



NATIONAL BIOLOGICAL INFORMATION INFRASTRUCTURE

NBII Enterprise Architecture
Section 2 – Business Architecture
Version 1.1

NBII Program
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Note: This document is Section 2 of a three-section document titled *NBII Enterprise Architecture*. The document sections include:

- Section 1 – *Introduction*
- Section 2 – *Business Architecture*
- Section 3 – *Design Architecture*



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2 Business Architecture

Business Architecture provides a business overview of the National Biological Information Infrastructure (NBII) Program. It defines the business needs being met by the NBII today and includes a discussion of the environment in which the NBII Program operates. Specifically, *Business Architecture* illustrates the concept of operations (the business objective), describes the context in which that objective is met (what is provided, how is it provided, to whom is it provided, and from what business locations), and illustrates the concept and context within a high-level business model.

2.1 Concept of Operations

In 1993, the National Research Council (NRC) published a report titled *A Biological Survey for the Nation*. Among many other recommendations, this report called for the development of the mechanism to make the immense volume of biological information generated by both the public and private sectors available and useable by policy- and decision-makers, resource managers, researchers, educators, and the public.

The NBII was developed to address this NRC recommendation. The NBII provides both the technical and organizational infrastructure to coordinate the delivery of the nation's biological information and data resources to consumers of biological information. The goals of the NBII are to:

- Provide the framework to support information discovery and knowledge creation for the nation's biological and ecological resources.
- Create an integrated virtual library of biological knowledge by systematically discovering, organizing, storing, and making available scientific data and information from diverse sources.
- Lead the development, selection, and distribution of the tools and standards necessary to facilitate interoperability and allow meaningful interactions with scientific data and information.
- Empower biological information consumers by creating an awareness of the NBII and its capabilities.
- Enable users to apply NBII products and services within their areas of concern.

As a collaborative program, the NBII is focused on building a community of producers of reliable, high-quality biological information to support a range of consumers and a variety of uses. The NBII provides the link between the producers or contributors of biological information and the consumers of that information. Biological information contributors participating in the NBII represent all economic sectors including federal, state, local, and tribal government agencies; academic institutions; non-government organizations (NGOs); and private industry. The biological databases, information products, sources of biological expertise, biological resource links, and analytical tools developed and/or maintained by NBII contributors provide scientists, natural resource managers, decision-makers, and citizens fast and easy access to a more comprehensive and inclusive biological knowledge resource than is available from any

other single provider. Software tools made available through the NBII help biological information consumers analyze, integrate, and visually display biological data and information. Additionally, the NBII is the U.S. contributor to continental, hemispheric, and global biological information access efforts, with NBII Program staff and partners serving as focal points for the coordination of U.S. data and information.

Today, the NBII is helping people make better decisions about managing the nation’s biological resources. The collaborative nature of the NBII helps avoid duplicative data collection efforts, allowing scarce resources to be utilized more effectively to fill important biological data gaps. Additionally, the NBII supports the federal government’s mission to identify opportunities to consolidate information technology (IT) investments, providing an infrastructure for the sharing of biological information that can be leveraged by multiple organizations. The key to providing the level of data and information required to support the goals of NBII is to:

- 1) Develop a network of partners who share biological information.
- 2) Provide robust analytical tools and capabilities delivered through the NBII over the Web to provide unparalleled ease and efficiency of data access.
- 3) Actively partner with organizations involved in the data creation process as well as those involved with new technologies development.

The framework supporting a national and an international information cooperative for biological resources is in place. However, the NBII is a work in progress and there is still much work to be completed. The NBII stands poised to build on this solid base of accomplishment as additional partners, information sources, and tools are put in place. The primary driver of the development and continued expansion of the NBII is to meet the needs of biological information consumers throughout the nation. The figure below provides a conceptual representation of the NBII.

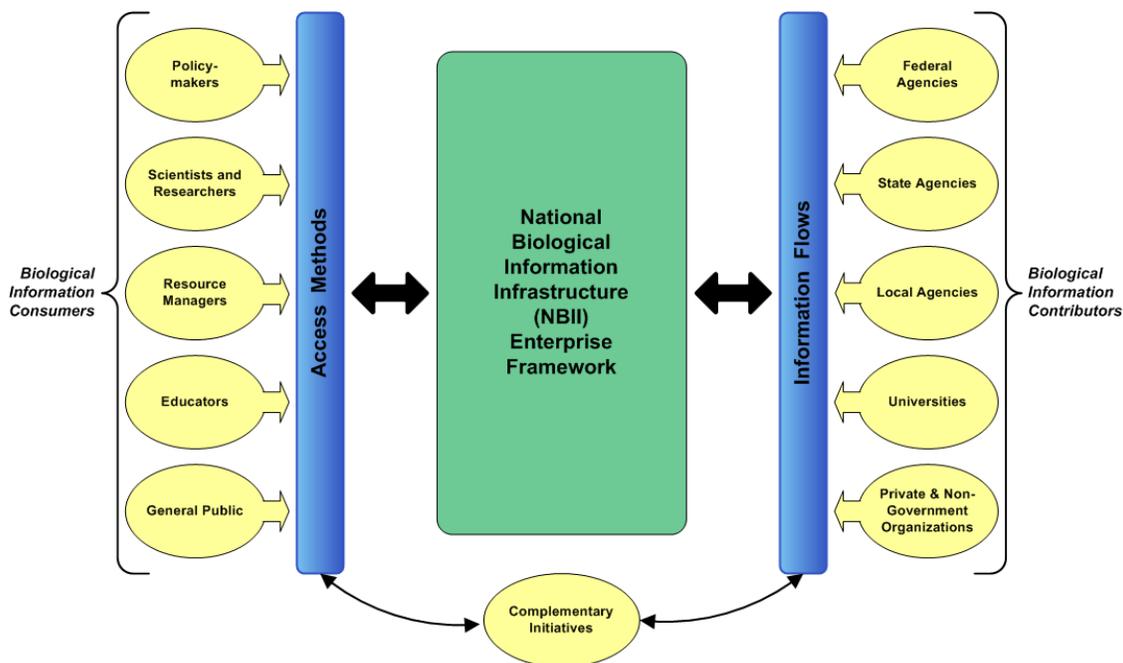


Figure 2-1. Concept of Operations



As illustrated in the preceding figure, at a simplified level, the NBII is an enterprise framework that connects biological information consumers with biological information contributors and provides a means for interacting with complementary initiatives. The following sections discuss the four operational components of the NBII:

1. NBII biological information consumers interact with the NBII through various methods to obtain access to NBII services and data.
2. NBII biological information contributors, through various information flows, provide information sources accessible to the biological information consumer.
3. Complementary initiatives (e.g., international projects with similar goals) interact with the NBII as both consumers and contributors of biological information.
4. The NBII Enterprise Framework provides the technical and organizational infrastructure necessary to support the sharing of biological information between contributors and consumers.

2.2 Biological Information Consumers

Biological information consumers include anyone who manages, studies, or uses biological data, resources, and tools. Typically, consumers come from both the public and private sectors – scientists, planners, decision-makers within the Department of the Interior (DOI) and other federal agencies, state and local governments, industry, educational institutions, and the general public. Some typical needs of biological information consumers include:

- Scientists and researchers need access to the highest quality data to help design and direct their research.
- Public agencies need easy access to the best biological data for managing public lands, such as the National Parks, or National Refuges.
- The private sector needs better information to understand the impacts of metropolitan growth on ecological resources.
- Educators at all levels need the most relevant and stimulating information and materials available to motivate and enlighten their students.
- The general public needs unbiased information on regional and local trends and the role of humans in the environment to better understand the ecosystems with which they interact.

As part of the federal government’s development of a business-based architectural framework, the Federal Enterprise Architecture (FEA) Program Management Office (PMO) developed a Business Reference Model (BRM). The purpose of the FEA BRM is to define and communicate how the federal government achieves its various missions. The FEA BRM defines four distinct business areas. One such business area, Services for Citizens, “describes the mission and purpose of the United States Government in terms of the services it provides both to and on the behalf of the American citizen. It includes the delivery of citizen-focused, public, and collective

goods and/or benefits as a service and/or obligation of the federal government to the benefit and protection of the nation’s general population.”¹

The Services for Citizens business area includes nineteen (19) lines of business and, within those lines of business, sixty-six (66) sub-functions. A significant amount of biological information is produced as a result of these lines of business and sub-functions. The NBII works to provide consumers of biological information with access to this information. In many instances, the consumer of the biological information served over the NBII network uses this information to support additional Services for Citizens. The figure below identifies the different types of biological information consumers that access the NBII. Additionally, it shows the various Services for Citizens, including lines of business and sub-functions that are supported by the NBII.

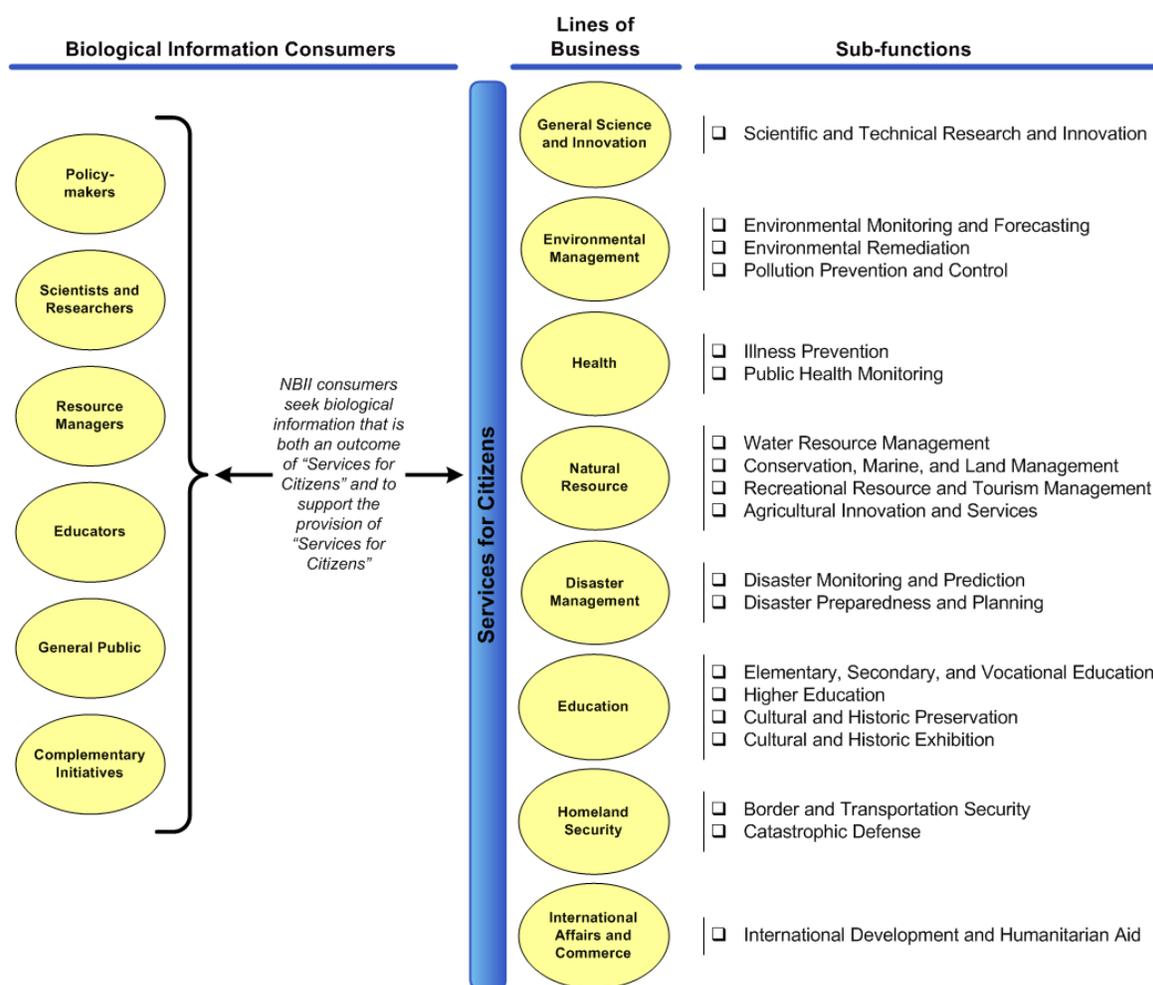


Figure 2-2. Biological Information Consumers and Services for Citizens

¹ Federal Enterprise Architecture Program Management Office, *The Business Reference Model Version 2.0: A Foundation for Government-wide Improvement* (Washington, DC: Office of Management and Budget, 2003), page 4.



The NBII serves the citizens of the nation by providing a dramatic increase in the return on investment in the creation of biological information. By making previously unavailable information easily accessible, the NBII expands the knowledge base from which resource decisions are made and provides the documentation of scientific data and information that allows users to assess the quality and content of that information. The following table summarizes the NBII’s support of the Federal government’s Services for Citizens as defined in the FEA BRM v2.0.

Table 2-1. NBII Support of Services for Citizens

| LINES OF BUSINESS | SUB-FUNCTIONS |
|---|--|
| <p><u>General Science and Innovation</u> – The NBII facilitates the federal government’s activities to advance scientific knowledge and support the development of scientific innovations across a broad array of general research and technology programs.</p> | <p><u>Scientific and Technological Research and Innovation</u> – Via the NBII network, biological information consumers are provided with data and information pertaining to the current state of the nation in areas such as biodiversity, land usage, invasive species, bird conservation, and natural resources. By making this information generally available, and particularly by providing access to the data and information resources of diverse organizations from all sectors, the NBII serves to advance the potential for information discovery and knowledge creation through scientifically planned and controlled, as well as through serendipitous, circumstances.</p> |
| <p><u>Environmental Management</u> – The NBII provides data that supports the determination of proper environmental standards and to assess compliance with those standards.</p> | <p><u>Environmental Monitoring and Forecasting</u> – The NBII provides data related to the observation of environmental conditions, species, and ecosystems. These data are used to support ecological forecasting to predict the effects of biological, chemical, physical, and human-induced changes on ecosystems and their components. For example, the NBII provides scientific information generated from, and in support of, the monitoring and forecasting of the behavior of toxic substances in the nation’s hydrologic environments.</p> <p><u>Environmental Remediation</u> – Biological information consumers can access data via the NBII to support immediate and long-term activities associated with the correcting and offsetting of environmental deficiencies or imbalances. For example, the NBII contains information related to river restoration standards, protocols, and analysis over the past 10-15 years within the United States.</p> <p><u>Pollution Prevention and Control</u> – Several data sets within the NBII contain information related to pollution, global climate change, etc. These data support researchers addressing the establishment of standards to control the levels of harmful substances emitted into the soil, water, and atmosphere. For example, the NBII Clearinghouse includes data sets from studies of the effects of deicing material on water quality.</p> |
| <p><u>Health</u> – The NBII includes data contributing to activities to protect and improve the health of the nation, including the monitoring and tracking of public health indicators for the detection of</p> | <p><u>Illness Prevention</u> – Through the analysis of biological data associated with diseases affecting the nation’s wildlife, the NBII supports activities related to the prevention and mitigation of public illness and diseases. The need to develop an understanding of the relationship between wildlife and human related diseases is underscored by the recent expansion of West Nile virus, etc. The</p> |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|---|
| <p>trends and identification of wide-spread illnesses and diseases. The NBII supports the use of wildlife as sentinels for potential public health threats as well as for identifying emerging zoonotic diseases.</p> | <p>NBII supports this through the Wildlife Disease Information Node and other Program efforts.</p> <p><u>Public Health Monitoring</u> – The NBII provides data from public health agencies, in cooperation with the Centers for Disease Control and Prevention and various state wildlife management and environmental protection agencies that support efforts to monitor vector-borne diseases such as West Nile virus outbreaks involving migratory birds. Additionally, the NBII includes several data sets of interest to public health monitoring activities (e.g., sediment toxicity, water contaminants, and wastewater reclamation and treatment) and assists states in coordinating efforts to control outbreaks of Chronic Wasting Disease.</p> |
| <p><u>Natural Resources</u> – The NBII includes biological information that is both an output from and input to activities supporting conservation planning, land management, forecasting, and tourism management of the nation’s natural and recreational resources, both private and federal. Good stewardship of the nation’s natural and recreational resources relies on a range of scientific data to guide planning processes and the development of regulatory requirements.</p> | <p><u>Water Resource Management</u> – The NBII provides regional and state specific information that supports the development of policies to promote the effective use and management of the nation’s water resources. For example, the NBII links to datasets produced by the Texas Natural Resources Information Systems that include the results of annual testing of municipal and industrial water use in counties and river basins in Texas.</p> <p><u>Conservation, Marine, and Land Management</u> – NBII biological information consumers use NBII data to support activities to manage land, water, wildlife, and natural resources both domestically and internationally. Both federal and non-federal agencies use NBII resources to support strategic growth, planning, and land acquisition activities. Additionally, the NBII provides decision support tools to assist with management and planning activities.</p> <p><u>Recreational Resource and Tourism Management</u> – The NBII includes biological information resulting from the surveying, maintaining, and operating of public lands. This includes information related to the National Parks, Bureau of Land Management (BLM), and U.S. Fish and Wildlife Service (USFWS) lands. For example, the NBII includes information related to the social valuation survey of the Colorado southern plateau. These data may be used by federal and state land managers, state tourism agencies, and local governments to better design recreation management policies that meet the needs and expectations of the public. They also will guide resource planners in attending to the “quality-of-life” concerns of the local public.</p> <p><u>Agricultural Innovation and Services</u> – The NBII provides biological information documenting the results of various studies designed to enhance farming methods and crop yield and to assess the impact of current farming practices on the environment. For example, the NBII includes several data sets developed by the U.S. Department of Agriculture (USDA). Examples of the type of data include soil sampling, pesticide use, nutria damage, general invasive species impacts, models, and vegetation maps.</p> |
| <p><u>Disaster Management</u> – The NBII supports the activities required to prepare for, mitigate, respond to,</p> | <p><u>Disaster Monitoring and Prediction</u> – Data included in the NBII supports the analysis and prediction of when and where a biological disaster may take place and supports the</p> |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|---|--|
| <p>and repair the effects of biological and natural resource disasters.</p> | <p>communication of that information to interested biological information consumers. For example, the NBII is tracking a current biological issue: the threat of invasive or non-native species to an area or ecosystem. Providing biological information consumers with the appropriate data may help minimize the potentially enormous, negative impacts from invasive species to biodiversity and the economy.</p> <p><u>Disaster Preparedness and Planning</u> – NBII data supports the development of response programs and emergency management programs to be used in case of a biological or natural resource disaster. For example, the NBII includes geo-referenced data sets originated by the Federal Emergency Management Agency used to support floodplain management.</p> |
| <p><u>Education</u> – The NBII supports the transfer of biological knowledge to the American public. The NBII’s educational support activities include formal education, training, advising, educational material development, and consulting on biological topics.</p> | <p><u>Elementary, Secondary, and Vocational Education</u> – The NBII provides resources designed to help guide educators providing biological and natural resource education. This includes material applicable to all education levels as well as material tailored for specific grades. The NBII works with a number of academic partners in order to leverage its Educational Programs. For example, the NBII is working with GLOBE, a worldwide hands-on, primary, and secondary school-based education and science program.</p> <p><u>Higher Education</u> – The NBII has numerous academic partners. These partnerships are designed to promote the distribution of science-based knowledge related to natural ecosystems and the human communities that depend on them and to develop and use innovative educational resources and high-technology interpretive outreach programs that combine research with hands-on education.</p> <p><u>Cultural and Historic Preservation</u> – The NBII is assisting museum consortia to digitally preserve their invaluable specimen collections and data holdings and facilitating the sharing of these collections. Targeted in the near future are museums, zoos, arboreta, botanical gardens, and private and public research collections. These collections are used by scientists to more fully understand and document the history and variability of the Earth’s biological communities. Additionally, the NBII supports development of the Electronic Natural History Museum, a broad collaboration among museums, government, universities, and the private sector that will implement an integrative infrastructure to support the development of credible information resources; discovery, access, and use of biological information; and improvement of the quality of life through knowledge and appreciation of the natural world.</p> <p><u>Cultural and Historic Exhibition</u> – The NBII promotes biological education through digital access to the specimen collections of the nation’s museums, which might otherwise never be physically available to the majority of Americans, particularly students. Making such collections accessible is a priority as described in the NBII Strategic Plan.</p> |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|--|
| <p><u>Homeland Security</u> – The threat of bioterrorist attacks have attracted considerable public attention and concern, as well as generated a call for action. The NBII provides information to help combat threats to the nation’s health security.</p> | <p><u>Border and Transportation Security</u> – The NBII provides data resources to assist biological information consumers with the assessment of dangerous and regulated biological and wildlife imports and to assist with the development of protocols to be followed by port entry inspectors (e.g., red imported fire ant). Additionally, the NBII develops tools for specific consumers such as an avian identification key for use in enforcing import regulations in the Hawaiian Islands. The NBII is also developing wildlife disease reporting systems.</p> <p><u>Catastrophic Defense</u> – As the NBII develops processes, mechanisms, and communication channels to assess and monitor wildlife diseases that impact public health (e.g., West Nile virus), the resources available to respond to a bioterrorist event are improved. NBII’s research and information technology investments can be leveraged to help the development of a bioterrorism infrastructure.</p> |
| <p><u>International Affairs and Commerce</u> – The NBII supports the promotion of U.S. interests beyond our national borders.</p> | <p><u>International Development and Humanitarian Aid</u> – The NBII is actively involved in several international initiatives focused on the sharing of biodiversity information. The NBII’s role in these initiatives is as a contributor of resources, as an advisor regarding the establishment of the architecture necessary to support knowledge sharing, and as a provider of technical assistance in the design, development, and setup of IT infrastructures. For example, the NBII actively supports the Inter-American Biodiversity Information Network (IABIN) in seeking to promote greater coordination among Western Hemisphere countries in the collection, sharing, and use of biodiversity information relevant to decision-making and education. As part of an invasive species project funded by the U.S. State Department, the NBII is managing the creation of a distributed network of interoperable nodes using common standards that will provide Web-accessible information on invasive species in the Americas. Eleven IABIN countries each receive support to inventory their invasive species information.</p> |

