that allow geospatial data to be used in more efficient and effective ways.
- Encourage cooperative efforts at all organizational levels.

GOAL 3: Develop and maintain cooperative efforts and partnerships to effectively access and disseminate geospatial information, data, and technological resources.

Strategy 3.1 Enter into cooperative efforts and partnerships to further BRD goals.

Objectives:

- Identify important existing geospatial information and data sources.
- Develop agreements with cooperators and partners to promote innovative approaches to supporting related activities and functions.
- Continue to publicize the availability of geospatial information through presentations, electronic media (the Internet), and other outlets.

Strategy 3.2 Use and maintain existing BRD geospatial technology capabilities.

Objectives:

- Identify and promote Centers with specific technical expertise.
- Integrate existing geospatial tools, technology, capabilities, and expertise to support the BRD mission.
- Actively promote the understanding and use of geospatial technology and data through the OBIO, Science and Technology Centers, and major Programs.

GOAL 4: Facilitate development, use, and application of geospatial technology and expertise that support the biological research and resource management communities.

Strategy 4.1 Inventory existing BRD geospatial tools and technology.

Objectives:

In the categories of GIS, satellite-based positioning systems, remote sensing, and telemetry:

- Determine the status of resources.
- Identify core capabilities.
- Develop a catalog of available technical expertise.
- Promote the most practical, cost-effective, and timely applications of technology.

Strategy 4.2 Identify geospatial technology needs of the biological research and resource management communities.

Objectives:

- Determine the geospatial technology needs of BRD Programs.
- Determine the gaps between BRD current capabilities and needs.
- Develop an implementation plan that meets the needs of BRD Programs.

Strategy 4.3 Develop standards and guidelines for geospatial tools and technology.

Objectives:

- Review existing standards and procedures related to geospatial technology, and make recommendations to the OBIO for revisions based on these reviews.
- Adopt existing, proven standards when possible.
- Draft and implement new standards as necessary.

GOAL 5: Ensure availability and accessibility of geospatial technology and expertise to the biological research and resource management communities.

Strategy 5.1 Manage and maintain geospatial technology resources to ensure functionality and reliability.

Objectives:

- Annually review geospatial technology resources and upgrade as needed.
- Enhance the geospatial technology resources available to BRD personnel.
- Implement a geospatial technology emergency response team to provide support in situations that require immediate action.
- Continually evaluate emerging geospatial technology for biological resources applications.

Strategy 5.2 Facilitate geospatial information sharing and acquisition practices.

Objectives:

- Prepare and disseminate geospatial information via reports, bulletins, scientific publications, electronic media (the Internet), CD-ROM, maps, charts, and other information transfer materials, providing access to the biological research community with and without Internet connectivity.
- Coordinate the acquisition and dissemination of geospatial technology.
- Continue to strengthen BRD centers of expertise in geospatial technology.

GOAL 6: Manage geospatial data and information as valuable resources and incorporate their development as an integral part of the research and data sharing process.

Strategy 6.1 Inventory existing geospatial data available within the BRD.

Objectives:

- Lead the effort to identify, inventory, and document geospatial databases available within the BRD, including legacy data holdings and recently developed datasets.
- Promote communication of geospatial data needs during project planning to determine data availability and to avoid duplication of effort.

Strategy 6.2 Promote the use and development of geospatial data management standards and procedures.

Objectives:

- Comply with Executive Order No. 12906 through application of the FGDC Content Standard for Digital Geospatial Metadata, Version 1.0 (FGDC 1994) and participation in the NSDI and geospatial data clearinghouse.
- Participate in the NBII and other data sharing efforts, as appropriate.
- Provide guidance on geospatial data processing standards, data entry procedures, and data management techniques.
- Encourage coordination of geospatial data collection procedures.
- Identify and implement quality assurance, quality control, and accuracy assessment requirements.

Strategy 6.3 Manage geospatial data and information.

Objectives:

- Encourage sharing of geospatial data as a common resource.
- Develop metadata for geospatial data holdings and planned data collections.
- Oversee and coordinate the development and use of metadata capture software and user interfaces needed to document geospatial data, and provide staff with appropriate training.

Strategy 6.4 Provide access to and distribute geospatial data and information.

Objectives:

- Continue to evaluate, select, and serve geospatial data.
- Establish priorities and a schedule for serving geospatial data.
- Coordinate with IRM and other national Programs on the interactive distribution of geospatial data.

- Coordinate implementation of a geospatial meta-data clearinghouse.
- Implement the NBII and the NSDI.

GOAL 7: Develop and implement a geospatial technology training program.

Strategy 7.1 Identify training needs.

Objectives:

- Identify deficiencies in existing skills and knowledge.
- Identify training needs related to emerging geospatial technology.

Strategy 7.2 Develop a training program.

Objectives:

- Develop a comprehensive training program that targets appropriate audiences.
- Identify critical knowledge and skills in geospatial technology, and support proficiency in each area.

Strategy 7.3 Promote and provide training opportunities.

Objectives:

- Identify, publicize, and facilitate access to existing training opportunities.
- Promote participation in training opportunities offered in conjunction with professional gatherings.
- Provide geospatial technology training that meets identified needs.

Ends/Means Summary

Current conditions are summarized in Table 1, which provides an overview of the short- and long-term approaches needed to accomplish the geospatial technology goals outlined in this Geospatial Technology Strategic Plan.

Table 1. Ends/means summary of geospatial technology goals.

| | Item | Current (1997) | Short-term (1998-1999) | Long-term (2000 on) |
|----------------------------------|--------------------------------|--|--|---|
| E N D S | Geospatial technology | Geographic information systems (GIS), remote sensing, telemetry, thematic mapping, and satellite positioning systems are used throughout the Biological Resources Division (BRD), but sharing of information on applications, new technology, and standards is lacking. | The Geospatial Technology Coordinating Group (GTCG) will strive to meet the goals outlined in the Geospatial Technology Strategic Plan through coordination among Science and Technology Centers, Programs, and the BRD geospatial technology user community. | The GTCG will develop standards and policy related to the use and application of geospatial technology within the BRD to meet future needs to better understand biological resources in support of national and global efforts. |
| M E A N S | Geospatial data | Geospatial data use is variable, not standardized, with no common data, organization, or dictionary. In general, metadata are not available. | The National Biological Information Infrastructure (NBII) will support Centers and Programs in the identification and description of sources of data, information, tools, standards, and procedures to allow for easily accessible retrieval of existing data. | Extensive use of standardized data will be promoted. An agency-wide data elements dictionary will be developed, and quality control and security policies and procedures will be reviewed and implemented. |
| | Geographic information systems | A number of different GIS software programs are currently used to develop and analyze geospatial data. | The Office of Biological Informatics and Outreach (OBIO), with the GTCG, scientists, and partners, will develop the standards, policies, and guidelines necessary to achieve long-term objectives. | The GTCG will implement national standards for data conversion and transfer. |
| | Remote sensing technology | A number of different remote sensing software programs are currently used to develop and analyze geospatial data. | The OBIO, with the GTCG, scientists, and partners, will develop the standards, policies, and guidelines necessary to achieve long-term objectives. | The GTCG will implement national standards for remote sensing software and will evaluate and make recommendations for BRD use and applications. |
| | Telemetry | Radio, satellite, and acoustic telemetry equipment and techniques for data analysis range from obsolete to state-of-the-art. Equipment in use varies according to individual project goals and objectives. | BRD Science and Technology Centers, Programs, and Field Stations will continue to assess their need for telemetry equipment and analytical data processing methods. | Technological advances in telemetry equipment and techniques will continue to be evaluated at the Center, Program, and Field Station level. Communication on advances will be shared across BRD. |
| | Thematic mapping | Only a few Centers have the in-house expertise and equipment for acquiring aerial photography and for producing interpreted maps (e.g., vegetation). Several Centers produce GIS analysis maps without consistency of quality and cartographic oversight. There exists no master list of expertise or products developed within BRD. | The GTCG will develop a means of listing BRD expertise and of cataloging all BRD thematic maps and aerial photography produced yearly. Legacy products developed at Centers will be listed and documented. The OBIO, through the GTCG and the Geospatial Technology Council, will review and recommend standards, conventions, and guidelines to achieve consistency in BRD geospatial products. | The OBIO, through the GTCG, will continue to review the consistency of BRD output and will pursue initiatives to incorporate new technology into the next century. |
| | Satellite positioning systems | The Center for Biological Informatics and other BRD Centers maintain expertise in and provide coordination of satellite positioning systems technology for the BRD. | BRD Science Centers, Programs, and Field Stations will assess their status and need for satellite positioning systems technology. | The GTCG will implement national standards for the use and application of satellite positioning systems technology. |
| | Data communications | The current situation consists of fragmented, slow, and unreliable networks. | BRD-wide NBII/Internet connectivity will be completed for all BRD locations. | Reliable high-speed wide area network connectivity will be in place at all appropriate BRD locations. |
| | Equipment | Equipment ranges from obsolete to state-of-the-art, and consistency differs among and within locations. | Support and justification for the installed and planned equipment base will be provided through the budgetary process, to include the Maintenance Management System and budget model formulation. | Access will be available to all who need it. Equipment will be compatible among and between systems, subsystems, and locations. |
| | Staffing | Current geospatial technology staffing is very limited among BRD Science Centers, Programs, and Field Stations. | Human resources and training plans will be developed. A knowledge, skills, and abilities database will be central to developing these plans. | Staffing will be consistent with human resources and training plans. Contract staff will provide additional flexibility to meet Program needs. |
| | Infrastructure | Currently, no measurable Program standards or management control procedures exist. | The GTCG will form a subject-matter project team to develop measurable Program standards. | Measurable Program standards (quality, timeliness, reliability, security) will be developed and implemented. The use of established management control procedures will be consistent with Departmental regulations. |

Performance Measures and Critical Success Indicators

To help assess the success of this Geospatial Technology Strategic Plan, performance measures and critical success indicators will be applied to all goals (Table 2). These measures and indicators will reflect the relevance and timeliness of the information and technology provided to BRD scientists and partners in the biological community. Indicators are defined as follows:

Quality – a measure of accomplishment or attainment of a goal in providing accurate information and sound scientific analysis.

Quantity – a measure of the extent to which the goal has been implemented to meet the needs of the biological community.

Client Satisfaction and Use – a measure of the response of the biological community that reflects their ability to successfully implement, apply, and expand the use of geospatial technology.

Roles and Responsibilities

Office of Biological Informatics and Outreach

- Establish policy, standards, and guidelines for geospatial data technology, such as metadata documentation, metadata procedures training, and spatial data management and dissemination.
- Provide a focal point for communication, such as training opportunity announcements, workshops, conferences, and funding opportunities.
- Represent the BRD in interagency coordinating groups such as the FGDC, GSGDC, IGDC, and National Technical Means.

- Provide technical support for geospatial technology in conjunction with partnerships and cooperative programs.
- Maintain a leadership role in and promote the continued growth and institutionalization of the GTCG.
- Coordinate research, development, and testing of emerging geospatial technology.
- Maintain leadership in developing and implementing the NBII, NSDI, and Executive Order 1206.
- Maintain leadership in outreach and extension activities.
- Coordinate emergency response efforts requiring geospatial technology applications.
- Provide leadership in data and metadata serving (through a clearinghouse), data and information distribution, archival and data management practices, and quality control issues.
- Assist Centers, Programs, and Field Stations in developing and publishing geospatial data in various formats.

Regional Offices

- Implement geospatial technology activities in the field through Centers and partners in accordance with the resources and guidance provided by the Chief Biologist and the Management Council.
- Provide regional perspectives, plans, proposals, and priorities for consideration in program and budget development.

Science and Technology Centers and Programs

- Designate a GTCG representative as the Center, Program, or Field Station communications link between the local geospatial technology community, its partners, and the GTCG.

Table 2. Performance measures and critical success indicators for Geospatial Technology Strategic Plan goals.

| Geospatial Technology Strategic Plan goals | Critical success indicators | | | P E R F O R M A N C E M E A S U R E S |
|---|--|--|--|---|
| | Quality | Quantity | Client satisfaction and use | |
| Provide leadership in geospatial technology activities. | Biological Resources Division (BRD) Program review process. | Participation on teams, committees, and working groups. | Expanded use of technology and user feedback. | |
| Promote integration of geospatial technology within the biological research and resource management communities. | Recognized technical advances. | Increased implementation of geospatial technology. | Increased integration within BRD and across Divisions. | |
| Develop and maintain cooperative efforts and partnerships to effectively access and disseminate geospatial information, data, and technological resources. | Recognized cost savings through resource sharing. | Expanded partnerships. | Partner feedback. | |
| Facilitate development, use, and application of geospatial technology and expertise that support the biological research and resource management communities. | Active participation in local, regional, and national forums. | Development of tools, publications, demonstrations, and presentations. | Expanded use of tools and technology in the biological community. | |
| Ensure availability and accessibility of geospatial technology and expertise to the biological research and resource management communities. | Increased availability of technology and expertise. | Increased knowledge of and access to expertise and technology. | Expanded use of technology and user feedback. | |
| Manage geospatial data and information as valuable resources and incorporate their development as an integral part of the research and data sharing process. | Incorporation of geospatial technology applications into study plans and Program elements. | Increased availability of geospatial data, documentation, and methods of distribution. | Increased use of data and information by a broadened user community. | |
| Develop and implement a geospatial technology training program. | Improved training in geospatial technology. | Increased access to training opportunities. | Expanded use of technology and user feedback. | |

- Support designated representative’s attendance at GTCG meetings and participation by representative and other staff in activities and on teams as needed.
- Implement geospatial policy and guidance that result from GTCG recommendations.
- Ensure local compliance with data management and data documentation (i.e., metadata) related to programmatic datasets.

***Geospatial Technology
Coordinating Group***

- Organize GTCG meetings, and develop and design the GTCG organizational structure (e.g., group, teams, council).
- Communicate GTCG issues and activities to respective Centers, Programs, and Field Stations.
- Establish and maintain a BRD Geospatial Technology Home Page.