The information needed to support the activities of, and as an outcome of, the various services for the citizens of our nation drive both the information content requirements and the information content sources of the NBII. The U.S. Government accomplishes the goals and desired outcomes of its services for citizens through various mechanisms. The FEA BRM includes a Mode of Delivery business area that “describes the mechanisms the government uses to achieve the purpose of government, or its services for citizens.”² Within the Mode of Delivery business area, the FEA BRM defines seven (7) lines of business and within those lines of business, twenty-four (24) sub-functions. These mechanisms are the processes that produce the outputs by which the goals of the services for citizens are realized. The following figure illustrates the Mode of

² Federal Enterprise Architecture Program Management Office, *The Business Reference Model Version 2.0: A Foundation for Government-wide Improvement* (Washington, DC: Office of Management and Budget, 2003), page 13.

Delivery business lines used by the NBII to support the Services for Citizens described in the table above.

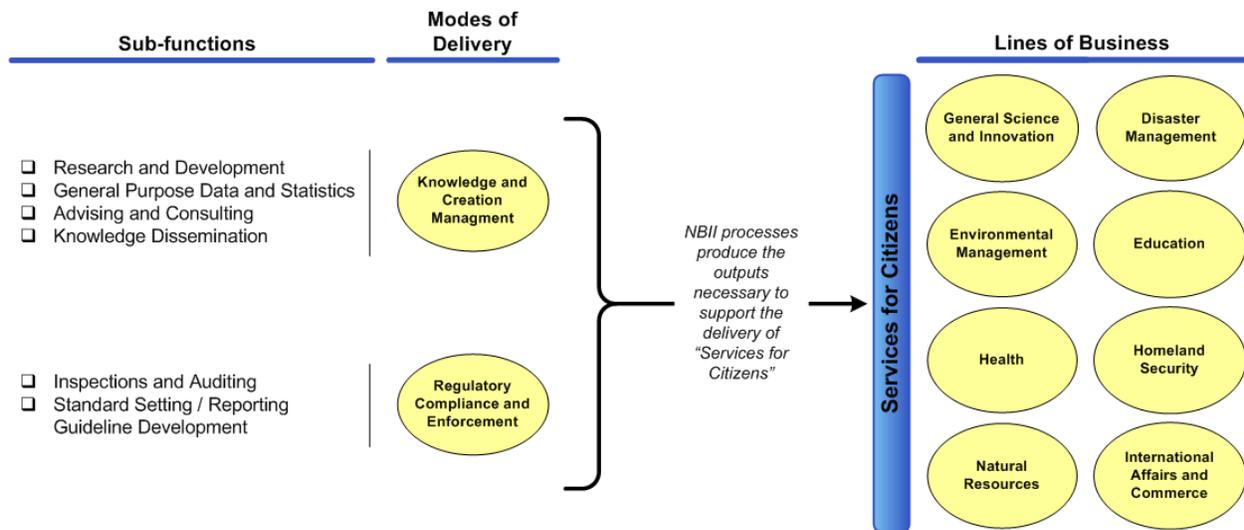


Figure 2-3. Services for Citizens and Modes of Delivery

The biological information required by the NBII’s consumers is developed as an output of the processes performed by various federal, state, and non-government partners and cooperators. For example, the research and development activities of various organizations generate biological and ecological information that is made available to consumers via the NBII. The NBII uses the delivery processes described in the table below to provide biological information to consumers.

Table 2-2. NBII Mode of Delivery Business Lines

| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|---|
| <p><u>Knowledge Creation and Management</u> – One of the goals of the NBII is to develop a framework that supports knowledge discovery, creation, and aggregation of the nation’s biological and ecological knowledge, making this information readily accessible to both federal and non-federal organizations and individuals.</p> | <p><u>Research and Development</u> – The NBII facilitates the creation and sharing of new knowledge or understanding; the gathering and analysis of data and the dissemination of results; and the development of new products, methodologies, and ideas. This includes the development of processes, equipment, tools, and facilities to support research and development activities performed in the biological and physical sciences. The NBII also supports research in partnering with the National Science Foundation (NSF) in computer science, engineering, and geospatial disciplines.</p> <p><u>General Purpose Data and Statistics</u> – Partners within the NBII network provide empirical, numerical, and related data and information pertaining to the nation’s biological and ecological resources. Via the NBII network, biological information consumers can access regional and thematic resources related to biodiversity, land usage, invasive species, bird conservation, etc.</p> <p><u>Advising and Consulting</u> – The NBII works in a variety of capacities to provide guidance and advice to support the delivery of Services for Citizens. The NBII is actively working with complementary initiatives</p> |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|---|--|
| | <p>to provide technical advice, share lessons learned, and provide advice on the ways and means to develop networks designed to share knowledge. The NBII works collaboratively with many organizations to develop standards that improve the quality and usability of data collection and sharing. Additionally, the NBII provides resources designed to help guide educators by providing biological and natural resource education.</p> <p><u>Knowledge Dissemination</u> – The NBII provides the necessary infrastructure to support continuous access and dissemination of biological spatial and non-spatial data in multiple formats. The NBII provides lifecycle management of aggregated biological data sets, including the acquisition, storage, and dissemination of information. Additionally, the NBII develops various tools to aid researchers and data providers in the acquisition and dissemination of biological data and information.</p> |
| <p><u>Regulatory Compliance and Enforcement</u> – The NBII supports direct monitoring and oversight of regulated biological and ecological activities by providing data sets developed through regulatory inspection and auditing activities and providing data sets that support the development of regulatory standards and control requirements.</p> | <p><u>Inspections and Auditing</u> – The NBII includes several data sets that list items regulated under specific biological and ecological regulations (e.g., Federal Noxious Weed Act of 1975, Plant Pests Regulated by Animal and Plant Health Inspection Service). Additionally, the NBII provides resources related to the results of regulatory inspections and auditing. For example, the NBII includes resources from the Port Information Network-309 that is used to support activities such as risk assessments, international phytosanitary discussions, port resource allocation, local program analysis, customer inquiries, and analyses regarding the movement of certain potentially invasive alien species. The NBII also includes the results of numerous inspections related to water and sediment pollutants, fisheries and aquatic resources, and invasive species.</p> <p><u>Standard Setting / Reporting Guideline Development</u> – Departments engaged in invasive species prevention and control activities have developed a variety of databases and decision support tools to increase predictive capacity for preventing the introduction of new invasives and to improve control efforts in both agricultural production and conservation areas. DOI and USDA have joined efforts to combine components of the NBII and various research and bibliographic databases at the National Agricultural Library (NAL) to assist the National Invasive Species Council in its charge to implement a Web-based network capability for information sharing among professionals and the public at large. This information will be used to assist the Council to prepare a guide to assist rapid response teams and others that will incorporate the methodology developed for response measures and guidance on regulatory compliance and jurisdictional and budget issues.</p> |

The mechanisms, described in the table above, support the delivery of services for citizens. These mechanisms are used by both the NBII and by the biological information contributors that provide content to the NBII.

2.3 Biological Information Contributors

The NBII supports a distributed federation of biological information contributors established through a network of federal, state, and non-government partners and cooperators. A collaborative program of biological partnerships is essential to the NBII mission since U.S. Geological Survey (USGS) Biological Resources Discipline (BRD) produced data and information constitutes only a fraction of the nation's total set of biological data and information, as is true for all federal organizations producing biological information. The development of strategic partnerships assists the NBII in accomplishing its goal of providing qualitative and quantitative biological information and gives more stakeholders a voice in the future strategic direction of the NBII. Through these partnerships, the NBII promotes the development and integration of advanced technology across the NBII while leveraging resources among all partners. Currently, the NBII has technology and information partnership agreements with several federal agencies, with more than 20 states, and with numerous private organizations. The following summarizes the types of biological information contributors participating with the NBII today.

- State agencies and organizations holding state information – The NBII has relationships with both individual states and the national organizations that represent state interests (e.g., International Association of Fish and Wildlife Agencies, state environmental offices (Environmental Protection Agency [EPA]), State/County extension offices (USDA), Organization of Fish and Wildlife Information Managers, and State Heritage Programs).
- Federal land management and environmental monitoring and assessment agencies – The NBII has national level partnerships with agencies responsible for land management to understand their information needs and to make their natural resource information accessible (e.g., USFWS, BLM, Centers for Disease Control and Prevention; EPA; NASA; NOAA/National Marine Fisheries Service; National Park Service; NSF; and the Departments of Agriculture, Defense, Energy, and Transportation).
- Organizations and initiatives that lead biological information networks/systems – The NBII partners with other networks to facilitate complete content coverage, data access, standards development, and technology deployment (e.g., Center for International Earth Science Information Network, CSA, Federal Geographic Data Committee (FGDC), Long-Term Ecological Research Network, National Spatial Data Infrastructure (NSDI), NatureServe, Ocean Biodiversity Information System, The Nature Conservancy, USDA Forest Service, USGS EROS Data Center, USGS National Map, USGS National Water Quality Assessment Program, and selected universities).
- Organizations and initiatives that lead information science research and development (R&D) activities – The NBII partners with organizations leading or conducting information science R&D that can be leveraged and applied to the biodiversity and ecosystems domain (e.g., NSF, EPA, Institute of Museum and Library Services, Los Alamos National Laboratory, NASA, National Institutes of Health, National Science and Technology Council, and selected universities).
- Stewards of natural science collections – Natural history museums, herbaria, botanical and zoological gardens, and other natural science collections have been identified as important contributors to the NBII, providing both taxonomic expertise and specimen

data (e.g., Natural Science Collections Alliance, Academy of Natural Sciences, American Museum of Natural History, B. P. Bishop Museum, Missouri Botanical Garden, Smithsonian Institution, and selected botanical and zoological gardens).

- International initiatives – Serious and costly issues such as invasive species and zoonotic diseases require the sharing of knowledge with other countries. Participation in continental, hemispheric, and global biodiversity networking initiatives provides the opportunity to make U.S. biological information and data resources available to the world and to make the world’s biological knowledge base available to the United States through the NBII (e.g., Clearing-House Mechanism of the Convention on Biological Diversity, Global Biodiversity Information Facility [GBIF], IABIN, North American Biodiversity Information Network [NABIN], Organization of American States, U.S. Agency for International Development, and the World Bank).
- Private organizations – Private sector organizations have partnered with the NBII to develop data and information tools, resources, and applications for natural resources research and management (e.g., HiSoftware, Michael Baker Engineering, Plumtree Corporation, ESRI, etc.).

The NBII’s network of partners is organized to support the contribution of biological information through participation in one of four resource channels as depicted in the figure below:

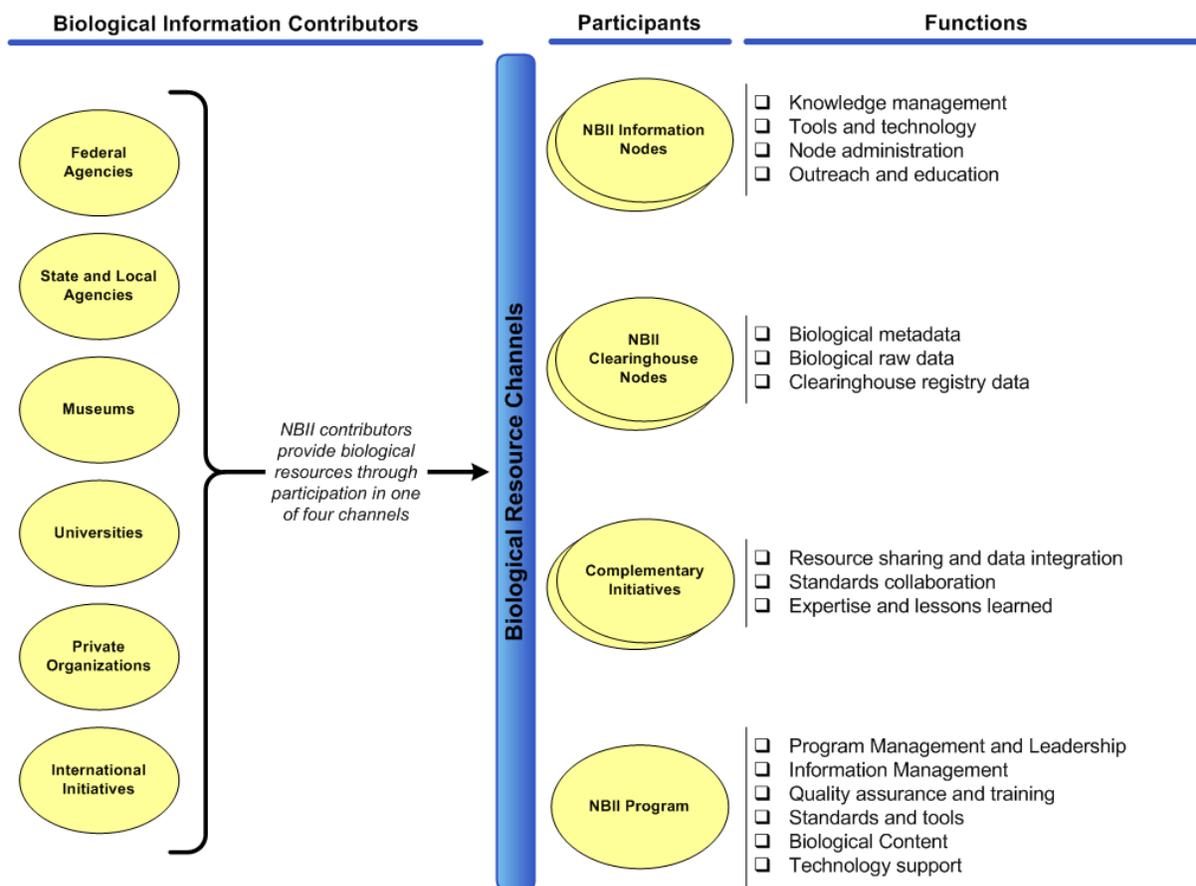


Figure 2-4. Biological Information Contributors



The following sections describe the resource channel participants shown in the preceding figure.

2.3.1 NBII Information Nodes

NBII Information Nodes support the delivery of biological information and resources within a defined scope, partnering with organizations to provide biological information content to NBII consumers. As fully digital, distributed, and interactive systems, NBII Information Nodes are interconnected entry points that form a nationwide network, part of the global biodiversity community, that provide access to data, information, and expertise about biological resources. NBII Information Nodes support a significant portion of the NBII, providing the following functions:

- Analytical capabilities,
- Technology support,
- Synthesis capabilities,
- Data warehousing,
- Data mining,
- Collaboration,
- Training,
- Outreach, and
- Education.

NBII Information Nodes provide national coverage on a range of major biodiversity and environmental issues. Each NBII Information Node focuses on a narrowly defined scope or purpose, or on a group of issues related to a single geographic region. Recognizing the potential of the Information Nodes as a source of expert information, some nodes have begun to develop international sources of data in support of its focus and mission. An NBII Information Node’s scope is categorized as either regional or thematic:

- Regional – These nodes focus on topics or biological issues of regional interest and provide the support and infrastructure to help address issues on behalf of biological partners, stakeholders, and consumers within the region.
- Thematic – These nodes focus on a particular biological issue of national importance (e.g., avian conservation or invasive species) and provide the support and infrastructure to help address these biological issues. Such issues often cut across geographic areas.

The following tables identify the NBII regional and thematic nodes.