- Establish guidelines for prioritizing metadata and data to be served.
- Promote the use of standardized metadata tools.
- Recommend policy to collect geospatial coordinates as an integral and required part of field data collection.
- Coordinate geospatial technology training, conduct a survey of existing courses/instructors, and establish a directory of BRD geospatial technology training facilities.
- Provide the lead role for a general geospatial technology needs assessment.
- Communicate the roles of the NBII and NSDI to the BRD geospatial technology community.
- Evaluate current policy and consider recommending new policy on BRD handling and release of sensitive data.
- Recognize and communicate significant geospatial technology procedures, principles of operation, and roles and responsibilities of BRD Centers, Programs, and Field Stations.
- Communicate with BRD Center and Program management and the geospatial technology community concerning related policy, standards, guidelines, and resource needs.
- Make recommendations to the OBIO Assistant Chief Biologist regarding geospatial technology policy, standards, and guidelines.
- Establish a geospatial data inventory and directory.
- Establish a geospatial technology resources directory.
- Serve as respective Center, Program, or Field Station representative at GTCG meetings to discuss geospatial technology issues, needs, and concerns.
- Establish and actively participate on GTCG teams to accomplish the goals and objectives of this Strategic Plan.
- Compile Center, Program, and Field Station responses to requests for information on issues such as geospatial technology accomplishments, ongoing projects, new projects, milestones reached, geospatial expertise and capabilities, and geospatial hardware and software holdings.

Partnerships

The USGS BRD maintains partnerships through interagency and intra-agency agreements, memorandums of understanding, and international agreements.

Many partnership activities include the use and application of geospatial technology. Formal agreements have been entered into with other DOI bureaus (Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, U.S. Fish and Wildlife Service, National Park Service, Office of Surface Mining), U.S. Department of Agriculture bureaus (Agricultural Research Service, Natural Resource Conservation Service, Forest Service), and with the U.S. Environmental Protection Agency.

Among other interagency partnerships, the BRD participated in the establishment of a Federal Interagency Committee for the Management of Noxious and Exotic Weeds and participates in The Southern Appalachian Man and the Biosphere Program. The BRD also is undertaking an initiative to increase communication and collaboration among Federal agencies and the museum community, including a partnership with the Association of Systematics Collections.

The BRD works closely with non-government and State agencies and has formal agreements with Argonne National Laboratory, Champion International Corporation, the Great Lakes Fishery Commission, The Nature Conservancy, the National Fish and Wildlife Foundation, the Resources Agency of California, the Timberlands Operating Company, Ltd., and the Tennessee Valley Authority, among others. International agreements have been entered into on several

fronts, including those established with the International Association of Fish and Wildlife Agencies and the U.S./Mexico Border Environmental Issues Field Coordinating Committee. A Statement of Intent to Cooperate has been implemented between the USGS BRD and the Comision Nacional para el Conocimiento y Uso de la Biodiversidad, the Mexican Biodiversity Commission.

To help accomplish its mission, the BRD is continually seeking to establish new partnerships with Federal, State, and local government agencies and with universities, museums, libraries, private corporations, conservation organizations, and other nations and international organizations.

Acknowledgments

The Geospatial Technology Strategic Plan was reviewed by many Biological Resources Division staff members. The final version of this document is largely the result of their efforts, and we thank them for their contributions.

In particular, we thank the Geospatial Technology Coordinators, who consolidated comments from geospatial technology users at their respective Centers and Programs, and who were vital partners in organizing and fine-tuning the Strategic Plan. Interim drafts of the Strategic Plan were sent to all BRD Center Directors, the Regional Chief Biologists, the Office of Biological Informatics and Outreach Assistant Chief Biologist, the Cooperative Research Units Chief and all Co-op Unit Leaders, the Deputy Chief Biologists, and the Chief Biologist. We thank them for their guidance and encouragement. Their contributions were invaluable in developing the final document.

Implementation of this Strategic Plan will rely upon BRD-wide acceptance and participation. The authors recognized that careful consideration of all comments and concerns would be required to produce a document which reflects user and management needs—and that by inviting such wide review the time to final publication

would be greatly extended. But we also recognized that the success of the Geospatial Technology Strategic Plan will be a direct result of active participation by all those affected by it. We greatly appreciate the comments provided by all reviewers.

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Glossary

Abbreviations and Acronyms

| | | | |
|-------|--|-------|--|
| ABSC | Alaska Biological Science Center | HALE | Haleakala Field Station |
| ACRU | Alabama Cooperative Research Unit, Auburn University | HAVO | Hawaii Volcanoes National Park |
| BRD | Biological Resources Division | ICRU | Iowa Cooperative Research Unit |
| CBI | Center for Biological Informatics | IGDC | Interior Geographic Data Committee |
| CPSU | Cooperative Park Studies Unit | IRM | information resources management |
| CRO | Central Regional Office | ITB | Information Technology Budget |
| CRRL | Columbia River Research Laboratory | JCWS | Johnson Controls World Services, Inc. |
| CRU | Cooperative Research Unit | JMFS | Jemez Mountains Field Station |
| CSC | California Science Center | KCRU | Kansas Cooperative Research Unit |
| DOD | Department of Defense | LADNR | Louisiana Department of Natural Resources |
| DOI | Department of the Interior | LSC | Leetown Science Center |
| ECRC | Environmental and Contaminants Research Center | MESC | Midcontinent Ecological Science Center |
| EMTC | Environmental Management Technical Center | NBII | National Biological Information Infrastructure |
| FCSC | Florida Caribbean Science Center | NCSU | North Carolina State University |
| FGDC | Federal Geographic Data Committee | NPS | National Park Service |
| FRESC | Forest and Rangeland Ecosystem Science Center | NPWRC | Northern Prairie Wildlife Research Center |
| FY | fiscal year | NREL | Natural Resources Ecology Laboratory |
| GBFS | Glacier Bay Field Station | NSDI | National Spatial Data Infrastructure |
| GBPO | Gulf Breeze Project Office | NWHC | National Wildlife Health Center |
| GFS | Glacier Field Station | NWRC | National Wetlands Research Center |
| GIS | geographic information systems | OBIO | Office of Biological Informatics and Outreach |
| GLSC | Great Lakes Science Center | OKCRU | Oklahoma Cooperative Research Unit |
| GOGA | Golden Gate Field Station | PIERC | Pacific Island Ecosystems Research Center |
| GPS | Global Positioning System | PORE | Point Reyes National Seashore Field Station |
| GPRA | Government Performance and Results Act | PPS | Precise Positioning Service |
| GRSM | Great Smoky Mountains National Park Field Station | PWRC | Patuxent Wildlife Research Center |
| GSGDC | Geological Survey Geographic Data Committee | | |
| GTCG | Geospatial Technology Coordinating Group | | |

| | | | |
|-------|---|------|---|
| REDW | Redwoods National Park Field Station | UMSC | Upper Mississippi Science Center |
| RENO | Reno, Nevada, Field Station | UNLV | University of Nevada, Las Vegas |
| SEKI | Sequoia Kings Canyon National Parks Field Station | USGS | U.S. Geological Survey |
| SMU | Saint Mary's University | UTN | University of Tennessee |
| UAZ | University of Arizona | UWL | University of Wisconsin, La Crosse |
| UI | University of Idaho | WFRC | Western Fisheries Research Center |
| UMCRU | University of Minnesota Co-op Research Unit | YELL | Yellowstone National Park Field Station |
| | | YOSE | Yosemite National Park Field Station |

Appendix A.

Biological Resources Division Representation on Federal Geographic Data Committees and Working Groups

The following list of geographic data committees includes all current working groups. U.S. Geological Survey (USGS) Biological Resources Division (BRD) staff are included for working groups with BRD representatives.