Table 2-3. NBII Information Nodes – Regional Scope

| REGIONAL NODES | PURPOSE | URL |
|-----------------------------|---|---|
| California Information Node | Supports information systems addressing interagency biodiversity and watershed assessments in California, the Pacific Coast, and desert ecosystems. | http://cain.nbii.org |



| REGIONAL NODES | PURPOSE | URL |
|---|--|---|
| Central Southwest/Gulf Coast Information Node | Addresses the biodiversity aspects of sustainable development issues within the Central Southwest and Gulf Coast through research into the applications of new spatial digital data analysis and visualization technologies. | http://cswgcin.nbii.org |
| Great Basin Information Project | Provides consolidated and efficient access to information about the Great Basin and the Columbia Plateau regions. | http://greatbasin.nbii.gov |
| Mid-Atlantic Information Node | Encourages accessibility to and appropriate use of biological resource information throughout the Mid-Atlantic Region – Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia. | http://main.nbii.org |
| Mountain Prairie Information Node | Supports natural resource management decisions covering wildlife and related issues in the states of Montana, North Dakota, South Dakota, Nebraska, Kansas, and Wyoming. | http://mpin.nbii.org |
| Northeast Information Node | Supports planning and resource management agencies in the Northeast by providing improved access to biological resource information and decision support tools to allow users to easily access and analyze large and complex data sets. | http://nin.nbii.org |
| Pacific Basin Information Node | Addresses issues of importance to Hawaii and U.S. territories. A primary focus is on invasive and endemic species as well as coral reefs and forest birds. Products include: mapping and taxonomic services; an image gallery; and information management and design. | http://pbin.nbii.org |
| Pacific Northwest Information Node | Offers information to evaluate strategies in the Pacific Northwest regarding the management of the region's forest ecosystems. | http://pnwin.nbii.gov |
| Southern Appalachian Information Node | Connects people with science through the development of regionally-oriented biological information content and visualization tools as well as national and international metadata clearinghouse efforts. Takes a lead in related issues of information science and technology. | http://sain.nbii.org |



| REGIONAL NODES | PURPOSE | URL |
|----------------------------|--|---|
| Southwest Information Node | Provides access to hundreds of biological databases and will host a suite of information tools tailored to address the complex environmental issues of the arid Southwest. | http://swin.nbii.gov |

Table 2-4. NBII Information Nodes – Thematic Scope

| THEMATIC NODES | PURPOSE | URL |
|--------------------------------------|---|---|
| Bird Conservation Node | Provides a location for the coordination, management, and dissemination of data and information related to the conservation and management of North American birds. | http://birdcon.nbii.gov |
| Fisheries and Aquatic Resources Node | Provides access to fisheries and aquatic resources information including fish species, watershed based data, socio-economic information, and essential framework data such as ortho photography, roads, streams, as well as elevation and topographic data, and the USGS-BRD National Fish Strain Registry. | http://far.nbii.gov |
| Invasive Species Information Node | Provides access to a vast array of information on potentially harmful invasive species across the nation, including online tools for identification, reporting sightings, e-mail alerts, mapping, management, and modeling potential distribution. | http://invasivespecies.nbii.gov/ |
| Pollinator Declines Node | Provides access to information regarding pollinator declines to promote public awareness, works with groups to ensure healthy and self-sustaining populations of pollinators, and promotes the conservation of native pollinators in various ways. | http://pollinators.nbii.gov/ |
| Wildlife Disease Information Node | Provides information on the variety of wildlife diseases and their implications, including those affecting humans. | http://wildlifedisease.nbii.gov |

In support of the mission of the NBII, each NBII Information Node is responsible for providing knowledge management, tools and technology, regional and thematic coordination, educational activities, and node operations within its defined scope. These services, as described below, characterize the breadth of the responsibilities of a fully functioning and fully funded NBII

Information Node. Each of the regional and thematic nodes described in the tables above are in various stages of realization of a fully functional status.

2.3.1.1 Knowledge Management Services

A fully functioning NBII Information Node provides the following knowledge management services:

1. Apply innovative knowledge management processes and schemas for resource discovery, information filtering, intelligent browsing, and knowledge engineering.
2. Provide support for the creation of knowledge information architectures, semantic networks, and thematic structuring and their application within the context of a global scientific network.
3. Develop various tools to aid researchers and data providers in the acquisition and dissemination of biological data and information.
4. Ensure that data collection, processing, and retrieval activities are compatible with the program-adopted standards for information management.
5. Provide life cycle management of biological data sets, including the acquisition, storage, and dissemination of biological information.
6. Support the needs of biological information consumers.
7. Perform biological clearinghouse functions related to the management and distribution of biological data and metadata within the NBII Metadata Clearinghouse network.
8. Perform archiving functions of biological data for non-spatial and spatial data.
9. Provide training and support to diverse audiences on the use of NBII tools, processes, and principles.

2.3.1.2 Tools and Technology Services

A fully functioning NBII Information Node provides the following tools and technology services:

1. Implement various tools to aid researchers and data providers in the acquisition, generation of required metadata, and dissemination of biological information.
2. Develop tools and technologies that facilitate the seamless interaction of data and information within the NBII Enterprise Framework.
3. Employ commercial off-the-shelf software as a means of acquiring, processing, and delivering biological information.
4. Provide backup and mirroring of related NBII node repositories to mitigate technology concerns caused by sporadic system failure or data access issues.
5. Allow a variety of biological communities the ability to perform high-end computations on various biological data sets through the application of super-computing and high-performance computing capabilities.
6. Provide the necessary infrastructure to support access and continuous dissemination of biological spatial and non-spatial data in multiple formats.



7. Assist in the development of decision support tools and capabilities through data sharing, information availability, data mining applications, and data synthesis among various biological repositories and data users.

2.3.1.3 Node Administration

A fully functioning NBII Information Node provides the following node administration services:

1. Assist in the coordination of regional biological data capture and acquisition activities to help ensure that the biological data produced within a node's scope is made available.
2. Disseminate information regarding NBII node capabilities and functional responsibilities to establish collaborative relationships and partnerships with applicable biological information sources.
3. Maintain full documentation of NBII node processes and procedures for performing all aspects of biological data and information management.
4. Assist in the performance of management reviews and self-assessments to monitor the overall effectiveness of NBII node performance related to yearly goals and objectives.
5. Properly maintain the NBII Information Node Web sites, databases, and other applications.
6. Provide support to NBII cross-node working groups addressing network wide problems such as data interoperability, geospatial applications, security, and other issues.
7. Support the NBII Program through representation of the NBII node and overall network at meetings, symposia, and other related fora.

2.3.1.4 Outreach and Education Services

A fully functioning NBII Information Node provides the following outreach and education services:

1. Support communication and dissemination of NBII Program information to the general public and raise awareness of the NBII mission.
2. Participate in working groups to foster communication, awareness, and sharing of information and technology across Information Nodes.
3. Develop and manage partnerships with organizations to provide biological information resources.
4. Create educational products designed to help guide educators providing biological and natural resource education.
5. Provide formal education, training, advising, educational material development, and consulting on biological topics to the public, as applicable.
6. Foster academic partnerships to promote the distribution of science-based knowledge related to natural ecosystems, to develop and use innovative educational resources, and to develop outreach programs that combine research with hands-on education.

2.3.2 NBII Clearinghouse Nodes

In addition to the information provided by NBII Information Nodes, the NBII delivers biological information through a clearinghouse initiative. The clearinghouse is designed to help biological information consumers locate, evaluate, and access biological data, information, and analytical resources from a distributed network of Clearinghouse Nodes. The Clearinghouse Nodes are cooperating data and information partners that provide the NBII with metadata that describe the biological data sets and information products available from that node. This metadata, or data about data, are made available to the NBII's biological information consumers via a clearinghouse mechanism.

Through its clearinghouse partnerships, the NBII connects numerous organizations to provide access to a distributed network of biological information sources from a single access point. These partners include national, state, local, public, and educational organizations. There are two ways by which an NBII partner can make metadata accessible through the NBII Clearinghouse:

1. The partner prepares standardized metadata descriptions of its data and/or information, the NBII Program performs a quality control review of the submission, and the reviewed metadata are loaded into the centralized NBII Clearinghouse Node where they are served for the partner, or
2. The partner establishes its own NBII Clearinghouse Node, providing biological information consumers with the capability to search the partner's metadata holdings, as well as having access to the distributed metadata holdings of the entire NBII network.

The primary difference between the NBII Information Nodes and Clearinghouse Nodes is the level of participation in and governance by the NBII. Additionally, the scope of an Information Node, within the context of the NBII, exceeds that of a Clearinghouse Node. NBII Information Nodes have significant responsibilities for the development, operations, and management of the NBII network and are eligible to receive funds from the NBII for approved projects. Conversely, NBII Clearinghouse Nodes are solely providers of data to the NBII without specific network responsibilities. The table included as Appendix 2-A lists current nodes within the NBII Clearinghouse network.

2.3.3 Complementary Initiatives

In addition to the partnerships formed to support the NBII Information and NBII Clearinghouse nodes, NBII partners with organizations to further the development of a global biological information network. These complementary initiatives serve as both biological information contributors and consumers. The NBII develops collaborative relationships with external partners that address conservation issues that are important to the United States and are developing technologies useful to the NBII mission. Currently, complementary initiative activities focus on three areas:

1. Sharing biological data and information;
2. Developing standard approaches for biological inventory, monitoring, and research; and
3. Providing expertise and lessons learned to expedite scientific exchange.



The following table describes the current list of NBII Complementary Initiatives and each initiative’s interaction with the NBII Enterprise Framework.

Table 2-5. Complementary Initiatives

| EXTERNAL PARTNERS | DESCRIPTION |
|--|---|
| Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) | CONABIO is a partner that has developed a comprehensive biodiversity information system for Mexico. CONABIO and the NBII are collaborating in the planning and development of regional information networks, such as the NABIN and IABIN. CONABIO also participates in the Integrated Taxonomic Information System (ITIS) and the Biodiversity Information Table of the Canada/Mexico/U.S. Trilateral Committee. |
| Global Biodiversity Information Facility | GBIF is an international scientific effort to access massive amounts of genetic, taxonomic, geographical, and ecological data about organisms. Central to GBIF is the Catalog of Life, a standardized electronic index providing uniform taxonomy and nomenclature for all known living organisms. Through this index, users of the GBIF portal will employ cutting-edge information technology to find their way, interactively and in real time, through millions of biodiversity records on the three billion specimens located in the collections of natural history museums, herbaria, and microorganism repositories located around the globe. The NBII Program is the United States node for GBIF, which seeks to increase access to biodiversity information by linking biodiversity databases and tools into a single global information resource. |
| Inter-American Biodiversity Information Network | The NBII Program participates in the planning and development of IABIN, which seeks to increase access to and integration of biodiversity data across the Western Hemisphere. IABIN comprises all of the countries of the Americas, with 28 countries designated official IABIN Focal Points. |
| Invasive Species Specialist Group (ISSG) | The ISSG is part of the Species Survival Commission of the World Conservation Union (IUCN) and deals with invasive species that cause biodiversity loss across the globe. The ISSG created the Global Invasive Species Database as a resource for policymakers, conservation practitioners, and the public. The NBII has partnered with ISSG to help populate the database and to stimulate the development and implementation of technologies, protocols, and practices needed to share knowledge relevant to invasive species. |
| North American Biodiversity Information Network | The NBII Program participates on the Steering Committee for the development of NABIN, which seeks to increase access to and integration of biodiversity data from Canada, Mexico, and the United States. |
| National Spatial Data Infrastructure | The NSDI focuses on geospatial data: data that identify the geographic location and characteristics of natural or constructed features on Earth. Such data may be derived from remote sensing, mapping, and surveying technologies, among others. The NBII recently joined with the FGDC, the NSDI parent organization, to help support cooperative activities through FGDC NSDI Competitive Cooperative Agreements Program. The NBII’s participation in this endeavor is to promote projects aimed at increasing access to geospatial data on biological resources, such as distributions of different plant and animal species or significant ecosystems. |



| EXTERNAL PARTNERS | DESCRIPTION |
|-------------------------|---|
| World Data Center (WDC) | The NBII is a U.S. WDC for Biodiversity and Terrestrial Ecology. The WDC system promotes the international exchange of solar, geophysical, and environmental data through designated WDCs. The aim of the WDC system is to support International Council of Scientific Unions (ICSU) programs. ICSU programs in global change, climate, and the environment are placing new requirements on a worldwide system to serve the data needs of the scientific community. |

2.3.4 NBII Program

The function of the NBII Program is to provide technical support, leadership, management, and strategic direction for the NBII. In addition to these responsibilities, the NBII Program serves as a contributor of biological information. The NBII, with support from the USGS Center for Biological Informatics (CBI), works cooperatively with federal and state agencies to share information necessary to develop a comprehensive picture of the nation’s biological resources.

Federal and non-federal programs and resources are frequently directed towards the needs and responsibilities of resource management bureaus, such as studies supporting development of annual waterfowl regulations, research leading to better land protection strategies for national parks, and investigations seeking optimal water control practices for enhancement of fisheries. The NBII Program compiles relevant output from these programs, making the biological information available to the consumer via the NBII. NBII Program staff has expertise in information science, computer science, education, administration, and biology. This depth and breadth of expertise and experience allows the NBII Program to ensure high-quality products and services are being compiled to meet the needs of NBII biological information consumers. The following table provides a listing of the types of content contributed by the NBII Program.

Table 2-6. NBII Program – Content Contributions

| CONTENT CONTRIBUTIONS | DESCRIPTION |
|---------------------------|---|
| Current Biological Issues | Information about some of the major “hot topics” for biological researchers today, including links to biodiversity resources, biology in the news, and specific topics of timely interest as published by NBII Information Nodes. |
| Biological Disciplines | The Web includes an enormous wealth of data, references, and research on a wide variety of biological disciplines. The NBII serves as a gateway to these resources, selecting, annotating, and organizing them according to topic and discipline for ease of discovery and access by NBII users. |
| Geographic Perspectives | This area of the NBII conceptualizes, organizes, and displays a wide range of information from geographical and geospatial perspectives. |
| Teacher Resources | Provides educators, parents, and students of all ages with access to online resources that emphasize the teaching of biology, biodiversity, and ecology. Included are activities, lesson plans, experiments, projects, resources, and references for classroom and home use. The goal of this area of the NBII is to assist teachers and parents in educating today’s students and shaping the biologists, resource managers, and environmental stewards of tomorrow. |



| CONTENT CONTRIBUTIONS | DESCRIPTION |
|------------------------------|--|
| Data & Information Resources | |
| Conferences | Listing of upcoming biological conferences of interest to the NBII community and identification of which conferences will have NBII exhibits. |
| Biocomplexity Thesaurus | The Biocomplexity Thesaurus was developed in 2002-2003 through a partnership between the NBII and Cambridge Scientific Abstracts (CSA), a leading bibliographic database provider. The CSA/NBII Biocomplexity Thesaurus is a merger of five thesauri: <ul style="list-style-type: none"> • CSA Aquatic Sciences and Fisheries Thesaurus • CSA Life Sciences Thesaurus • CSA Pollution Thesaurus • CSA Sociological Thesaurus • CERES/NBII Thesaurus |
| Expertise Databases | Listing of potential experts on biological, ecological, and natural resources management issues from a variety of reputable sources. |
| Metadata | This section provides fact sheets about and access to the NBII Metadata Clearinghouse, and also includes information about training courses in metadata creation provided by the NBII Program. |
| Museums and Collections | An index of links to national and international specimen collections and museums of interest to the biological community. |
| Online References & Journals | Links users to science magazines; academic and research journals; dictionaries; vocabularies; hypertexts; and other aids to biological research. |
| Organizations & Associations | A comprehensive index of links to various biological, scientific, and environmental organizations and associations. |
| Tools | Index of aids for collecting, managing, documenting, analyzing, and applying biological data and models to biodiversity problems. |
| Toward Best Practices | Program to foster the dissemination and discussion of sound best practices for the conservation community. |

2.4 NBII Enterprise Framework

The NBII Enterprise Framework is a set of services managed and delivered by the NBII Program that provide the foundation necessary to 1) support the creation and integration of the biological information harvested from NBII contributors and complementary initiatives, and 2) provide meaningful access to and use of that information by biological information consumers. The NBII Enterprise Framework is composed of three service layers.

1. Knowledge Management – Supports the delivery of products and services that address a consumer's specific biological information needs.
2. Technology Management – Delivers the systems that allow biological information consumers to access and interact with scientific data and information.

3. Program Management – Provides the operational support required to effectively plan and manage NBII activities and to generate awareness in the biological community of the NBII and its capabilities.

The figure below provides a conceptual representation of the NBII Enterprise Framework services layers.



Figure 2-5. NBII Enterprise Framework

Similar to the use of FEA BRM to identify the Services for Citizens and Mode of Delivery supported by the NBII, the NBII Program used the FEA BRM to help frame the identification and categorization of the services included in the NBII Enterprise Framework. The Support of Delivery Services business area provides “*the critical policy, programmatic and managerial foundation to support Federal Government Operations*”³ and includes eight (8) lines of

³ Federal Enterprise Architecture Program Management Office, *The Business Reference Model Version 2.0: A Foundation for Government-wide Improvement* (Washington, DC: Office of Management and Budget, 2003), page 17.



businesses and thirty-five (35) sub-functions. This area is supported by the Program Management services layer of the NBII Enterprise Framework. The Management of Government Resources business area “refers to the back office support activities that enable the government to operate more effectively”⁴ and includes five (5) lines of business and twenty-eight (28) sub-functions. This area is supported by the Technology and Knowledge Management services layers of the NBII Enterprise Framework.

Although the NBII Enterprise Framework supports many of the functions in these two business areas, some of the functions are performed outside the scope of the NBII. For example, Human Resource Management functions are centralized at the USGS level and not a direct function of the NBII.

The following table describes the Support of Delivery Services lines of business included in the Program Management services layer of the NBII Enterprise Framework.

Table 2-7. NBII Specific Support of Delivery Services

| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|--|
| <p><u>Controls and Oversight</u> – The NBII Program has developed processes to support the control and oversight of its operations. The process to ensure the Program, as well as the Partner and Clearinghouse Nodes, are in compliance with application laws, regulations, and policies.</p> | <p><u>Corrective Action</u> – The NBII analyzes compliance information gathered through ongoing program evaluations to assess compliance effectiveness and to determine whether correction action is indicated. In the event of non-compliance, steps are taken to initiate and implement the appropriate corrective action.</p> <p><u>Program Evaluation</u> – In the event a corrective action is required to remedy an incident of non-compliance, the NBII Program monitors the deployment of the recommended corrective action and resulting compliance status.</p> <p><u>Program Monitoring</u> – The NBII Program monitors the data sharing activities within the NBII network to determine the extent to which the network complies with applicable laws, regulations, and policies.</p> |
| <p><u>Internal Risk Management and Mitigation</u> – The NBII Risk Management Plan includes assessed risks and identifies appropriate counter-measures.</p> | <p><u>Contingency Planning</u> – The NBII’s Risk Management plan includes contingency plans that address the actions required to respond to and mitigate a risk event.</p> <p><u>Continuity of Operations</u> – The NBII’s Risk Management Plan identifies the systems and processes and processes that should receive priority attention in order to provide continuity of operations following a failure event.</p> <p><u>Service Recovery</u> – In the event of a network failure, the NBII’s Risk Management Plan includes the actions necessary to recover operations.</p> |
| <p><u>Planning and Resource Allocation</u> – Effective planning is required to ensure NBII resources are efficiently</p> | <p><u>Budget Formulation</u> – The NBII’s budget projection was developed as part of a strategic planning activity for a five-year period and is updated annually to address changes in scope and strategic direction. Additionally, the NBII Program Office assists the NBII Information</p> |

⁴ Federal Enterprise Architecture Program Management Office, *The Business Reference Model Version 2.0: A Foundation for Government-wide Improvement* (Washington, DC: Office of Management and Budget, 2003), page 21.



| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|--|
| <p>allocated. To support this goal, the NBII Program determines strategic direction, identifies and establishes programs and processes to enable planned and effective change, and allocates capital among the program and processes supported.</p> | <p>Nodes with development budget requests to support proposed projects within the scope of the node’s activities, as well as assisting partners with the development of budgets to support proposed new partner nodes. The NBII has implemented processes to assess the effectiveness of programs and to develop budget priorities.</p> <p><u>Capital Planning</u> – The NBII investment prepares an annual Capital Asset Plan and Business Case for submission to the Office of Management and Budget (OMB). The development of this plan includes an assessment of the proposed investments of NBII Program funds and the recommendation of capital expenditures.</p> <p><u>Enterprise Architecture</u> – The NBII has developed its Enterprise Architecture, including principles and goals, management environment, the balance between Program-level and Node-level services, and the elaboration of the business and design architectures. The current Enterprise Architecture serves as the baseline from which further architectural optimization across the NBII initiative and alignment with DOI and USGS architecture standards can be achieved.</p> <p><u>Strategic Planning</u> – NBII strategic plans are reviewed on a regular basis and adjusted to meet changing technical, regulatory, and business drivers.</p> <p><u>Budget Execution</u> – The NBII Program Office works with USGS procurement officials to discharge responsibilities for the day-to-day requisitions and obligations of the NBII Program, including invoicing, billing dispute resolution, reconciliation, service level agreements, and distributions of shared expenses.</p> <p><u>Workforce Planning</u> – The NBII Program Office and its partners have identified the core competencies and skill sets required for successful management of the NBII investment and implementation of the network. As technologies and standards evolve, these core competencies are reevaluated and updated to address new and changing requirements.</p> <p><u>Management Improvement</u> – The NBII’s governance structure provides the means by which the efficiency of the investment’s business processes and technical infrastructure are assessed and opportunities for reengineering or restructuring are identified. Via the governance structure, the NBII continually assesses opportunities to improve information content, access, and delivery.</p> |
| <p><u>Public Affairs</u> – The NBII Program is actively involved in the exchange of information and communication between federal and non-federal organizations, biological information consumers and contributors, and stakeholders that have a direct impact on the Services for Citizens supported by the NBII.</p> | <p><u>Customer Services</u> – The NBII provides information to biological information contributors and consumers that describes NBII services. For example, the NBII Toolkit contains information and tools related to the NBII and associated biological informatics programs. The toolkit is designed to educate partners and customers about the NBII and its capabilities.</p> <p><u>Official Information Dissemination</u> – The NBII makes available information products, such as fact sheets, designed to inform the public about specific activities, programs, or topics.</p> <p><u>Product Outreach</u> – The NBII uses a variety of mechanisms and media, including an active use of the NBII node Web sites and the NBII Portal to support communication and dissemination of NBII Program information to the general public and to raise awareness of</p> |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|-------------------|--|
| | the mission of the NBII. Additionally, the NBII is an active participant in various conferences and meetings to foster communication, awareness, and the sharing of information between complementary initiatives. |

The following table describes the Management of Government Services lines of business included in the Knowledge Management and Technology Management services layers of the NBII Enterprise Framework.

Table 2-8. NBII Specific Management of Government Resources

| LINES OF BUSINESS | SUB-FUNCTIONS |
|--|--|
| <u>Administrative Management</u> – One of the core functions of NBII nodes is to provide assistance to users, to enable users to interact well with the NBII network, data, and tools. | <u>Help Desk</u> – The NBII offers training in the use of tools designed to interact with data served through the network and responds to ad hoc requests for assistance from users. Users may request such assistance via the Web, telephone, or e-mail. |
| <u>Information and Technology Management</u> – Knowledge (information) management is the conscious and comprehensive gathering, organization, sharing, and analysis of collective knowledge in terms of resources, documents, and people skills. Knowledge management services of the NBII framework include storage of biological and ecological information, standards to support integration of data and resources from biological information contributors, and mechanisms to provide access to biological information consumers. Critical to the success of the NBII is the technical foundation that supports and enables the knowledge management services provided by the NBII. The NBII Program provides technology support and management of the “core” NBII databases and systems. This effort, managed by CBI, provides interoperability, availability, and consistency of | <u>Record Retention</u> – The NBII investment collects, compiles, and stores, primarily in electronic format, biological content from numerous sources. These data are stored and presented in a variety of formats, including XML, PDF, HTML, and SQL. The NBII leverages the mechanisms and infrastructure used to store biological content to manage the official documents and records for the program. <u>Information Management</u> – Information management improves the quality of the services provided by the NBII Program by ensuring that information is available to biological information consumers. Information management involves the coordination of information collection processes, information storage, information dissemination, and management of the policies, guidelines, and standards regarding information management. It includes services in compiling, aggregating, and storing biological data and information. Specific to the NBII Program are critical processes, mechanisms, and standards that support information management. These include standards and taxonomy, content delivery, search services and intelligent agents, and collaboration and communities. <u>System Development</u> – The NBII supports all activities associated with in-house design and development of software applications as well as the deployment of commercial-off-the-shelf (COTS) applications. The NBII develops tools and supports applicable Partner and Clearinghouse Nodes development efforts including the design, development, or serving of Web pages; the capture and submission of resource catalogue information; deployment of developed geographic information system (GIS) applications and functionality; the harvesting of resource catalogue data for inclusion on node Web pages; and the harvesting of clearinghouse metadata. Systems development also includes the development of geospatial tools to extend the NBII’s capability to provide geography as key criteria for data discovery of spatially relevant data and development and deployment of a suite of software tools that model, simulate, forecast, interpret, and visualize biological and environmental |



| LINES OF BUSINESS | SUB-FUNCTIONS |
|-----------------------------------|--|
| resources throughout the network. | <p>conditions and processes.</p> <p><u>Lifecycle / Change Management</u> – The NBII utilizes lifecycle and change management processes that facilitate a smooth evolution, composition, and workforce transition of the design and implementation of changes to NBII IT resources such as assets, methodologies, systems, or procedures. These processes including asset management, systems performance management, capacity planning, and change control.</p> <p><u>System Maintenance</u> – The NBII performs all activities associated with the maintenance of in-house designed software and COTS applications.</p> <p><u>IT Infrastructure Maintenance</u> – Creating and managing the basic infrastructure to support the data, models, tools, and applications developed by the NBII Program is the key to overall network performance. CBI provides technical support and management of the infrastructure supporting the flow and processing of biological information served via the NBII network. The NBII Program and CBI work together to plan, design, and maintain the IT infrastructure required to deliver NBII services. IT infrastructure maintenance activities include network management, local area network (LAN) and systems management, and storage management.</p> <p><u>IT Security</u> – Security plays a vital role in ensuring the integrity of the biological content provided by the NBII and in managing the permissions and connections to ensure appropriate information sharing. Security ensures the proper use of NBII data, provides for 24/7 availability of NBII information, provides mechanisms for the assessment of security effectiveness, and includes backup/contingency plans for the network. Security for the NBII investment was designed to support the “Three A’s”: authentication, access control, and auditing.</p> |

The NBII Program has in the place the services necessary to support the goals and operations of the NBII. It is anticipated that the services included in the NBII Enterprise Framework will be elaborated over time to support emerging trends and strategies. The figure below illustrates the mapping of applicable FEA BRM lines of business and functions to the applicable NBII Enterprise Framework services layer.

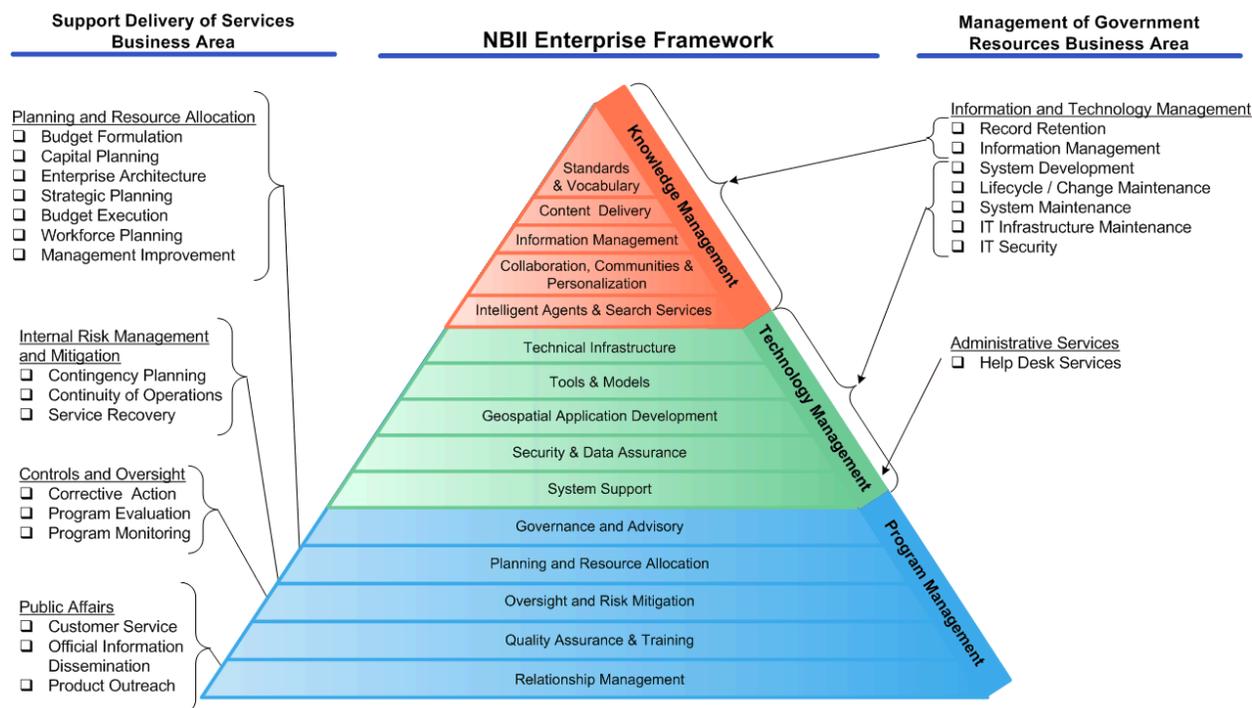


Figure 2-6. NBII Enterprise Framework Mapped to BRM Business Areas

The following sections describe the functions within each service layer of the NBII Enterprise Framework.

2.4.1 Knowledge Management Services

Knowledge management is the conscious and comprehensive identification, gathering, organization, transformation, analysis, and sharing of meaningful information. NBII’s Knowledge Management Services include storage of biological and ecological information, standards to support integration of data and resources from biological information contributors, mechanisms to provide access to biological information, and a forum to support biological resource collaborations and communities.

The NBII Information and Clearinghouse Nodes share the responsibility for knowledge management with the NBII Program. The following table identifies the role of the nodes and Program in support of the knowledge management process.



Table 2-9. Shared Knowledge Management Responsibilities

| KNOWLEDGE MANAGEMENT PROCESS | NBII PROGRAM | | NBII INFORMATION AND CLEARINGHOUSE NODE RESPONSIBILITIES |
|------------------------------|---|--|---|
| | RESPONSIBILITIES | SUPPORT FUNCTION | |
| Gathering | Compile and store metadata from Information and Clearinghouse Nodes | <ul style="list-style-type: none"> Standards and taxonomy | Data entry, optical character recognition and scanning, voice input, pulling information from various sources, searching for information to include |
| Organizing | Filtering, linking | <ul style="list-style-type: none"> Content delivery Information management | Web content, resource cataloging, data storage |
| Refining | Data personalization | <ul style="list-style-type: none"> Collaboration and communities | Contextualizing, collaborating |
| Disseminating | Flow, sharing, alert, push | <ul style="list-style-type: none"> Search & retrieval Intelligent agents | Sharing |

2.4.1.1 Standards and Taxonomy

Standards and taxonomy that support the consistent application of NBII business rules, enable effective and efficient exchange of information, facilitate the discovery of information, and significantly enhance information management are the Program’s underlying foundation. The NBII Program also supports the ongoing development, distribution, and usage of standards and taxonomy. The application of standards and a common taxonomy to name, describe, and classify information supports the gathering of the nation’s biological knowledge and enables the NBII Program to create and maintain relationships between the metadata contributed by NBII Information and Clearinghouse Nodes. The following sections describe the standards that impact both the operations and architecture of the NBII.

FGDC Metadata Standard with Biological Data Profile Extension

A key element in the development of the NBII as a distributed federation of biological data and information was the development of a standardized format that describes the biological data and information products. Metadata -- data elements that describe other data -- serve as a card catalog describing the NBII library. Given the broad range of sources from which the NBII provides data and information, the development of metadata standards was critical. To function properly, metadata must be consistent and include standardized descriptions of data content, quality, lineage, condition, and other characteristics. Development of a standard metadata format supports the effective integration of the information resources of the NBII’s independent and geographically dispersed biological information contributors.

The NBII biological metadata standard was developed in cooperation with the FGDC, the interagency group responsible for developing standards to support increased exchange and dissemination of geospatial data among federal agencies and their non-federal cooperators. The NBII metadata standard, the Biological Data Profile, extends the utility of the existing FGDC Content Standard for Digital Geospatial Metadata to support describing and cataloging biological



data and information of all types. Since the Biological Data Profile includes all the elements of the base FGDC geospatial metadata standard, software tools and protocols used for collecting, indexing, or exchanging FGDC metadata are compatible with metadata produced according to the NBII profile.

Taxonomic Nomenclature and Standards

Taxonomy is the science of animal and plant classification in which related organisms are grouped together based on their characteristics. Understanding the similarities and differences among groups of organisms is the foundation for understanding all other aspects of biology and ecology. Similarly, taxonomic standards help document the quality of the information provided by NBII biological information contributors.

The NBII is cooperating with U.S., Canadian, and Mexican agencies; other organizations; and taxonomic specialists in developing and supporting a database on the plants and animals of North America and the world. The database, known as ITIS, provides a standardized source of information on the scientific names and synonyms, common names, and the origin and general distribution of these biological species. ITIS is accessible on the Internet through the NBII and directly at <<http://www.itis.usda.gov>>.

Geospatial Standards

Open interfaces and protocols defined by OpenGIS® Specifications support interoperable solutions that “geo-enable” the Web, wireless and location-based services, and mainstream designed to make complex spatial information and services accessible <www.opengis.org>. There are two important sets of OpenGIS Implementation Specifications that impact NBII services.

1. OpenGIS Web Mapping Service – This is a family of specifications that enable servers to dynamically query, access, process, and combine different types of spatial information over the Web with OpenGIS Specification conformant servers developed by other companies and organizations. To date, the Open Geospatial Consortium (OGC) has developed three (3) OpenGIS Web Mapping Service Specifications:
 - a. OpenGIS Web Map Server Specification (Approved),
 - b. OpenGIS Web Feature Server Specification (Approved), and
 - c. OpenGIS Web Coverage Server Specification (Approved).
2. OpenGIS Geospatial Fusion Services – Non-map information (e.g., text, video, audio, digital photographs, mpeg movies, sensor data, work processing documents) often refer to place. The goal of the OGC’s OpenGIS Geospatial Fusion Services specifications is to allow for the “fusion” of information such as addresses, place names, and coordinates into one information management framework that supports search, discovery, and sharing of spatial information store in non-map formats. This specification set includes: 1) OpenGIS Gazetteer Service Interface (GAZ) Specification (Candidate), 2) OpenGIS Geocoder Service Geocoder (GeoC) Specification (Candidate), 3) OpenGIS GeoParser Service (Geoparser or GeoP) Specification (Candidate), and 4) OpenGIS Location Organizer Folder (LOF) Specification (Candidate).

Adoption and implementation of standards for representation and exchange of geospatial information is critical for establishing the level of interoperability between technologies and organizations. These standards will be elaborated as part of the NBII's efforts to develop a geospatial information framework. The nature of geospatial information – its generation, management, communication, and visualization – lead to requirements which are in some measure a superset of those for non-geospatial information. Identifying those requirements within the context of NBII's enterprise framework is the responsibility of NBII's Geospatial Interoperability Working Group. Preliminary requirements are elaborated in the Geospatial Information Framework: Functional Requirements Description report.

Content Management Dublin Core Standards

The NBII Program has adopted the Dublin Core standard, with additional NBII elements added, as the metadata standard for the development of content registries, Web resource catalogues, and html metatags. Advantages of standardizing on the Dublin Core model include:

- Contains 15 major metadata elements, making it an easier standard to implement than other, more detailed standards,
- Provides a relatively straightforward standard that does not require a great deal of training, thus allowing non-specialists to perform resource cataloguing,
- Adopted as the ANSI/NISO standard for metadata in 2001 and for use by governments, libraries, and universities in more than 20 countries,
- Facilitates the integration of registries and catalogues within and across disciplines as Dublin Core becomes a more established standard among agencies and organizations from around the world,
- Raises awareness that while most search engines currently crawl standard metatags embedded in the HTML of Web pages, specialized search engines that can harvest Dublin Core metatags are being developed, promising more precise results to search engine users, and
- Implements Dublin Core metatags on Web pages created by the NBII Information Nodes, in addition to standard metatags that are already required, to support future integration efforts.

Web Site Standards

Each NBII Information Node develops and deploys a node specific Web site. In order to control and regulate NBII's brand, the NBII Program has created Web development guidelines and procedures that govern all Web pages served within the context of the NBII network. The *Partners Web Site Design Manual* includes a standard design definition for the Web pages of an NBII Information Node including such elements as:

- Default typeface, size, and color for headings and body text,
- Presentation of front matter (preface, figure list, title page, etc.),
- Section layouts (for example, two newspaper columns, one column with headings having hanging heads, etc.),
- Line spacing, margin widths on all sides, spacing between headings, etc.,
- Required metatags on HTML pages,



- Required disclaimer, privacy, and accessibility statements, and
- Guidelines to enhance Web site accessibility to all users, including the disabled.

The design manual facilitates consistency of presentation, improved usability by users, and data integration across all pages within the NBII network. The NBII Program uses electronic tools and reporting mechanisms to assess compliance of NBII Information Node Web sites with specific design and content guidelines.

2.4.1.2 Content Delivery

A primary goal of the NBII is the publishing, delivery, and sharing of an abundant amount of well-presented, high-quality biological and ecological content organized for easy and useful access. In addition to raw biological data, the NBII captures metadata describing different kinds of electronic content (e.g., documents, images, video, audio, databases, etc.) and makes them part of the NBII knowledge base while maintaining storage of that information in the native file formats.

An important aspect of the delivery of content is the effective branding of the information. Branding of the NBII is supported by the two content delivery vehicles, which helps to develop awareness for the NBII name and the products provided.