Federal Geographic Data Committee

| | |
|---------------------------------------|--|
| Base Cartographic Subcommittee | Maury Nyquist |
| Bathymetric Subcommittee | No BRD representative. |
| Biological Data Working Group | Anne Frondorf, Maury Nyquist |
| Cadastral Subcommittee | No BRD representative. |
| Clearinghouse Working Group | Maury Nyquist, Sharon Shin, Susan Stitt |
| Coordination Group | No BRD representative. |
| Cultural and Demographic Subcommittee | No BRD representative. |
| Earth Cover Working Group | James Getter, Mike Jennings, Maury Nyquist |
| Facilities Working Group | No BRD representative. |
| Framework Working Group | No BRD representative. |
| Geodetic Control Subcommittee | Karl Brown |
| Geological Subcommittee | No BRD representative. |
| Ground Transportation Subcommittee | No BRD representative. |
| Historical Data Working Group | No BRD representative. |
| International Boundaries Subcommittee | No BRD representative. |
| SIMNRE Working Group | Paul Geissler |
| Soils Subcommittee | No BRD representative. |
| Standards Working Group | Anne Frondorf, Maury Nyquist |
| Vegetation Subcommittee | Gary Waggoner |
| Water Subcommittee | No BRD representative. |
| Wetlands Subcommittee | No BRD representative. |

Interior Geographic Data Committee

| | |
|------------------------------|-----------------------------|
| Base Mapping Working Group | Phil Wondra |
| Remote Sensing Working Group | Maury Nyquist Ralph Root |

USGS Geographic Data Committee

| | |
|------------------------------|--|
| Clearinghouse Working Group | Gladys Cotter, James Getter |
| Remote Sensing Working Group | Susan Stitt |
| Requirements Working Group | James Getter, Ralph Root, Susan Stitt |
| Standards Working Group | Frank D'Erchia, Maury Nyquist James Getter, Maury Nyquist |

Appendix B.

Information Technology Budget Report

Data on acquisition, operation, and use of information systems are collected for oversight of the acquisition and use of automatic data processing equipment, telecommunications, and other information technology to manage information resources as required by the Paperwork Reduction Act of 1980. Office of Management and Budget Circular No. A-11, Information Technology Budget Report (Office of Management and Budget 1996), provides information on workyears and obligations for information technology activities. It includes obligations for planning, including requirements, feasibility, and cost-benefit studies; system design, development, and acquisition; and voice and data communications requirements, regardless of whether or not they are associated with an information system's installation, operation, maintenance, and support.

Exhibit 43 of the Information Technology Budget Report for the U.S. Geological Survey (USGS) Biological Resources Division follows.

Exhibit 43
Bureau/Office-Wide Summary Report on Obligations for
Information Technology
Bureau/Office: USGS Biological Resources
(in thousands of dollars)

| Item | FY 1996 | FY 1997 | FY 1998 |
|--|---------------|---------------|---------------|
| 1. Equipment | | | |
| A. Capital purchases | 925.0 | 875.0 | 962.0 |
| B. Other equipment purchases/leases | <u>160.0</u> | <u>170.0</u> | <u>178.0</u> |
| Subtotal | 1085.0 | 1045.0 | 1140.0 |
| 2. Software | | | |
| A. Capital purchases | 280.0 | 251.0 | 263.0 |
| B. Other software purchases/leases | <u>212.0</u> | <u>204.0</u> | <u>214.0</u> |
| Subtotal | 492.0 | 455.0 | 477.0 |
| 3. Services | 67.0 | 84.0 | 88.0 |
| 4. Support services | 1535.0 | 1613.0 | 1694.0 |
| 5. Supplies | 164.0 | 165.0 | 173.0 |
| 6. Personnel (compensation and benefits) | 4421.0 | 4443.0 | 4600.0 |
| 7. Other (<i>Department of Defense [DOD] use only</i>) | 0 | 0 | 0 |
| 8. Intra-governmental payments | 46.0 | 46.0 | 46.0 |
| 9. Intra-governmental collections (-) | 1500.0 | 1500.0 | 1500.0 |
| 10. Total obligations | <u>6310.0</u> | <u>6351.0</u> | <u>6718.0</u> |
| 11. Workyears | 75.0 | 75.0 | 77.0 |

Explanations of the information in Exhibit 43 are given below.

| Item | Explanation |
|--|--|
| 1. Equipment | Any equipment or interconnected system or subsystem of equipment used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. |
| A. Capital purchases | Capital investments for equipment for data processing and telecommunications, such as supercomputers, mainframes, mini-computers, microcomputers, analog and digital private branch exchanges, ancillary equipment, such as disk drives, tape drives, plotters, printers, storage and back-up devices cable-connected to computers, digital imaging equipment; optical storage and/or retrieval equipment (e.g., optical character recognition devices, computer-generated microfilm and other data acquisition devices), punch card accounting equipment, and office automation equipment that was designed for use in conjunction with or controlled by a computer system; telecommunications networks and related equipment, such as voice communications networks, data communications networks, local area networks, terminals, modems, data encryption devices, fiber optical and other communications networks; packet switching equipment, terrestrial carrier equipment (e.g., multipliers and concentrators), lightwave, microwave, or satellite transmission and receiving equipment, telephonic (including cellular and other hand-held devices) equipment, and facsimile equipment. Does not include furniture, typewriters, copiers, calculators, or microfilm/microfiche equipment. |
| B. Other equipment purchases/leases | Non-capital purchases or losses for equipment as defined above. |
| 2. Software | Any software, including firmware, specially designed to make use of and extend the capabilities of Federal Information Processing equipment identified in Item 1 above. |
| A. Capital purchases | Software purchases (including one-line obligations for long-term licenses) or leases costing \$25,000 or more for system programs (e.g., control and library programs, assemblers, compilers, interpreters, utility programs, sort-merge programs, and maintenance diagnostic programs); application programs; and commercial off-the shelf software (e.g., word processing, communications, graphics, file management, and database management system software). Software also includes independent subrouters, related groups of routines, sets or systems of programs; databases; and software documentation. |
| B. Other software purchases/leases | Software purchases or leases costing less than \$25,000. |
| 3. Services | Any service, other than support services, performed or furnished by using the equipment or software identified in Items 1 and 2 above. Services include teleprocessing, local batch processing, electronic mail, voice mail, centrex, cellular telephone, facsimile, and packet switching of data. |
| 4. Support services | Any commercial services, including maintenance, used in support of equipment, software, or services identified in Items 1, 2, and 3 above. Support services include source data entry, training, planning for the use and acquisition of information technology, studies (e.g., requirements analysis, analyses of alternatives, and conversion studies), facilities management of government-furnished information technology, custom software development, system analysis and design, and computer performance evaluation and capacity management. |
| 5. Supplies | Any consumable item designed specifically for use with equipment, software, services, or support services identified in Items 1, 2, 3, and 4 above |
| 6. Personnel (compensation and benefits) | Includes the salary (compensation) and benefits for government personnel (both civilian and/or military) who perform information technology functions 51% or more of their time. Functions include but are not limited to policy, management, systems development, operations, telecommunications, computer security, contracting, and secretarial support. Personnel in user organizations who simply use information technology assets incidental to the performance of their primary functions are not to be included. |
| 7. Other (<i>DOD use only</i>) | Include items not otherwise reported in Items 1 through 6 above. |
| A. Capital purchases | Items costing \$25,000 or more. |
| B. Other purchases | Items costing less than \$25,000. |

| Item | Explanation |
|---------------------------------------|--|
| 8. Intra-governmental payments | Payments for all information technology services within agencies, between executive branch agencies, judicial and legislative branches, and State and local governments. (Within DOD, the military services and Office of the Secretary of Defense are considered agencies for this purpose, e.g., between DOD components and between activities within a DOD component.) |
| 9. Intra-governmental collections (-) | Collections for all information technology services within agencies, between executive branch agencies, judicial and legislative branches, and State and local governments. (Within DOD, the military services and Office of the Secretary of Defense are considered agencies for this purpose, e.g., between DOD components and between activities within a DOD component.) |
| 10. Total obligations | The sum of Items 1 through 8 above. |
| 11. Workyears | Estimated number of workyears associated with the civilian and/or military personnel reported in Item 8 above. |

Appendix C.