1. NBII Web Network – The NBII network of Web sites is hosted on the geographically dispersed servers of the NBII Information Nodes and NBII Program. Within the NBII network, each biological content contributor is identified by a domain name that is translated into an Internet Protocol address. When the biological information consumer locates and requests information content of interest, the NBII network re-routes the user's request from the site's originating server to the server hosting the requested content. The NBII Program and NBII Information Node Web sites present information with a consistent look and feel to promote NBII brand recognition.
2. NBII Portal – A portal, generally synonymous with gateway, is a major starting site for users when they get connected to the Web or that users tend to visit as an anchor site. Examples of some major general portals include Yahoo, Excite, and Netscape. The NBII Portal is a niche portal that serves content specialized to meet the needs of biological information consumers and contributors.

The delivery of content via the Web empowers NBII's biological information consumers and contributors to share information. However, effective delivery of content requires the use of proper controls. The infrastructure on which the NBII Portal was built supports a set of capabilities for automatic monitoring and routing of documents to the users responsible for working on them to support each step of the business cycle. Specifically, the portal's content server workflow engine allows the NBII Program to institute multi-stage business processes for posting new content to its knowledge-base or publishing announcements to a portal page. Implementation of this functionality is planned but not yet deployed.

2.4.1.3 Information Management

Information management involves the coordination, organization, and control of information collection processes; information storage; information dissemination; information updates; and management of the policies, guidelines, and standards regarding information management. The NBII's information management services include the capabilities that control the processes for compiling, tagging, aggregating, and managing NBII products (focusing on biological data and information) to ensure the availability of information and to improve the quality of the services provided by the NBII Program.

The NBII Program collects, compiles, stores, and manages biological content from numerous sources. The data are stored and presented in a variety of formats, including XML, PDF, HTML, and SQL. Biological content includes:

- Biology news feeds,
- Biological resource metadata,
- Bibliographies,
- Checklists,
- Fact sheets,
- K-12 curricula and lesson plans,
- Life histories,
- Maps and map services,
- Practices and methods,
- Proceedings,
- Site conservation plans,
- Taxonomies,
- Theses and dissertations,
- Unpublished documents,
- Taxonomy references,
- URL registry,
- Announcements and news releases,
- Case studies,
- Data sets and statistics,
- Graphics and images,
- Laws and regulations,
- Management plans,
- Organizations and agencies,
- Presentations,
- Publications,
- Standards and guidelines,
- Thesauri, glossaries, and dictionaries,
- Tools and software, and
- Partner biological data repositories.

In addition to compiling biological content, the NBII Program aggregates biological content to support information dissemination. Data aggregation is the process by which content is gathered and expressed in a summary form as metadata. A core mission and focus for the NBII is to provide access to biological metadata, data that describes the biological data sets, tools, and information products of the NBII's biological information contributors. NBII biological information contributors create metadata that describe the resources available through the NBII network. The NBII harvests these metadata, consolidating them into databases accessible to the applicable NBII's services.

The NBII includes four metadata collections that provide categorized listings of the biological data and information accessible via the NBII content delivery mechanisms. These collections, that support the rapid retrieval of information through a structured construct, include clearinghouse metadata, Web resources catalog, map services registry, and clearinghouse registry. Biological information consumers use NBII metadata to:



- Search hundreds of biological data sets and information products from numerous sources to identify items that meet user needs.
- Identify data on specific research topics.
- Identify data from studies in specific geographic regions.
- Compile background information before launching a new study.
- Compile information to facilitate the design of new research and inventory studies.
- Identify organizations and scientists who have done or are doing work on specific issues to facilitate future interactions or collaborations.
- Access various tools and models that support decision-making.
- Link to other documents and information for related content.

NBII Metadata Clearinghouse

The NBII Metadata Clearinghouse contains standardized metadata-based descriptions of biological data sets and information products contributed by NBII's Clearinghouse Nodes. The NBII Metadata Clearinghouse serves as an online, searchable "card catalog" containing metadata descriptions of hundreds of different biological data sets and information products. Additionally, the NBII Metadata Clearinghouse is compatible with, and a participating node on, the FGDC's NSDI Clearinghouse, which provides online access to metadata descriptions of thousands of different geospatially-oriented data sets. Clearinghouse metadata are developed in compliance with the FGDC Metadata Standard with Biological Data Profile Extension.

Web Resources Catalogue

A key service provided by NBII Information Nodes is the population of a comprehensive index listing existing Web resources for a particular region or thematic topic. NBII Information Nodes discover, analyze, evaluate, and catalog scientifically credible resources, providing access to these resources on the Information Node's Web site. At the program level, the NBII consolidates the content catalogues of NBII Information Nodes into a biological Web Resources Catalogue. The goal of the resource catalogue is to facilitate resource sharing, provide a source from which an Information Node can automatically import content description records developed by other Nodes, and enhance resource discovery by NBII biological information consumers. NBII resources are described using metadata based on the Dublin Core standard, with specific enhancements supporting the biological community.

Map Services Registry

As a component of the ongoing development of NBII Geospatial Standards, work is currently underway to create a NBII Map Services Registry, which supports the data discovery of the NBII and other federal agency Internet mapping applications. The metadata standard for these registry entries is based on the Dublin Core standard, with additional NBII elements added (e.g., keyword, common name, scientific name), which contains information on the Internet mapping application as it pertains to the compilation of the individual geospatial layers. The Map Services Registry has two primary uses:

1. To support Internet users searching for geographically referenced biological data and/or map services via both NBII and external search engines, and
2. To serve as a source of data for dynamic access by other NBII map services.

Clearinghouse Registry

As a component of the NBII Metadata Clearinghouse process, each Clearinghouse Node must provide specific information to register the node with the NBII. Registration is required for the node's information to be accessible on the NBII network. The Clearinghouse Registry includes metadata describing NBII Clearinghouse Nodes that serve data via the NBII network. Clearinghouse registry metadata are used by the NBII Program to support the harvesting of metadata from the NBII Clearinghouse Nodes.

2.4.1.4 Collaboration, Communities, and Personalization

The NBII allows biological information consumers and contributors to collaborate on projects to set schedules, assign tasks, share documents, participate in threaded discussions, and exchange ideas. The NBII Portal provides interactive workspaces where NBII consumers and contributors can drive initiatives, exchange information, and interact with other resources integrated into the portal.

Biological information consumers and contributors grouped by a common goal, purpose, or collaboration can form communities of practice within the NBII Portal. Communities are a Web site within the portal used to deliver applications and workspaces specific to the needs of a defined group. Each community can function as a separate site within the NBII Portal, each with its own security, branding, and functionality.

NBII users can create and maintain a unique profile within the NBII Portal that controls their unique portal settings. By modifying their portal settings, users can:

- Set colors and greeting, including
 - Personalize the welcome greeting
 - Maintain “My Page” update frequency
 - Change portal colors
- Set locale settings, including
 - Personalize time zone
 - Control language display
 - Modify character set
- Personalize how the portal displays documents
- Change user's portal password
- Change mobile device login to facilitate authentication with mobile devices
- Specify the accessibility options of the portal interface

In addition to modifying specific portal settings, NBII biological consumers and contributors can personalize the portal interface according to their own interests, determining what and how data are displayed. Portal users can create personalized portal pages where they can assemble the information, services, and tools relevant to their work. The personalized portal pages can be used to create a space where biological information contributors, consumers and NBII Program staff can get work done, monitoring multiple projects, collaborating on documents created by different portal participants, and, ultimately, interacting with applications hosted in distant data centers.

Portal personalization supports the development of workgroups, allowing multiple users to work on related tasks. The results are higher productivity, streamlined economics of delivering information to broad audiences, and increased return on existing information technology.

2.4.1.5 Intelligent Agents and Search Services

The NBII provides access to its information through the use of intelligent agents and search services. An intelligent agent -- a program that gathers information or performs some other service without the immediate presence of the information consumer -- uses push technology. The NBII Portal supports push technology by providing the delivery of specialized information to the biological information consumer based on predefined parameters established by the consumer. The agent program, using parameters provided by the consumer, searches all or some part of the NBII, gathers the relevant information, and presents the information on a predefined periodic basis. Other uses of the NBII intelligent agent include the presentation of personalized content (as described in the Communities, Collaboration, and Personalization Section above), alerts regarding updates to content of interest, and notification of subscriptions or services of interest. Intelligent agents and push technologies provide a much-needed capability to profile biological information consumers and to establish baseline information needs. As this capability develops over the next several years, intelligent agents will play a key role in delivering timely, customized information to NBII biological information consumers.

Search services are a fundamental function provided by the NBII. The NBII provides biological information consumers the ability to query multiple, distributed data sources from a single user interface. The NBII search services provide a single point of access to network holdings, including data and information, as well as those of other federal agencies. NBII consumers do not, and will not necessarily know, all of the biological information resources available on the Web. To support the seamless interface to the various biological repositories in existence, the NBII provides search services that query the content of all biological information contributors, regardless of their physical location.

BioBot

BioBot searches the NBII and other biological information resources. Biological information consumers can search for specific terms, choose resources to be searched (e.g., NBII Web Resources, NBII Metadata Clearinghouse), search by topic (e.g., Amphibians, Birds, Fisheries, Forestry, Invasive Species), search Cambridge Scientific Abstracts (e.g., Published Literature Citations, Web Resources), and search partner portals (e.g., National Institutes of Health Portal).

Advanced Search

Advanced search provides criteria based searching of all resources in the NBII Portal. These resources include portlets, communities, and users; content indexed from file systems, Web sites and document databases; as well as the project documents and Web. Through the NBII Portal, biological information consumers can access a wide expanse of content, services, and people in a single stroke. Advanced searches created within the NBII Portal can be saved, edited, and rerun, eliminating the need to recreate complicated search queries.



NBII Metadata Clearinghouse Search

The NBII Metadata Clearinghouse search function enables the biological information consumer to search through the metadata-based descriptions of biological data sets and information products of the NBII Clearinghouse Nodes. The metadata provided by all Clearinghouse Nodes are searched simultaneously via a single query. The biological information consumer can perform keyword searches using a variety of search options, search for multiple words or phrases and search using various inclusion parameters (e.g., and, or, and not). Searches can be more fully defined to include temporal, spatial, format, and source criteria.

2.4.2 Technology Management Services

Critical to the success of the NBII Enterprise Framework is the technical foundation that supports and enables the various services provided by the NBII. The NBII Program provides technology support and management of the “core” NBII databases and systems. This effort, managed by CBI in Denver, CO, provides interoperability, availability, and consistency of resources throughout the network.

The functions included in the NBII technology management services address two of the Management of Government Resources lines of business as described in the FEA BRM, including Information and Technology Management and Administrative Services. The following sections described the technology management functions provided by the NBII Program.

2.4.2.1 Technical Infrastructure

Creating and managing the basic infrastructure to support the data, models, tools, and applications developed by the NBII Program is the key to overall network performance. CBI provides technical support and management of the infrastructure supporting the flow and processing of biological information served via the NBII network. This infrastructure includes:

- The physical hardware used to connect biological information consumers and host metadata from biological information contributors,
- The transmission media, including telephone lines, network cabling, routers, aggregators, repeaters, and other devices that control transmission paths to core NBII applications,
- The software used to send, receive, manage, and display the signals and information that are transmitted, and
- The tools used to support the creation of electronic images and multimedia for static or dynamic use.

CBI plays a significant part in evolving the NBII, providing the technical expertise that supports software and hardware assessment, technology development and deployment, user accessibility, software and database development, geospatial application development, knowledge integration and engineering, information gateway expertise, standards leadership, and network-wide user specification and evaluation activities.



2.4.2.2 Security and Data Assurance

Security plays a vital role in ensuring the integrity of the biological content provided by the NBII and in managing the permissions and connections to facilitate appropriate information sharing. Security ensures the proper use of NBII information, provides for 24/7 availability, provides mechanisms for the assessment of security effectiveness, and includes backup/contingency plans and procedures for the network. Security for the NBII Program was designed to support the “Three A’s” of security:

1. Authentication – the process of verifying a user’s identity,
2. Access control – the mechanism for restricting users’ access to only those resources that are appropriate for them, and
3. Auditing – the maintenance of security logs that tell administrators who has accessed the system and what those users have accessed.

Security and data assurance are supported at both the network and portal levels. Network security provides a set of protocols to secure and monitor access to network services and data residing on the network. Portal security provides a set of protocols to secure and monitor access to NBII content and portal services. The NBII Portal is a key infrastructure building block that will support additional levels of secure access to biological information as new services are deployed. Currently, portal authentication is being used to deliver customized information to NBII biological information consumers and contributors via the NBII Portal and to authenticate and allow access to portal collaborations and communities. A potential future application of portal security could include the synchronization of security between the portal and applicable systems, supporting the integration of security policies and single sign-on. This capability has been piloted and can be fully implemented if beneficial or required.

2.4.2.3 System Support

An important component of the NBII Program is system support. System support services include the development and management of the NBII’s information technology resources and systems, including:

Lifecycle / Change Management – Involves the processes that facilitate a smooth evolution, composition, and workforce transition of the design and implementation of changes to NBII technology resources. Activities include:

- Asset management – the collection and reporting of IT hardware and software inventory data,
- System performance management – the tracking of systems performance indicators to identify optimization opportunities,
- Capacity planning – using performance information to track and project memory, storage, and bandwidth status and needs,
- Change control – identifying and detecting changes in deployed hardware and software; establishing and maintaining LAN/WAN operational baseline, and



- Requirements management – the gathering, analyzing, and tracking of technical and functional requirements of the NBII.

System Maintenance – Supports all activities associated with the maintenance, backup, archiving, and recovery of in-house designed software applications and data repositories. This component also includes the maintenance of COTS applications. The FEA BRM does not specifically reference COTS applications; however, the NBII makes significant use of commercially available technology to support its various services.

IT Infrastructure Maintenance – The NBII Program and CBI work together to plan, design, monitor, and maintain the IT infrastructure supporting the NBII’s technology enabled services. Activities include:

- Network management – concerned with communications connectivity, including support of performance management and capacity planning activities,
- LAN and systems management – concerned with managing LAN hardware and software (e.g., directory services), and
- Storage management – processes that support the movement and management of data, enabling short term and long-term data retrieval.

Integration Services – CBI supports the development of capabilities that provide communication between hardware, software applications, and data repositories.

- Legacy Integration – supports the communication between newer generation hardware/software applications and the previous, major generation of hardware and software applications,
- Enterprise Application Integration – redesign of disparate information systems into one system that uses a common set of data structures and rules, and
- Data Integration -- supports the organization of data from separate data sources into a single source using middleware or application integration as well as the modification of system data models to capture new information within a single system.

Help Desk Services – The NBII maintains a service desk to respond to the technical questions raised by the nodes. Additionally, the NBII is actively working with complementary initiatives to provide technical advice and share lessons learned. Help desk activities including internal infrastructure help desk support, incident reporting and tracking, knowledge base development, technical working groups, and work assignment tracking.

Online Help and Tutorials – The NBII provides online help supporting both the NBII Portal and the NBII Clearinghouse search capabilities. This online help is context sensitive. Clicking on the “Help” link provides help information specific to the Web page that a user is currently viewing. Another source of technical help is the *My NBII Portal* tutorial that provides basic information regarding the set up and use of the NBII Portal. In addition to the technical tutorial, users are provided access to a range of online and interactive tutorials regarding various biological topics via the NBII Portal.



2.4.2.4 Geospatial Services and Development

The NBII, through its establishment of the NBII Geospatial Working Group, has taken a leadership role within the geospatial community in the implementation and adoption of Open Geospatial Information Standards (OGIS). These standards support the NBII's ability to provide critically needed geospatial tools to biological information consumers and to extend the NBII's capability to provide geography as key criteria for data discovery of spatially relevant data.

The vision for an NBII geospatial application has three components: data discovery, data visualization, and data interoperability.

- Data Discovery – allows users to generate and run geographic parameter queries on all NBII resources including database, resource links, metadata, and mapping applications by using either geographic coordinates or place names,
- Data Visualization – allows users to see queried resources on a map at a level that makes sense for the resource, and
- Data Interoperability – brings to the NBII nodes, partners, and other users the capability to use an NBII resource without creating a duplicate copy on their local server.

2.4.2.5 System Development

In addition to helping to increase access to biological data and information from different sources, the NBII is working with others to increase access to software tools that can be used to collect, manage, document, analyze, and apply biological data. A suite of software tools available through the NBII allows users to model, simulate, forecast, interpret, and visualize biological and environmental data.

Software Development

The NBII provides both in-house design and development of software applications as well as selection and deployment of COTS applications. The FEA BRM does not specifically reference COTS applications; however, the NBII makes significant use of commercially available technology to support its various services. The NBII develops tools and supports applicable Information and Clearinghouse Nodes' development efforts, including:

- The design, development, and/or serving of Web pages,
- The capture and submission of resource catalogue information,
- Deployment of developed GIS applications and functionality, and
- Development of gadgets, services, or applications that extend the functionality of the NBII Portal.

Data Analysis Tools

Data analysis tools and capabilities are an important component of the NBII. The capability to download and manipulate data sets accessed through the NBII allows researchers, policymakers, and educators to model, forecast, and understand current and potential conditions. Traditional search and retrieval mechanisms for the Web will most likely be replaced by distributed queries across databases, as well as tools supporting further manipulation of the resulting data set on the

user's local workstation or server. Within the NBII network, several nodes are co-located at super-computing facilities whose capacities are shared across the NBII network. Providing easy access to these facilities enables the NBII's modeling, analysis, and data synthesis tools to process data in one-tenth the time it would traditionally take. Data analysis tools, developed at both the NBII Program and NBII Information Node level, can be used to simulate conditions or activities, predict future conditions based on historic data, and support decision-making and planning.

Content Creation Tools

A key responsibility for the NBII is to create and continue to enhance tools and practices that support the creation of metadata, the identification of important electronic resources, the conversion of files from one format to another, and the timely delivery of biological data and information relevant to a specific user's need. Paramount to the NBII's success and programmatic objectives is the ability to provide tools to biological information contributors that can help them deliver high-quality data and information to the NBII network.

The NBII Program partners with private sector organizations to implement COTS products to support this effort or develops in-house tools when no viable commercial solution exists. A suite of tools has been provided to support the creation and compilation of NBII content. For example, specific tools to create NBII-FGDC compliant metadata are licensed from a commercial vendor and provided by the NBII Program to Clearinghouse Nodes. The NBII Program also successfully partnered with a private-sector vendor to develop and license a suite of metadata content tools that monitor content standards for information, monitor compliance with those standards, and assist the Clearinghouse Nodes and NBII Program in resolving instances of non-compliance. Another set of tools developed in-house assists NBII Information Nodes in cataloging their biological data and information, facilitating faster and more relevant discovery of information resources by biological information consumers. In addition to biological content tools, the NBII Program uses various tools to support the creation of tutorials, Web sites, and other interactive programs.

2.4.3 Program Management Services

Program management is the coordinated support, planning, prioritization, and monitoring of a portfolio of projects to achieve a business objective. The NBII Program provides technical leadership, management, and strategic direction for the NBII and its investments. Effective program management is accomplished through various integrated processes designed to support the initiation, planning, execution, control, and closeout of NBII projects and provide for the planning, control, and continuity of the overall program.