Self-Directed Teams

The Biological Resources Division (BRD) of the U.S. Geological Survey is operating its Geospatial Technology Program in a virtual mode. That is to say, self-directed teams are formed of subject-matter specialists in response to a particular initiative, interest, project, or problem. Self-directed teams are sanctioned through charter, when necessary, with team members electing a Chair and/or Team Leader. The duration of a self-directed team is a function of a particular response. The following self-directed teams have been formed to date:

Geospatial Technology Coordinating Group

Purpose: The BRD has established a Geospatial Technology Coordinator for each of its Science and Technology Centers and major Program areas. The Geospatial Technology Coordinator provides technical assistance to end-users at the Center or Program and associated Field Offices.

| | |
|--|------------------|
| Alaska Biological Science Center | David Douglas |
| Biomonitoring of Environmental Status and Trends Program | Jim Coyle |
| Central Regional Office | Frank D'Erchia |
| Cooperative Research Units | Jim Fleming |
| California Science Center | William Perry |
| Center for Biological Informatics | Ralph Root |
| Environmental and Contaminants Research Center | Mark Lastrup |
| Environmental Management Technical Center | Carol Lowenberg |
| Florida Caribbean Science Center | Amy Benson |
| Forest and Rangeland Ecosystem Science Center | Tom Zarriello |
| Gap Analysis Program | Michael Jennings |
| Great Lakes Science Center | Gregory Kennedy |
| Leetown Science Center | John Young |
| Midcontinent Ecological Science Center | Barbara White |
| National Wetlands Research Center | Jimmy Johnston |
| National Wildlife Health Center | Paul Slota |
| Northern Prairie Wildlife Research Center | Larry Strong |
| Office of Biological Informatics and Outreach | James Getter |
| Pacific Island Ecosystems Science Center | Sandy Margriter |
| Patuxent Wildlife Research Center | Ian Thomas |
| Upper Mississippi Science Center | Carl Korschgen |
| Western Fisheries Research Center | Michael Parsley |

Geospatial Technology Council

Purpose: This seven-member rotating membership team serves as an advisory group that assists the Geospatial Technology Coordinating Group (GTCG) with recommendations on policy issues, standards, and guidelines. It also acts as a steering committee for the BRD geospatial technology function. Membership includes a nonvoting Office of Biological Informatics and Outreach (OBIO) representative. To maintain continuity, the Council has been formed so that at least half the members will overlap with new members.

Frank D'Erchia, Chair
 Amy Benson
 James Getter (nonvoting member)
 Larry Handley
 Mark Lastrup
 William Perry
 Ralph Root (nonvoting member)
 Barbara White

Central Regional Office
 Florida Caribbean Science Center
 Office of Biological Informatics and Outreach
 National Wetlands Research Center
 Environmental and Contaminants Research Center
 California Science Center
 Center for Biological Informatics
 Midcontinent Ecological Science Center

Geospatial Technology Strategic Planning Development Team

Purpose: This team includes BRD-wide representatives. The team's purpose is to provide a Strategic Plan for the GTCG and the OBIO Assistant Chief Biologist.

Frank D'Erchia, Team Leader
 Terry D'Erchia, James Getter
 Marcia McNiff

Central Regional Office
 Office of Biological Informatics and Outreach
 National Wetlands Research Center
 (currently with U.S. Fish and Wildlife Service)
 Center for Biological Informatics
 Midcontinent Ecological Science Center

Ralph Root, Susan Stitt
 Barbara White

Geospatial Technology Home Page Team

Purpose: This team will develop style guidelines for the BRD Geospatial Technology Home Page.

Frank D'Erchia, Team Leader
 Terry D'Erchia
 Harvey Fleet
 Michael Parsley
 William Perry
 John Young

Central Regional Office
 Office of Biological Informatics and Outreach
 Center for Biological Informatics
 Western Fisheries Research Center
 California Science Center
 Leetown Science Center

Geospatial Metadata Implementation Team

Purpose: This team recommends procedures and policies that will facilitate the production and serving of metadata within the BRD. Specifically, this team will address options to survey and identify existing but undocumented datasets, options for training and data entry, quality control issues, and methods for serving metadata through the Clearinghouse.

Susan Stitt, Team Leader
 Jennifer Gaines
 Gregory Kennedy
 Mark Lastrup
 William Perry
 Sharon Shin
 Barbara White
 John Young

Center for Biological Informatics
 Office of Biological Informatics and Outreach
 Great Lakes Science Center
 Environmental and Contaminants Research Center
 California Science Center
 Center for Biological Informatics
 Midcontinent Ecological Science Center
 Leetown Science Center

Geospatial Technology Strategic Plan Objectives Review Team

Purpose: This team developed a set of condensed, concise objectives for the Strategic Plan.

| | |
|----------------------------|--|
| Barbara White, Team Leader | Midcontinent Ecological Science Center |
| Larry Handley | National Wetlands Research Center |
| Mark Lastrup | Environmental and Contaminants Research Center |
| Carol Lowenberg | Environmental Management Technical Center |
| Michael Parsley | Western Fisheries Research Center |

Geospatial Technology Standards Team

Purpose: This team will review existing policies and regulations to determine which of them are essential to the BRD. The team will develop new standards as needed. Findings and recommendations will be presented to the Geospatial Technology Council to be forwarded to the OBIO Assistant Chief Biologist for implementation.

| | |
|----------------------------|--|
| Larry Handley, Team Leader | National Wetlands Research Center |
| Gregory Kennedy | Great Lakes Science Center |
| Mark Lastrup | Environmental and Contaminants Research Center |
| Tom Owens, Ralph Root | Center for Biological Informatics |
| Tom Zariello | Forest and Rangeland Ecosystem Science Center |

Geospatial Technology Training Team

Purpose: This team will evaluate existing geospatial technology training opportunities and will develop or recommend training options.

| | |
|----------------------------|---|
| William Perry, Team Leader | California Science Center |
| Frank D'Erchia | Central Regional Office |
| James Getter | Office of Biological Informatics and Outreach |
| Larry Handley | National Wetlands Research Center |
| Carol Lowenberg | Environmental Management Technical Center |

Global Positioning System Contacts

Purpose: Global Positioning System (GPS) contacts facilitate equipment purchase questions, give advice on functionality and suitability of equipment choices for varied investigations and research needs, assemble Center GPS orders for limited access Precise Positioning Service (PPS) equipment, and annually coordinate crypto rekeying and maintain PPS capabilities for Center users of military-type GPS equipment.

| | |
|--|-------------------------|
| Center for Biological Informatics | Karl Brown, Coordinator |
| Alaska Biological Science Center | John Dunlap |
| Environmental and Contaminants Research Center | Mark Wildhaber |
| Environmental Management Technical Center | Carol Lowenberg |
| Florida Caribbean Science Center | Charles Boydston |
| Great Lakes Science Center | Gregory Kennedy |
| Leetown Science Center | John A. Young |
| Midcontinent Ecological Science Center | Bob Waltermire |

National Wetlands Research Center
Northern Prairie Wildlife Research Center
Patuxent Wildlife Research Center
Upper Mississippi Science Center
Western Fisheries Research Center

Larry Handley
Glenn Guntenspergen
Robert Munro
Kevin Kenow
Michael Parsley

Appendix D.