The functions included in the NBII Program management services address four of the Support Delivery of Services lines of business as described in the FEA BRM, including Controls and Oversight, Internal Risk Management and Mitigation, Planning and Resource Allocation, and Public Affairs. The following sections described the program management functions provided by the NBII Program.

2.4.3.1 Governance and Advisory

The NBII is a widely distributed, partner based, and highly leveraged endeavor. While the individual projects pursued by the NBII are generally not complex, it is the interrelationships of applications, systems, and data sources and the interaction with external organizations (e.g., Information Nodes, Clearinghouse Nodes, and Complementary Initiatives) that provide the complexity. Strong national coordination, leadership, and a structure intended to influence and determine decisions, actions, business rules, and other matters within an organization are required to preserve an appropriate balance across the NBII.

The NBII makes numerous decisions regarding policy, finances, planning, project scope changes, etc. The NBII has established a governance structure that helps direct and coordinate NBII decision-making activities. This governance structure provides for national oversight and direction through the facilitated participation of program stakeholders at the appropriate level. As the NBII network has grown, including both the technical network infrastructure and network of partners, the governance structure of the NBII Program has evolved.

Primary responsibility and accountability for the NBII resides with the NBII Sponsor or Senior Executive. In addition to this overall responsibility, the Sponsor leads the NBII Program Office, which is responsible for the nodes and initiatives operating under the umbrella of the NBII. Particularly, the Sponsor has oversight authority for the NBII projects funded at the Information Node level. These projects constitute a significant investment within the NBII scope.

It is not appropriate or feasible for a centralized decision-making body to make all NBII decisions. Given the geographic and functional scope of the NBII, a governance process that pushes down decision-making as far as possible within the organization is critical to the success of the NBII. The NBII governance process is designed to provide all of the stakeholders in the NBII with input into decisions.

The Sponsor, Program Manager, Technology Director, and senior managers, with guidance from the Science Committee, make up the primary decision-making body in the NBII governance process. This body is known as the NBII Steering Team. Node Managers have the authority to make a variety of day-to-day operational decisions when issues arise. In addition to governance at the national program level, the NBII supports an advisory structure through the establishment of various work groups to support the development of data and information standards, the selection of network wide tools and technologies, and the management of nodes and initiatives. These groups are utilized at various levels to support the governance structure and to provide decision input and guidance to the NBII.

The following diagram illustrates the NBII governance structure.

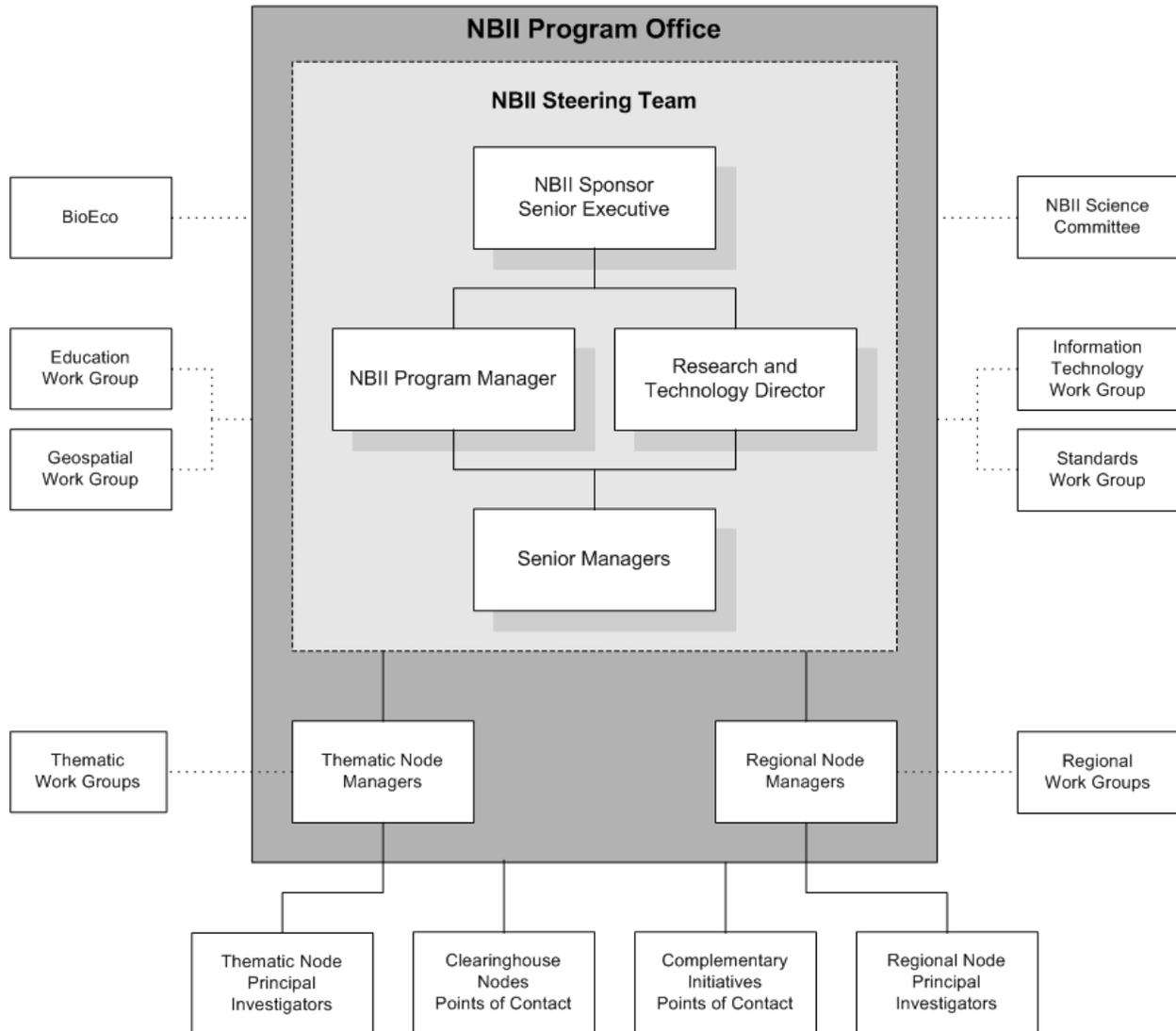


Figure 2-7. NBII Governance Structure

NBII Program Office

The NBII Program Office is USGS-coordinated and is the central governance body for the NBII Program. The NBII Program Office manages every aspect of the NBII from day-to-day operations to long range planning and implementation. The NBII Program Office acts as the liaison to BioEco and NBII Science Committee. Of primary importance to the NBII Program is the management of ongoing communications to coordinate partner and stakeholder input into future NBII activities, products, and deliverables.

Within the NBII Program Office, the Steering Team establishes policy to be implemented across the NBII, addressing important topics such as data quality, valuation of leveraged resources, and network security. NBII Program activities are ratified and implemented through the NBII



Steering Team, which meets monthly to review NBII activity status, proposals, and program performance and quality results. Additional responsibilities of the NBII Program Office include:

- Program and budget accountability: The NBII Program Office develops and implements metrics and engages in continual performance measurement. As part of this accountability process, the Program Office ensures that all technical and regulatory requirements are met.
- Standards and infrastructure: Through participation in larger standards-setting bodies, the Steering Team engages in the development and/or adoption of standards related to NBII content as well as the network's underlying technology. The Steering Team convenes working groups as needed to help determine enterprise-wide components.
- Operational activity monitoring and assessment: The Steering Team interacts continuously with node teams through Node Managers.
- Evaluation and review: The Steering Team reviews, advises on, and ultimately approves (or rejects) all activities proposed by the Nodes. This process ensures that field activities remain on target with national goals and objectives. In addition, the Steering Team monitors the progress of these activities for cost and schedule performance as well as intended functionality. The NBII Steering Team also receives and coordinates input from outside experts related to review and planning efforts.

NBII Information Node Managers

The NBII Program Office assigns a manager to each Information Node. The Node Manager is responsible for the overall operation and development of the node. The Node Managers work with a Principle Investigator within each node to ensure projects are properly scoped, adequate resources are available, and work is delivered on-time. In addition to leading node activities, a Node Manager serves as the liaison between the Information Node and the NBII Program, as well as with the other Node Managers to ensure that network-wide leveraging, resource sharing, and data integration occurs. Node Managers also organize peer reviews of Information Node annual projects.

Biodiversity and Ecosystems Informatics Work Group (BioEco)

BioEco was established in 1998 under the committee structure of the White House's Office of Science and Technology Policy. The charter of BioEco is threefold: 1) to provide a focus for federal biodiversity and ecosystem informatics activities; 2) to coordinate federal products and activities with those of the non-federal sector; and 3) to ensure U.S. coordination with international and global efforts. BioEco developed an initial structure for the NBII and monitors NBII activities, providing ongoing assessment of progress and outcomes. The NBII Program delivers progress and activity briefings to BioEco and receives feedback from BioEco at bimonthly meetings.

NBII Science Committee

The NBII Program has commissioned a Science Committee that is comprised of nationally and internationally known experts from the fields of biology and other natural sciences, information science, and computer science; the USGS chief scientist; and representatives from other USGS disciplines. The primary role of the NBII Science Committee is to provide guidance on the



scientific and technical content of the NBII and to provide advice regarding standards, quality, and other high-level issues as the NBII evolves.

Education Work Group

The NBII Education Work Group is responsible for identifying and leveraging existing NBII Educational activities throughout the NBII network, including the development of the NBII's education policies and goals. The work group supports the planning, assessment, and development of educational products at the Information Node level to provide useful tools for educators. To facilitate this effort, the Education Work Group has established a community within the NBII Portal to support collaboration. The sharing of common methodologies, lessons learned, and education needs greatly improves the NBII's delivery and support to educational institutions.

Geospatial Information Systems Technologies Work Group

A primary goal of the Geospatial Work Group is to help NBII biological information contributors understand and implement OpenGIS and other pertinent geospatial standards. In addition, this work groups supports Information Nodes by providing assistance with geospatial application usability testing, cross-node geospatial project coordination, national program (e.g., National Atlas, OneStop) assessment, providing central access to Web mapping services, and exposing Web mapping services to search engines. The Geospatial Work Group also supports the development of geospatial outreach and education materials.

Information Technology Work Group

The Information Technology Work Group ensures the development and delivery of the tools, applications, processes, and systems to support overall network development and operations. This work group also seeks existing tools, capabilities, and/or expertise in existence throughout the network to leverage across participants. To accomplish these objectives, the NBII maintains an awareness of and implements appropriate state-of-the-art technologies developed by both private and public research organizations.

Standards Work Group

The Standards Work Group ensures the development and adoption of a core set of standards to support the identification, retrieval, and use of the biological information accessible via the NBII. This work includes the implementation of knowledge management standards and approaches and the development of controlled vocabularies, taxonomies, and authorities.

Thematic and Regional Information Node Work Groups

The Node Work Group supports the management of NBII Information Node projects and initiatives throughout the network. These work groups are designed to: 1) share and leverage existing information technology capabilities throughout the NBII, and 2) identify the functionality necessary to improve the overall operation and development of the network. These groups focus on providing a forum for interaction between the Thematic and Regional Nodes, as related to national and regional science issues, to promote sharing of common standards, leverage resources, and support data integration throughout the network.



2.4.3.2 Planning and Resource Allocation

The scope of the NBII Program includes not just the sharing of national biological resources, but also the development of cooperative participation with complementary initiatives to increase the global visibility of biological information. Effective planning is required to ensure that NBII resources are efficiently managed and allocated across both the NBII's domestic and international efforts. To support this goal, the NBII Program Office determines strategic direction, identifies and establishes programs and processes to enable planned and effective change, and allocates capital among the program and processes supported. The following paragraphs summarize the key planning and resource allocation activities performed by the NBII Program Office.

Budget Formulation

The NBII Program has developed an itemized forecast of the future funding and expenditures. This budget was developed for a targeted period of time and is updated annually to address changes in scope and strategic direction. Additionally, the NBII Program Office assists NBII Information Nodes with the development of budgets to support proposed projects within the scope of a node's activities, as well as working cooperatively with partners in determining the budget needed to support proposed new Information Nodes. The NBII has implemented processes to assess the effectiveness of programs and to develop budget priorities. While the NBII Program is responsible for the budget at a program level, Node Managers, and the NBII Director of Research and Technology are primarily responsible for budget execution within their specific scope.

Capital Planning

The NBII Program Office prepares an annual Capital Asset Plan and Business Case for submission to the OMB. The development of this plan includes an assessment of the proposed investment of NBII Program funds and the recommendation of capital expenditures.

Enterprise Architecture

The Enterprise Architecture is the explicit description of the current and desired relationships among business and management process and information technology. It describes the "target" situation that the agency wishes to create and maintain by managing its IT portfolio.

The NBII Program is responsible for the creation and documentation of the NBII Enterprise Architecture, including principles and goals, management environment, the balance between Program-level and Node-level services, and the elaboration of the business and design architectures. NBII's Enterprise Architecture will be included in the DOI's overall Enterprise Architecture efforts. The business architecture defines the current business needs being met by the NBII today as well as identifies the business functions and capabilities currently in place. The design architecture defines the currently implemented data, applications, and technology used to support current business needs.

The baseline NBII Enterprise Architecture, including its elaboration of the data, application, and technology components, is completed. The NBII Enterprise Architecture serves as the baseline



from which further architectural optimization -- aligned with federal, DOI, and USGS architecture standards -- will be achieved across the NBII initiative.

Strategic Planning

The NBII Program has established a set of annual and long-term strategic goals, identifying and recommending appropriate approaches to meet these goals. Strategic planning efforts are reviewed on a regular basis and adjusted to meet changing technical, regulatory, and business drivers.

Budget Execution

NBII Node Managers are responsible for the day-to-day requisitions and obligations associated with the NBII Information Nodes, including invoicing, billing dispute resolution, reconciliation, service level agreements, and distributions of shared expenses. The NBII Steering Team assists with the reconciliation of NBII Information Node project budgets as well as the development of budgets for activities performed at the national level.

Workforce Planning

NBII biological information contributors are required to meet certain standards of service and data production for inclusion in the NBII. The NBII Program has identified the core competencies required for successful participation in the network and has developed strategies to help its partners meet these requirements. As technologies and standards evolve, these strategies will be updated to address new and changing requirements.

Management Improvement

The NBII's governance structure provides the means by which the efficiency of the NBII Program's business processes and technical infrastructure are assessed and opportunities for reengineering or restructuring are identified. Via the governance structure, the NBII continually assesses opportunities to improve the use and accessibility of information to stakeholders, policymakers, and the public. Additionally, the NBII gathers both system and investment performance statistics to measure the effective application of its financial assets and capital.

2.4.3.3 Oversight and Risk Mitigation

The NBII has developed processes to support the control and oversight of its operations to ensure that the NBII Program and the Information and Clearinghouse Nodes are complying with applicable laws, regulations, and policies. OMB Circular A-130, the Executive Branch counterpart to the original Paperwork Reduction Act of 1995, establishes information as an institutional resource that has value and associated costs, and promotes dissemination and public access to information. The NBII Program is in compliance with the following body of legislation and regulations designed to fulfill the letter and spirit of this mandate:

- Section 508 of the Americans with Disabilities Act,
- OMB Circular A-16, Federal Geographic Data Committee,
- Government Paperwork Elimination Act,
- Government Information Security Reform Act,



- GSA FedCirc,
- Privacy Act, and
- Freedom of Information Act.

The NBII Program Office monitors the data sharing activities across the NBII to ensure compliance with applicable laws, regulations, and policies. Compliance information gathered through ongoing program evaluations is analyzed to assess compliance effectiveness and to determine whether corrective action is indicated. In the event of non-compliance, or new and emerging regulatory requirements, steps are taken to initiate and implement the appropriate corrective action. If a corrective action is implemented to remedy an incident of non-compliance, the NBII Program monitors the deployment of the recommended corrective action and resulting compliance status.

In addition to providing active oversight and control of NBII activities, internal risk management and mitigation of those risks is an important function of the Program. The NBII has assessed its risk exposure and identified appropriate countermeasures to mitigate identified risks. CBI has developed a Risk Management Plan for the NBII Network to address technical risks related to the NBII infrastructure. The plan includes the internal actions to reinstitute operations following a failure, contingency plans to respond to and mitigate a damaging event, and the identification of systems and processes that should receive priority attention to provide continuity of operations following a failure event. In addition to the technical risk assessment and resulting plan, a Risk Inventory and Assessment has been performed in the following areas:

- Schedule,
- Initial costs,
- Life-cycle costs,
- Technical obsolescence,
- Feasibility,
- Reliability of systems,
- Dependencies and interoperability between and among nodes,
- Surety (asset protection),
- Risk of creating a monopoly for future procurements,
- Capability of the agency (USGS) to manage the NBII,
- Overall risk of failure,
- Organizational and change management,
- Business,
- Data and information management,
- Technology,
- Strategic,
- Security,
- Privacy, and
- Resources (cost/benefit analysis).

2.4.3.4 Quality Assurance and Training

An important consideration in development of the NBII was the need to ensure that data and information resources are of the highest quality possible, meet the needs of biological information consumers, and are maintained for currency. The NBII accomplishes these goals by dedicating staff resources to develop standards, review and approve content, develop tools to aid in the identification and management of relevant data and information, and implement state-of-the-art technologies to support the discovery and retrieval of biological information. In partnership with nodes and external partners, the NBII works to achieve quality assurance objectives through:

- Developing and applying metadata standards that support NBII integration requirements, making information more accessible to all participants;
- Establishing mechanisms to maintain and update relevant metadata data sets;
- Providing guidance for collecting, coding, and classifying the biological resources;
- Establishing information audit criteria to assist with the monitoring of the application of metadata standards, harvesting processes, and coding and classification procedures used by NBII biological information contributors;
- Implementing data backup and archive policies and procedures; and
- Deploying various tools to support the creation of quality data, the review of data prior to integration in the NBII Program, and the assessment of Web site usability and standard compliance.

While it is important to review the quality of the biological content received, it is perhaps more important to build quality into the creation of the content. The NBII, in partnership with the biological information contributors, has developed data quality standards and guidelines to ensure NBII resources are of the highest quality. To support the consistent application of those standards, as part of its workforce planning efforts, the NBII provides training to biological information contributors. This training is designed to support the creation of metadata describing biological resources and collaboration between contributors via the NBII Portal. Additionally, the NBII Program is investing in establishing bioinformatics curricula at several universities to support future biological data and information management requirements. The NBII has also established working groups to share applications, distribute “lessons learned” among participants, and provide expert support for basic questions.

2.4.3.5 Relationship Management

The NBII Program is actively involved in the exchange of information and communication between federal and non-federal organizations, biological information consumers and contributors, stakeholders, and third-party participants who have a direct impact on Services for Citizens. The relationship management processes support the NBII’s efforts to plan and monitor the activities between all program participants. Through both domestic and international communication and outreach efforts, the NBII provides information designed to raise awareness of its services. To support these efforts, a variety of mechanisms and media are used, including the NBII and Information Node Web sites, to support communication and dissemination of

Program information. The NBII, as an active participant in various conferences and meetings, works to foster communication, awareness, and the sharing of biological information.

To promote bi-directional communication, the NBII provides numerous programs to help address issues of concern to the citizens of our nation, providing mechanisms by which these concerns can be communicated to the NBII and its partners. The NBII uses Web-based customer feedback mechanisms to actively collect, analyze, and handle comments and feedback from NBII biological information consumers. This feedback is related to both the content of the NBII as well as the accessibility and usability of the content delivery mechanisms.

2.5 Activity Models

The activity models define how NBII participants relate to one another, both statically and dynamically, to produce the expected outcomes. The models emphasize the roles performed from a business perspective and the active responsibilities of each participant. The following sections describe the interactions of biological information consumers, contributors, and complementary initiatives within the NBII.

2.5.1 Biological Information Consumers

Biological information consumers access the NBII to request and receive biological information content. The diagram below illustrates, at a high-level, the interaction between biological information consumers and other participants of the NBII.

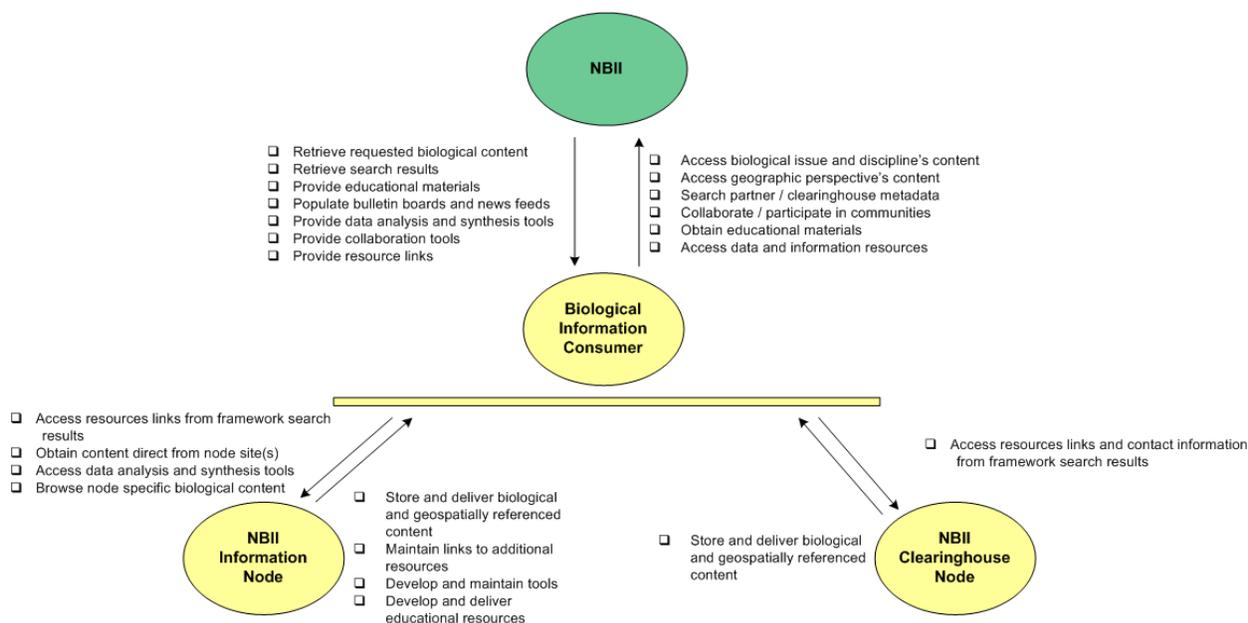


Figure 2-8. Activity Model – NBII Biological Information Consumers

In general, the biological consumer initiates activities with the NBII via one of the two content delivery mechanisms of the NBII Enterprise Framework. Using either the NBII Portal or the

NBII Web site, the biological information consumer can access biological issues, biological discipline information, educational materials, data and information resources, news feeds, bulletin board information, and biological community artifacts. The biological information consumer can either browse the Web site and portal for content or can search for specific content. The consumer can also access links to other biological resources including complementary initiatives, expertise databases, online references and journals, and other data and information resources.

In addition to obtaining content directly from the NBII Web site and portal, the biological information consumer can use one of several mechanisms provided by the NBII to search NBII Information Node content and Clearinghouse Node metadata. The NBII responds to the search, retrieving a list of resources that match the consumer's search criteria. Results from a search of Clearinghouse Nodes include the metadata describing the resources within the NBII Clearinghouse that match the search criteria. This metadata includes the point of contact for the biological information consumer to obtain additional information about the underlying data source. In some instances, the metadata includes a URL link that directs the biological information consumer to a Web site where the information can be downloaded.

In contrast, search results obtained by NBII Information Nodes includes links that are displayed to the consumer in the form of a highlighted word or phrase that can be selected, resulting in the immediate delivery and viewing of another file that resides on the Web site of the NBII Information Node. From this Web site, the biological information consumer can access the requested data, browse the node Web site for additional node specific biological content, and access available data analysis and synthesis tools.

Biological consumers more familiar with their information needs can go directly to the Web site of NBII Information Nodes to obtain biological resources. For example, a consumer interested in biological resources regarding the Central Southwest or Gulf Coast region (e.g., Arkansas, Louisiana, Oklahoma, Texas, and the Gulf of Mexico) can go directly to the Web site of the NBII Central Southwest/Gulf Coast Information Node. This node maintains a regionally specific digital collection of useful biological information maintained by a variety of partners, including governmental agencies, non-governmental and private sector organizations, and academic institutions organized by theme: Ecoregions (e.g., Gulf of Mexico, Urban, Big Bend, Fort Hood, Galveston Bay), Regional Issues (e.g., Air, Disasters, Research Collections, Invasive Species, NAFTA Highway, Oak Wilt), and Resources (e.g., Biological News, Data and Models, Interactive Maps, Visualizations, Other Resources).

2.5.2 Biological Information Contributors

The following sections describe the interactions between biological information contributors and the NBII.

2.5.2.1 NBII Information Nodes

NBII Information Nodes interact with both the NBII and the node’s resource partners. The diagram below illustrates, at a high-level, the interaction between NBII Information Nodes, the NBII, and its resource partners.

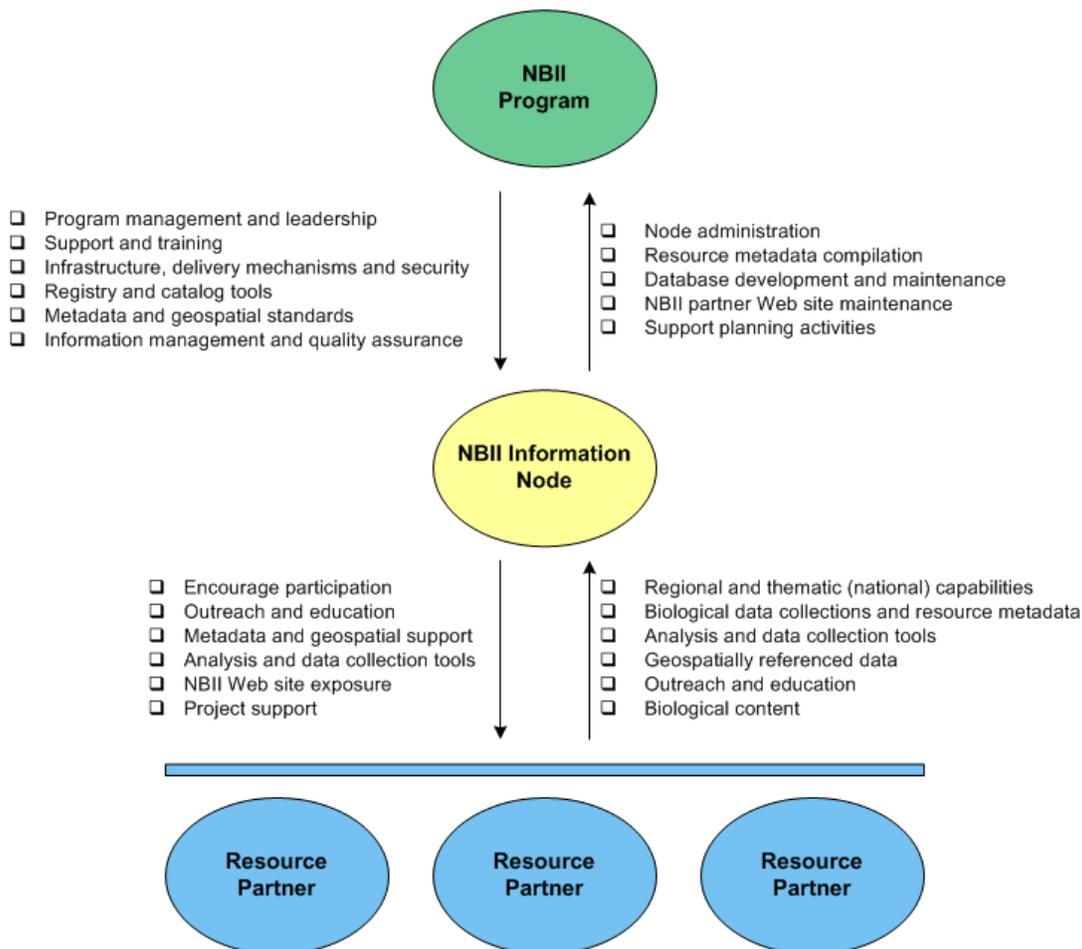


Figure 2-9. Activity Model – NBII Information Nodes

Information Nodes are responsible for developing partnerships with organizations to provide biological information resources. The Information Node manages and supports the activities of the resource partners providing metadata and geospatial support, analysis, data collection tools, NBII Web site exposure, and project support. In return, the resource partners help to expand the capabilities of the Information Node by providing biological data collections, content, and geospatially referenced data. The resource partners support the outreach and education efforts of the NBII Information Nodes and provide analysis/data collection tools applicable to their scope of work.

Information Nodes provide the administration necessary to support its specific thematic or regional scope. Information Nodes coordinate the delivery of biological information and resources from their resource partners. The nodes also develop and maintain node specific

databases accessible via the NBII or the node Web sites. As part of their management responsibilities, the NBII Information Nodes participate in planning activities and maintain an NBII Web site.

To support these efforts, the NBII provides the necessary program management, leadership, and training. Further, it provides the infrastructure, delivery mechanisms, and security required to support the sharing of the biological information resources of the Information Node and its resource partners. Additionally, the NBII provides the metadata and geospatial standards and the registry, catalog, and metadata tools to support resource metadata compilation by the Information Node. The NBII Program performs ongoing quality assurance and serves the information over its infrastructure via the secure delivery mechanisms.

2.5.2.2 NBII Clearinghouse Nodes

NBII Clearinghouse Nodes interact with both the NBII and node partners. The diagram below illustrates, at a high-level, the interaction between NBII Clearinghouse Nodes and the NBII.

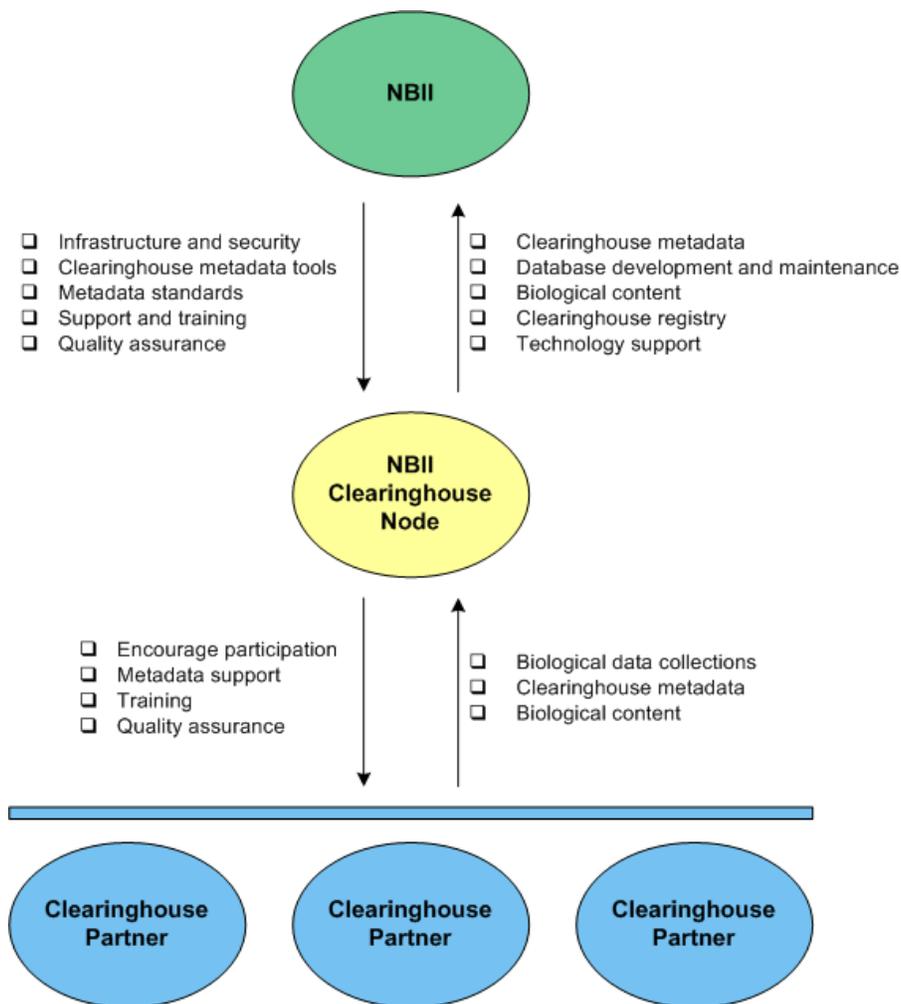


Figure 2-10. Activity Model – NBII Clearinghouse Nodes

Clearinghouse Nodes provide metadata that describe the biological data sets and information products available from that node. Organizations interested in serving as NBII Clearinghouse Nodes either submit clearinghouse registry metadata to the NBII or establish the required infrastructure to support the harvesting of metadata by the NBII. The NBII provides the metadata standards, metadata tools, support, and training to facilitate the metadata compilation efforts of Clearinghouse Nodes.

Clearinghouse Nodes generate biological content through encouraging participation in the NBII and developing clearinghouse partners. Clearinghouse partners create biological data collections, clearinghouse metadata, and biological content that are geospatially referenced. Clearinghouse Nodes coordinate the delivery of biological information and resources from their clearinghouse partners; providing metadata support, training, and quality assurance as required. Additionally, Clearinghouse Nodes develop and maintain node specific databases and biological content that are referenced by the NBII.

Resources from a node's clearinghouse partners are compiled, in the form of metadata, run through a quality control process, and forwarded to the NBII Program to support the search and retrieval services provided by the framework. The NBII Program performs ongoing quality assurance on the compiled data and serves the information over its infrastructure via the secure delivery mechanisms.

2.5.3 Complementary Initiatives

The interaction between the NBII and each complementary initiative (e.g., IABIN, CONABIO, and NSDI) is specific and unique to each initiative. Therefore, the activity model illustrating the interaction between a specific initiative and the NBII is also unique. As the relationship between each initiative and the NBII matures, these activity models will be elaborated.

This section discusses the interaction, and illustrates the activity models, between GBIF, one of the many complementary initiatives with which the NBII interacts, and the NBII. The following diagram illustrates, at a high-level, the proposed administrative interaction between GBIF and the NBII.

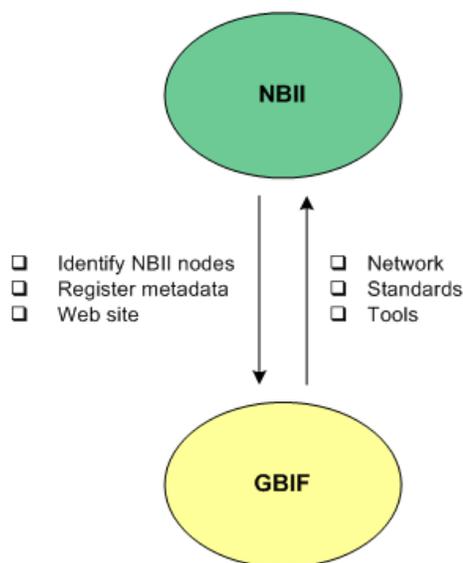


Figure 2-11. Administrative Activity Model – GBIF Complementary Initiative

GBIF is an international scientific effort to serve massive amounts of genetic, taxonomic, geographical, and ecological data about organisms from a central service provided via an Internet portal. The NBII, as a participant in the GBIF initiative, exchanges information with GBIF to support some basic administrative services as well as acting as both a data consumer and a data contributor of information served by GBIF.

In its administrative role, GBIF is developing a network that provides the architecture necessary to allow users to query millions of biodiversity records on three billion specimens located in the collections of various organizations across the globe. Additionally, GBIF is delivering the standards by which participants must submit specimen metadata and tools to facilitate the collection and submission of specimen metadata. To support GBIF administrative services, the NBII identifies data nodes from which it will harvest specimen metadata, register metadata that has been compiled, and maintain a Web site specific to its GBIF participation <gbif.nbi.gov>.

In addition to the administrative information flow between the NBII Program and GBIF, there is bi-directional flow of data. The NBII Program acts as both an information consumer of GBIF specimen data and an information contributor. The following diagram illustrates, at a high-level, the proposed interaction between GBIF and the NBII as an information contributor.