Biological Resources Division Geospatial Technology Users

| Center/name | Office | Phone | cc:Mail | Internet |
|--|-----------|----------------------|---------------------|-----------------------------|
| Alaska Biological Science Center (ABSC) | | | | |
| Anthony, Mike | ABSC | (907) 786-3636 | Anthony, Mike | mike_anthony@usgs.gov |
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| Durner, George | ABSC | (907) 786-3366 | Durner, George | george_durner@usgs.gov |
| Dunlap, John | ABSC | (907) 786-3385 | Dunlap, John | john_dunlap@usgs.gov |
| Hooge, Philip | ABSC-GBFS | (907) 697-2230 | Hooge, Philip | philip_hooge@usgs.gov |
| Hupp, Jerry | ABSC | (907) 786-3303 | Hupp, Jerry | jerry_hupp@usgs.gov |
| James, Ford | ABSC-GBFS | (907) 697-2230 | James, Ford | ford_james@usgs.gov |
| Jay, Chad | ABSC | (907) 786-3856 | Jay, Chad | chad_jay@usgs.gov |
| Monson, Dan | ABSC | (907) 786-3449 | Monson, Dan | dan_monson@usgs.gov |
| Rehberg, Mike | ABSC | (907) 786-3686 | Rehberg, Mike | mike_rehberg@usgs.gov |
| Smith, Tom | ABSC | (907) 786-3456 | Smith, Tom | tom_smith@usgs.gov |
| Ward, David | ABSC | (907) 786-3525 | Ward, David | david_ward@usgs.gov |
| California Science Center (CSC) | | | | |
| Casazza, Mike | CSC | (916) 756-1946 | Casazza, Mike | mike_casazza |
| Chow, Leslie | CSC-YOSE | (209) 372-0465 | Chow, Les | les_chow@usgs.gov |
| Daugherty, Joan | CSC | (916) 756-1946 | Daugherty, Joan | joan_daugherty@usgs.gov |
| Douglas, Charles L. | CSC-UNLV | (702) 895-3219 | | charles_l._douglas@usgs.gov |
| Esperanza, Annie M. | CSC-SEKI | (209) 565-3172 | Esperanza, Annie M. | annie_m._esperanza@usgs.gov |
| Estes, James | CSC | | | jestes@ucsc.ucsc.edu |
| Fellers, Gary | CSC-PORE | (415) 663-8522 | Fellers, Gary | gary_fellers@usgs.gov |
| Howell, Judd | CSC-GOGA | (415) 556-9506 | Howell, Judd | judd_howell@usgs.gov |
| Kunzmann, Mike | CPSU-UJAZ | (520) 621-7282 | Kunzmann, Mike | mike_kunzmann@usgs.gov |
| Madej, Mary Ann | CSC-REDW | (707) 822-7611 | Madej, Mary Ann | mary_ann_madej@usgs.gov |
| Moore, Peggy | CSC-YOSE | (209) 372-0466 | Moore, Peggy | peggy_moore@usgs.gov |
| Orthmeyer, Dennis | CSC | (916) 756-1946 | Orthmeyer, Dennis | dennis_orthmeyer@usgs.gov |
| Perry, William | CSC | (916) 756-1946 | Perry, William | william_perry@usgs.gov |
| Stine, Peter | CSC | (916) 227-2669 | Stine, Peter | peter_stine@usgs.gov |
| Takekawa, John | CSC | (707) 552-9880 | Takekawa, John | john_takekawa@usgs.gov |
| Van Wagtendonk, Jan | CSC-YOSE | (209) 372-0465 | Van Wagtendonk, Jan | jan_van_wagtendonk@usgs.gov |
| Center for Biological Informatics (CBI) | | | | |
| Brown, Karl | CBI | (303) 202-4240 | Brown, Karl | karl_brown@usgs.gov |
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| Fleet, Harvey | CBI | (303) 202-4224 | Fleet, Harvey | harvey_fleet@usgs.gov |
| Jennings, Michael | CBI-UI | (208) 885-6336 | | jennings@uidaho.edu |
| Nyquist, Maury | CBI | (303) 202-4217 | Nyquist, Maury | maury_nyquist@usgs.gov |
| Owens, Tom | CBI | (303) 202-4259 | Owens, Tom | tom_owens@usgs.gov |
| Root, Ralph | CBI | (303) 202-4232 | Root, Ralph | ralph_root@usgs.gov |
| Shin, Sharon | CBI | (303) 202-4230 | Shin, Sharon | sharon_shin@usgs.gov |
| Stitt, Susan | CBI | (303) 202-4234 | Stitt, Susan | susan_stitt@usgs.gov |
| Story, Mike | CBI-NPS | (303) 202-4236 | Story, Mike | story_mike@usgs.gov |
| Waggoner, Gary | CBI | (303) 202-4222 | Waggoner, Gary | gary_waggoner@usgs.gov |
| Central Regional Office (CRO) | | | | |
| D'Erchia, Frank | CRO | (303) 236-2730, x246 | Derchia, Frank | frank_derchia@usgs.gov |
| Wondra, Phil | CRO | (303) 236-2730, x251 | Wondra, Phil | phil_wondra@usgs.gov |

| Center/name | Office | Phone | cc:Mail | Internet |
|---|--------|----------------|---------------|----------------------------------|
| Cooperative Research Units (CRU) | | | | |
| Fettig, Steve | UMCRU | (612) 624-3699 | | sfettig@torpedo.forestry.umn.edu |
| Fisher, William | OKCRU | (405) 744-6342 | | wfisher@osuunx.ucc.okstate.edu |
| Fleming, Jim | CRU | (703) 648-4260 | Fleming, Jim | jim_fleming@usgs.gov |
| Gipson, Phillip | KCRU | (913) 532-6070 | | gipson@ksuvm.ksu.edu |
| Haultain, Sylvia | SEKI | (209) 565-3174 | | sahaultain@ucdavis.edu |
| Irwin, Elise | ACRU | (205) 844-4796 | R8CUAL | r8cual@usgs.gov |
| Klaas, Erwin | ICRU | (515) 294-3056 | R8CUAIA | eklaas@iastate.edu |
| Simons, Ted | NCSU | (919) 515-2689 | Simons, Ted | ted_simons@usgs.gov |
| Wright, Gerry | UI | (208) 885-7990 | Wright, Gerry | gerry_wright@usgs.gov |