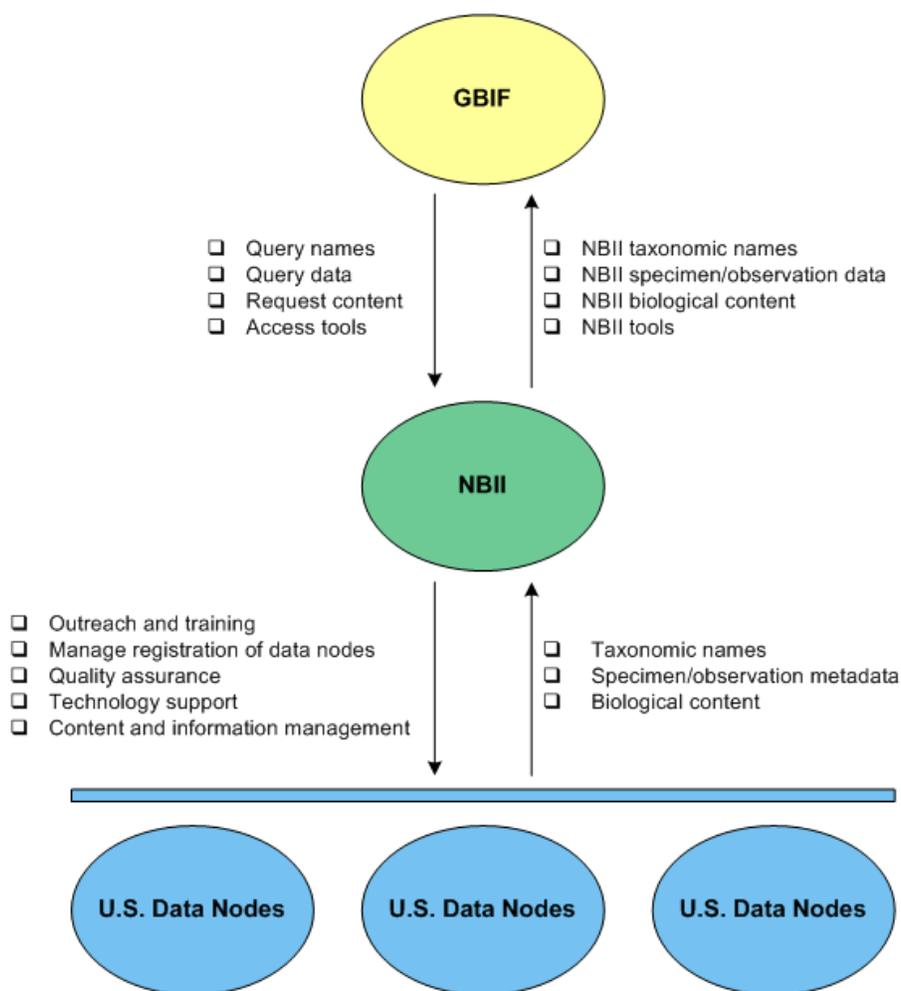


Figure 2-12. Data Contributor Activity Model – GBIF Complementary Initiative

As an information contributor, the NBII manages the registration of U.S. data nodes that collect specimen and observation data. The NBII supports the activities of the U.S. data nodes, providing training in the application of GBIF standards and use of GBIF tools, quality assurance, technology support, and content and information management services. As participants with the NBII in the GBIF Initiative, the data nodes provide taxonomic name collections, specimen/observation metadata, and biological content. The NBII coordinates the delivery of data node content to GBIF. Additionally, the NBII provides tools to support the analysis of the raw specimen/observation data. GBIF users are able to query taxonomic name collections and specimen/observation metadata submitted by the NBII, as well as make requests for content and access tools.

In addition to being a contributor of data to GBIF, NBII is a consumer of GBIF information. The diagram below illustrates, at a high-level, the proposed interaction between GBIF and the NBII as an information contributor.

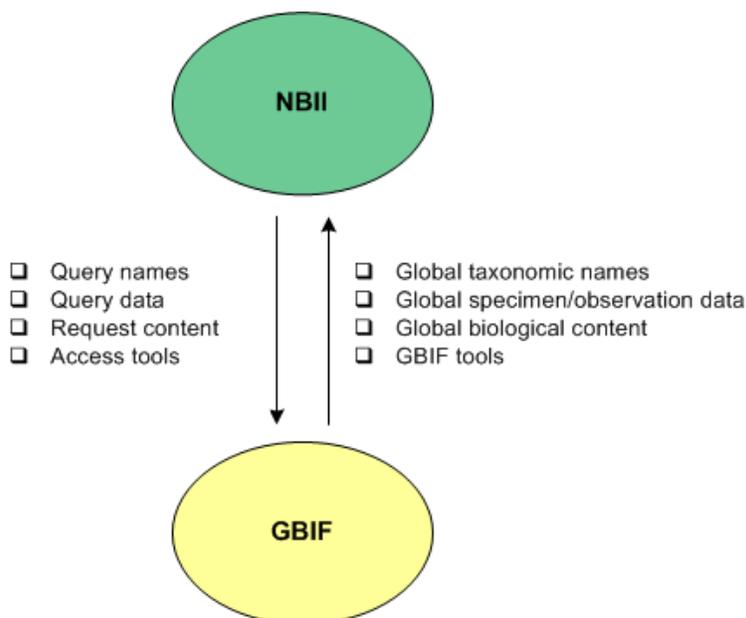


Figure 2-13. Data Consumer Activity Model – GBIF Complementary Initiative

GBIF compiles global data sets, initially focused on specimen collections, contributed by participants, including global taxonomic names, global specimen/observation data, global biological content, and GBIF tools. The NBII and its biological information consumers are able to query taxonomic name collections and specimen/observation metadata submitted by GBIF participants, as well as make requests for global content and GBIF access tools.

2.6 NBII Business Model

A business model is a visual representation of the operations of a business. It includes key structural and operational characteristics of a business providing a broader description than just its strategy. The business model of the NBII is an encapsulation of the business architecture, expanding on the concept of operations to illustrate the interactions between biological information contributors, the NBII Enterprise Framework, biological information consumers, and complementary initiatives.

It is important to note that the NBII business model was derived from the four business areas included in the FEA BRM. The NBII delivers the specific Services for Citizens by leveraging the outputs of various processes (e.g., Modes of Delivery). The delivery of this information is supported by critical policy, programmatic, managerial underpinnings (e.g., Support Delivery of Services business area) and day-to-day resource management activities (e.g., Management of Government Resources business area). The following figure illustrates how the business components of the NBII work together.

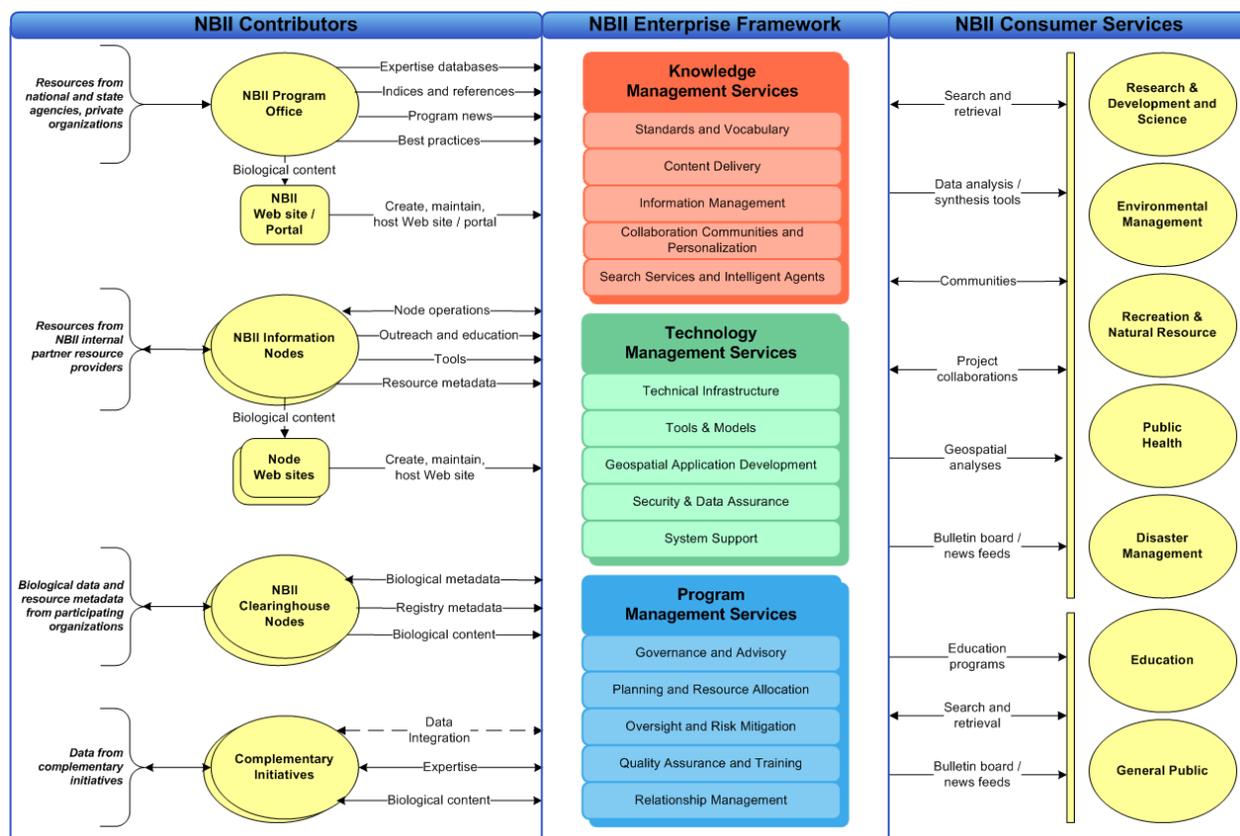


Figure 2-14. NBII High-Level Business Model

The mission of the NBII is to provide the nation with a mechanism for accessing a vast reservoir of biological and natural resources data, information products, and analytical tools that support and enhance science-based decision-making. The NBII is the cornerstone for the gathering and efficient transfer of research and monitoring information from all sectors of the global biological community to those involved with the care, use, and conservation of natural resources. The NBII delivers on this mission by facilitating the symbiotic relationship between the consumers of biological data and the contributors of that data, thereby enhancing the government’s ability to provide Services for Citizens. Biological information contributors provide resources to the NBII that are made available to biological information consumers. Resources from biological information contributors are often developed as a result a Service for Citizens. The biological information consumer may then access the outcome of a Service for Citizens to support the performance of a new Service for Citizens, providing the enhanced or new information back to the NBII as a biological information contributor. This new information is then made available via the NBII to support other services.

As an example of this relationship, the NBII includes survey data that is an outcome of the surveying of public lands (i.e., Conservation, Marine, and Land Management sub-function within the Natural Resources line of business line of the Services for Citizens business area). Via the NBII, this survey data are made available to researchers supporting the management of national parks (i.e., Recreation Resource Management and Tourism sub-function within the Natural



Resources line of business line of the Services for Citizens business area). The results of this research is contributed to the NBII and may later be accessed by researchers involved in environmental research (i.e., Environmental Monitoring and Forecasting sub-function within the Environmental Management line of business line of the Services for Citizens business area).

2.7 Summary

The NBII provides a mechanism that expands the universe of information readily available to biological information consumers. Delivery of knowledge management, technology management, and program management services by the NBII Program within the context of a defined framework supports this expanded flow of information between developers of biological information content and the ultimate consumers of that information. The NBII Business Architecture defines the business needs being met by the NBII today, illustrating the concept of operations (the business objective) and describing the context in which that objective must be met (what is provided, how is it provided, to whom is it provided, and from what business locations). Realization of the mission of the NBII is supported by the information technology enabled services provided within the NBII Enterprise Framework. The design architecture, presented in the next section, describes the relationship between the business services provided by the NBII and the IT components established to support those services.



Appendices

Appendix 2-A - Clearinghouse Nodes

| CLEARINGHOUSE NODES | DESCRIPTION |
|--|---|
| The NBII Clearinghouse Node | The NBII Clearinghouse Node includes biological data and information from a distributed network of cooperating data and information sources that choose not to operate as a separate clearinghouse. The Clearinghouse provides access to software tools to use in analyzing, integrating, and applying biological data. |
| BRD Bibliographic Metadata Node | The USGS-BRD publishes scientific and technical articles and reports resulting from the research performed by its scientists and partners. The metadata provides a bibliographic description of the published information that includes research that varies among science centers; with each center having its own areas of expertise and specialization, and national status and trend reports. |
| Columbia Environmental Research Center's Metadata Node | The Columbia Environmental Research Center (CERC) is a USGS research facility located in Columbia, MO. CERC provides scientific information and data needed to address national and international environmental contaminant issues, and effects of habitat alterations on aquatic and terrestrial ecosystems. Metadata provided by CERC include the results of multidisciplinary research that includes large river floodplains, coastal habitats, wetlands, streams, and lakes. |
| Eastern Sierra Geospatial Data Clearinghouse | Collection of data and metadata pertaining to the Eastern Sierra region (i.e. Inyo and Mono counties) of California. Priority is given to data sets produced locally that will be of value to researchers, land managers, and policymakers. Coverages currently identified for inclusion in the clearinghouse include soils, vegetation, precipitation, geology, roads, and political boundaries of selected portions of the region. |
| EMAN Data Set Library (Environment Canada Server) | The Ecological Monitoring and Assessment Network (EMAN) is composed of approximately 90 research and monitoring sites, partners, and volunteer observers spread among the fifteen terrestrial ecozones in Canada. EMAN metadata describe the ecological data collected by the Network, including data describing forest biodiversity, acidic deposition, and animal behavior. |
| Forest, Aquatic, and Rangeland Ecosystems in the Western USA | This clearinghouse node encompasses the research interests and geographic breadth of the USGS Forest and Rangeland Ecosystem Science Center, the USGS Western Fisheries Research Center, and various research partners. The node provides metadata describing both spatial and tabular data sets resulting from ecosystem research projects conducted throughout the western United States. |
| National Gap Analysis Program (GAP) Metadata Node | The metadata contained in this node is a compilation of metadata coverage information provided by the GAPs in individual states. The metadata provide information pertaining to GIS coverages of the following: species distribution (bird, mammal, herptiles, and some states have fish), land cover types, biodiversity management status, ancillary data (used to create the above coverages), and additional coverages developed through the National GAP by individual states (e.g., soils, geology, roads, etc.). |



| CLEARINGHOUSE NODES | DESCRIPTION |
|--|--|
| National Wetlands Research Center (NWRC) Spatial Data and Metadata Server Node | The NWRC Clearinghouse Node consists of metadata and data sets generated by the Center and its project offices. These data sets include, but are not exclusive to, habitat, aquatic, and vegetative research performed in the Gulf of Mexico region. The node also contains ancillary data sets, such as political boundaries, soils, geology, roads, etc. for the state of Louisiana. |
| New Mexico Resource Geographic Information System Clearinghouse | The New Mexico Resource Geographic Information System (RGIS) is a cooperative program between the University of New Mexico and the State of New Mexico Information Technology Commission. The RGIS Clearinghouse is a repository for New Mexico digital, geospatial data acquired from local and national public agencies or created expressly for RGIS. This node includes metadata describing the following resources: boundaries; cities and towns; climates; digital orthophotos; elevations; geographic place and feature names; geology; land ownership; land use and land cover; township, range, and section; quad grids and geodetic control; shaded reliefs; socioeconomic data; soils; topographic maps; transportation; vegetation; and water resources. |
| New Mexico USGS Partnership Clearinghouse | Earth Data Analysis Center's Clearinghouse Services has served the New Mexico community and southwest region as a central information and distribution center for all types of aerial photography and satellite imagery since 1968. This clearinghouse has broadened its scope in recent years to include spatial digital data. |
| Southwest Region Road Map of Natural Resource Data and Information | The University of New Mexico's Center for Wildlife Law (CWL) and Museum of Southwestern Biology (MSB) have established a National Geospatial Data Clearinghouse of state biodiversity laws and policies and the systematics, ecology, and life history of mammals of the Southwest. They have adapted the existing data collections of CWL and MSB to comply with NBII standards for biological data, and provide on-line search and retrieval of metadata and data sets of these collections. Additional metadata sets include the state game and fish management agencies and heritage programs for the states of Arizona, New Mexico, Oklahoma, and Texas. |
| Clearinghouse for the Olympic Peninsula | The Olympic Natural Resources Center's (ONRC) Clearinghouse for the Olympic Peninsula is a regional information resource for geospatial and biological metadata and data for the Olympic Peninsula and Willapa Bay areas of Washington state. The ONRC Clearinghouse archives natural and cultural resource information reflecting the region's diverse marine and terrestrial ecology, land ownership, and land use. Metadata are collected from data sets from government agencies (local, regional, state, and federal), tribes, NGOs, and individual researchers. |
| A Transboundary NSDI/NBII Metadata Clearinghouse node for the Texas/Mexico Borderlands | The node provides metadata that describes multi-use environmental data files for the Texas/Mexico border region. This clearinghouse node is being created and maintained by the Texas/Mexico Borderlands Information Center and the administrative section of the Texas Water Development Board's Texas Natural Resources Information System (TNRIS). |
| Texas Natural Resources Information Systems | TNRIS, a division of the Texas Water Development Board, is the state's clearinghouse for maps, aerial photos, and digital natural resources data. TNRIS also serves as a distribution center for USGS maps and has numerous other map collections available for in-house use or reproduction. |



| CLEARINGHOUSE NODES | DESCRIPTION |
|---|--|
| Virginia Natural Resources Geospatial Clearinghouse | The Virginia Geographic Information Network (VGIN) is responsible for promoting and coordinating the efficient and effective development and use of spatial data, GIS, and related technologies throughout the Commonwealth of Virginia. The VGIN, a network of data clearinghouses in the Commonwealth, contains spatial and non-spatial metadata for natural resource organizations in Virginia. |
| Washington State Geospatial Clearinghouse | This geospatial information service is being provided by the Washington State Geographic Information Council, the University of Washington Libraries, and Washington State Department of Information Services. This node serves as the parent node for a logically centralized approach to spatial information discovery in Washington State. |
| Wyoming Natural Resources Data Clearinghouse | The scope of this clearinghouse includes any natural resources geospatial data or related data within Wyoming. Themes include hydrography, land cover, soils, plant and animal species distribution, elevation, bedrock and surficial geology, mineral and gas deposits, information on ground water, as well as related information dealing with political boundaries, land ownership, public land survey system, mining, and water rights. |



Appendix 2-B - Acronyms Used

| ACRONYM | DESCRIPTION |
|---------|--|
| BLM | Bureau of Land Management |
| BRD | Biological Resources Discipline |
| BRM | Business Reference Model |
| CBI | Center for Biological Informatics |
| CERC | Columbia Environmental Research Center |
| CONABIO | Comisión Nacional para el Conocimiento y Uso de la Biodiversidad |
| COTS | commercial-off-the-shelf |
| CSA | Cambridge Scientific Abstracts |
| CWL | Center for Wildlife Law |
| DOI | Department of the Interior |
| EMAN | Ecological Monitoring and Assessment Network |
| EPA | Environmental Protection Agency |
| FEA | Federal Enterprise Architecture |
| FGDC | Federal Geographic Data Committee |
| GAP | Gap Analysis Program |
| GBIF | Global Biodiversity Information Facility |
| GIS | geographic information systems |
| IABIN | Inter-American Biodiversity Information Network |
| ICSU | International Council of Scientific Unions |
| ISSG | Invasive Species Specialist Group |
| IT | information technology |
| ITIS | Integrated Taxonomic Information System |
| IUCN | World Conservation Union |
| LAN | local area network |
| LOF | Location Organizer Folder |
| MSB | Museum of Southwestern Biology |
| NABIN | North American Biodiversity Information Network |
| NBII | National Biological Information Infrastructure |
| NGO | non-government organization |
| NRC | National Research Council |
| NSDI | National Spatial Data Infrastructure |
| NSF | National Science Foundation |
| NWRC | National Wetlands Research Center |
| OGC | Open Geospatial Consortium |
| OGIS | Open Geospatial Information Standards |
| OMB | Office of Management and Budget |
| ONRC | Olympic Natural Resources Center |
| PMO | Program Management Office |
| R&D | research and development |
| RGIS | Resource Geographic Information Service |
| TNRIS | Texas Natural Resources Information System |



| ACRONYM | DESCRIPTION |
|---------|---|
| USDA | U.S. Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VGIN | Virginia Geographic Information Network |
| WDC | World Data Center |