Environmental and Contaminants Research Center (ECRC)

| | | | | |
|----------------------|------|-----------------------|----------------------|------------------------------|
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| Burke, Vincent | ECRC | (573) 875-5399, x1721 | Burke, Vincent | vincent_burke@usgs.gov |
| Callahan, Ed | ECRC | (573) 875-5399, x1844 | Callahan, Ed | ed_callahan@usgs.gov |
| Delonay, Aaron | ECRC | (573) 875-5399, x1878 | Delonay, Aaron | aaron_delonay@usgs.gov |
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| Haverland, Pamela | ECRC | (573) 875-5399 | Haverland, Pamela | pamela_haverland@usgs.gov |
| Henke, Chris | ECRC | (573) 875-5399, x1884 | Henke, Chris | chris_henke@usgs.gov |
| Hoener, Donna | ECRC | (573) 875-5399, x1714 | Hoener, Donna | donna_hoener@usgs.gov |
| Jacobson, Robb | ECRC | (573) 875-5399 | Jacobson, Robb | robb_jacobson@usgs.gov |
| Lastrup, Mark | ECRC | (573) 875-5399, x1703 | Lastrup, Mark | mark_lastrup@usgs.gov |
| Poulton, Barry | ECRC | (573) 875-5399, x1873 | Poulton, Barry | barry_poulton@usgs.gov |
| Schmitt, Christopher | ECRC | (573) 875-5399, x1846 | Schmitt, Christopher | christopher_schmitt@usgs.gov |
| Wildhaber, Mark | ECRC | (573) 875-5399, x1847 | Wildhaber, Mark | mark_wildhaber@usgs.gov |

Environmental Management Technical Center (EMTC)

| | | | | |
|---------------------|----------|----------------------|---------------------|-----------------------------|
| Asp, Sean | EMTC | (608) 783-7550, x32 | Asp, Sean | sean_asp@usgs.gov |
| Bower, Mel | EMTC-UWL | (608) 783-7550, x725 | Bower, Mel | mel_bower@usgs.gov |
| Craig, Mary | EMTC-SMU | (608) 783-7550, x710 | Craig, Mary | mary_craig@usgs.gov |
| DeHaan, Hank | EMTC-SMU | (608) 783-7550, x710 | DeHaan, Hank | hank_dehaan@nbs.gov |
| DeHaan, Lynne | EMTC-UWL | (608) 783-7550, x30 | DeHaan, Lynne | lynne_dehaan@nbs.gov |
| Fitzpatrick, Daniel | EMTC | (608) 783-7550, x12 | Fitzpatrick, Daniel | daniel_fitzpatrick@usgs.gov |
| Friesen, Beverly | EMTC | (608) 783-7550, x47 | Friesen, Beverly | beverly_friesen@usgs.gov |
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| Hop, Kevin | EMTC | (608) 783-7550, x46 | Hop, Kevin | kevin_hop@usgs.gov |
| Joria, Pete | EMTC-SMU | (608) 783-7550, x703 | Joria, Pete | pete_joria@usgs.gov |
| Lowenberg, Carol | EMTC | (608) 783-7550, x18 | Lowenberg, Carol | carol_lowenberg@usgs.gov |
| Olson, Bekki | EMTC-UWL | (608) 783-7550, x727 | Olson, Bekki | bekki_olson@nbs.gov |
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| Robinson, Larry | EMTC | (608) 783-7550, x33 | Robinson, Larry | larry_robinson@usgs.gov |
| Rogala, Jim | EMTC | (608) 783-7550, x60 | Rogala, Jim | jim_rogala@usgs.gov |
| Rogers, Sara | EMTC | (608) 783-7550, x54 | Rogers, Sara | sara_rogers@nbs.gov |
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| Tyser, Rob | EMTC-UWL | (608) 783-7550, x710 | Tyser, Rob | rob_tyser@nbs.gov |
| Yin, Yao | EMTC-UTN | (608) 783-7550, x53 | Yin, Yao | yao_yin@usgs.gov |

Florida Caribbean Science Center (FCSC)

| | | | | |
|-------------------|----------|----------------|-------------------|---------------------------|
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| Nodvin, Stephen | FCSC-UTN | (615) 974-0739 | Nodvin, Stephen | stephen_nodvin@usgs.gov |
| Williams, Denise | GRSM | (615) 436-1703 | | grsm@grsm.brd.gov |

| Center/name | Office | Phone | cc:Mail | Internet |
|--|------------|----------------------|------------------------|----------------------------------|
| Forest and Rangeland Ecosystem Science Center (FRESC) | | | | |
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| Deshler, Paul R. | FRESC-CPSU | (602) 556-7466 | Deshler, Paul R. | paul_r_deshler@usgs.gov |
| Knick, Steve | FRESC | (208) 331-5208 | | sknick@eagle.idbsu.edu |
| Van Riper III, Charles | FRESC | (602) 556-7311 | Van Riper III, Charles | charles_van_riper_iii@usgs.gov |
| Zarriello, Tom | FRESC | (208) 331-5204 | | tzarriel@eagle.idbsu.edu |
| Great Lakes Science Center (GLSC) | | | | |
| Kennedy, Gregory | GLSC | (700) 378-1215 | Kennedy, Gregory | gregory_kennedy@usgs.gov |
| Kowalski, Kurt | GLSC | (313) 994-3331, x308 | Kowalski, Kurt | kurt_kowalski@usgs.gov |
| Nelson, Scott | GLSC | (313) 994-3331 x243 | Nelson, Scott | scott_nelson@usgs.gov |
| Leetown Science Center (LSC) | | | | |
| Brown, Jim | LSC | (304) 725-8461, x282 | Brown, Jim | jim_brown@usgs.gov |
| Burkhard, Elizabeth | LSC | (304) 725-8461, x384 | Burkhard, Elizabeth | elizabeth_burkhard@nbs.gov |
| Clark, Joe | LSC | (423) 974-0739 | Clark, Joe | jclark1@utk.edu |
| Haines, Terry | LSC | (207) 581-2578 | Haines, Terry | haines@maine.maine.edu |
| Letcher, Benjamin | LSC | (413) 863-9475, x34 | | |
| Parker, Chuck | LSC | (423) 436-1704 | Parker, Chuck | cparker@grsm.nps.gov |
| Smith, David R. | LSC | (304) 725-8461, x383 | Smith, David R. | david_r_smith@usgs.gov |
| Snyder, Craig | LSC | (304) 725-8461, x284 | Snyder, Craig | craig_snyder@usgs.gov |
| Villella, Rita | LSC | (304) 725-8461, x322 | Villella, Rita | rita_villella@usgs.gov |
| Washington, Priscilla | LSC | (304) 725-8461, x295 | Washington, Priscilla | priscilla_washington@usgs.gov |
| Young, John A. | LSC | (304) 725-8461, x364 | Young, John A. | john_a_young@usgs.gov |
| Midcontinent Ecological Science Center (MESC) | | | | |
| Allen, Craig | MESC-JMFS | (505) 672-3861 x541 | Allen, Craig | craig_allen@usgs.gov |
| Asherin, Duane | MESC | (970) 226-9402 | Asherin, Duane | duane_asherin@usgs.gov |
| Boyle, Terry | MESC | (970) 491-1452 | | tpboyle@lamar.colostate.edu |
| Brownne, Dawn | MESC-JCWS | (970) 226-9368 | Brownne, Dawn | dawn_brownne@usgs.gov |
| Chong, Geneva | MESC-NREL | (970) 491-5835 | | geneva@nrel.colostate.edu |
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| Emmerich, Chris | MESC-JCWS | (970) 226-9336 | Emmerich, Chris | chris_emmerich@usgs.gov |
| Fancher, Tammy | MESC-JCWS | (970) 226-9306 | Fancher, Tammy | tammy_fancher@usgs.gov |
| Gish, Charles | MESC | (970) 226-9363 | Gish, Charles | charles_gish@usgs.gov |
| Gogan, Peter | MESC-YELL | (307) 344-2223 | Gogan, Peter | peter_gogan@usgs.gov |
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| Hart, Judy G. | MESC-JCWS | (970) 226-9374 | Hart, Judy G. | judy_g_hart@usgs.gov |
| Horak, Gerry | MESC-JCWS | (970) 226-9413 | Horak, Gerry | gerry_horak@usgs.gov |
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| Kalkhan, Mohammed | MESC-NREL | (970) 491-7715 | | mohammed@nrel.colostate.edu |
| Keating, Kim | MESC-YELL | | | ueykk@msu.oscs.montana.edu |
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| Kern, Tim | MESC-JCWS | (970) 226-9366 | Kern, Tim | tim_kern@usgs.gov |
| Key, Carl | MESC-GFS | (406) 888-5441 | Key, Carl | carl_key@usgs.gov |
| Kotliar, Tasha | MESC | (970) 226-9446 | Kotliar, Tasha | tasha_kotliar@usgs.gov |
| Lee, Victor | MESC | (970) 226-9321 | Lee, Victor | victor_lee@usgs.gov |
| Mangus, Warren | MESC | (970) 226-9293 | Mangus, Warren | warren_mangus@usgs.gov |
| Moses, Mike | MESC | (970) 226-9266 | Moses, Mike | mike_moses@usgs.gov |
| Osborn, Ron | MESC | (970) 226-9380 | Osborn, Ron | ron_osborn@usgs.gov |
| Ouren, Doug | MESC | (406) 994-4760 | Ouren, Doug | doug_ouron@usgs.gov |
| Richards, Jon | MESC | (970) 226-9335 | Richards, Jon | jon_richards@usgs.gov |
| Richmond, Ann | MESC | (970) 491-1513 | | richmond@picea.cnr.colostate.edu |
| Schneider, Diane | MESC | (970) 226-9337 | Schneider, Diane | diane_schneider@usgs.gov |
| Schroeder, Rick | MESC | (970) 226-9417 | Schroeder, Rick | rick_schroeder@usgs.gov |
| Stohlgren, Tom | MESC-NREL | (970) 491-1980 | Stohlgren, Tom | tom_stohlgren@usgs.gov |
| Waltermire, Bob | MESC | (970) 226-9344 | Waltermire, Bob | bob_waltermire@usgs.gov |
| White, Barbara | MESC | (970) 226-929 | White, Barb | barb_white@usgs.gov |

| Center/name | Office | Phone | cc:Mail | Internet |
|---|------------|----------------|-----------------------|--------------------------------|
| National Wetlands Research Center (NWRC) | | | | |
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| Biagas, Janelda | NWRC | (318) 266-8649 | BiagasJ | BiagasJ@nwrc.gov |
| Books, Mark | NWRC-JCWS | (318) 226-8562 | Books, Mark | booksm@nwrc.gov |
| Bourgeois, Pete | NWRC-GBPO | (904) 934-9280 | | pete@octopus.gbr.epa.gov |
| Calix, Art | NWRC | (318) 266-8578 | Calix, Art | art_calix@usgs.gov |
| Carter, Jacoby | NWRC | (318) 226-8620 | Carter, Jacoby | carterj@usgs.gov |
| Chappell, Dal | NWRC | (318) 266-8695 | Chappell, Dal | dal_chappell@usgs.gov |
| Couvillion, Wendi | NWRC | | | wc0109@deq.state.la.us |
| Day, Richard | NWRC | (318) 266-8557 | Day, Richard | richard_day@usgs.gov |
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| | |
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| ACRU | Alabama Cooperative Research Unit, Auburn University |
| CPSU | Cooperative Park Studies Unit |
| CRRL | Columbia River Research Laboratory |
| GBFS | Glacier Bay Field Station |
| GBPO | Gulf Breeze Project Office |
| GFS | Glacier Field Station |
| GOGA | Golden Gate Field Station |
| GRSM | Great Smoky Mountains National Park Field Station |
| HALE | Haleakala Field Station |
| HAVO | Hawaii Volcanoes National Park |
| ICRU | Iowa Cooperative Research Unit |
| JCWS | Johnson Controls World Services, Inc. |
| JMFS | Jemez Mountains Field Station |
| KCRU | Kansas Cooperative Research Unit |
| LADNR | Louisiana Department of Natural Resources Building, Baton Rouge Project Office |
| NCSU | North Carolina State University |
| NPS | National Park Service |
| NREL | Natural Resources Ecology Laboratory, Colorado State University |
| OKCRU | Oklahoma Cooperative Research Unit |
| PORE | Point Reyes National Seashore Field Station |
| REDW | Redwoods National Park Field Station |
| RENO | Reno, Nevada, Field Station |
| SEKI | Sequoia Kings Canyon National Parks Field Station |
| SMU | Saint Mary's University |
| UAZ | University of Arizona |
| UI | University of Idaho |
| UMCRU | University of Minnesota Co-op Research Unit |
| UNLV | University of Nevada, Las Vegas |
| UTN | University of Tennessee |
| UWL | University of Wisconsin, La Crosse |
| YELL | Yellowstone National Park Field Station |
| YOSE | Yosemite National Park Field Station |

Appendix E.

Related World Wide Web Internet Addresses

Home Pages

| | |
|--|---|
| Association of Systematics Collections | http://www.ascoll.org/ |
| Biological Resources Division (BRD) | http://biology.usgs.gov/ |
| BRD Geospatial Technology Program | http://biology.usgs.gov/geotech/ |
| Comision Nacional para el Conocimiento y Uso de la Biodiversidad | http://www.conabio.gob.mx/textos/coninge.htm |
| Department of the Interior | http://www.doi.gov/ |
| Federal Geographic Data Committee | http://www.fgdc.gov/ |
| Government Performance and Results Act | http://www.npr.gov/library/misc/s20.html |
| National Biological Information Infrastructure (NBII) | http://biology.usgs.gov/nbii/index.html |
| National Spatial Data Infrastructure | http://www.fgdc.gov/NSDI/Nsdi.html |
| Southern Appalachian Man and the Biosphere Program | http://www.lib.utk.edu/samab/index.html |
| U.S. Geological Survey (USGS) | http://www.usgs.gov/ |
| USGS Geographic Data Committee | http://www.usgs.gov/USGS/gsgdc/ |

Related Documents

| | |
|---|---|
| A Biological Survey for the Nation | http://biology.usgs.gov/nbs/nbs2_8_1.htm |
| BRD Strategic Science Plan | http://biology.usgs.gov/science/strategicplan.html |
| Establishing Roots in Our Landscapes of Complexity Remarks by Interior Secretary Bruce Babbitt, ESRI – ARC/INFO User Conference, Palm Springs, CA, Tuesday, May 21, 1996 | http://www.doi.gov/glenspch.html |
| Government Performance and Results Act | http://www.informs.org/Conf/WA96/TALKS/MA19.1.html |

Information Resources Management Strategic Plan

<http://biology.usgs.gov/irm/STP.html>

NBII MetaMaker

<http://biology.usgs.gov/nbii/metamaker/metamaker.html>

Paperwork Reduction Act

<http://policyworks.gov/org/main/mi/LIBRARY/prah.htm>

USGS Strategic Plan

<http://online.wr.usgs.gov/stratplan/>

National Performance Review, DOI03: Establish a
National Spatial Data Infrastructure

<http://www.npr.gov/library/reports/DOI3.html>

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