

April 2000

Biological Data Working Group

Descriptions of Selected Biological Data Programs and Activities of Individual Member Agencies and Organizations

The Biological Data Working Group of the Federal Geographic Data Committee (FGDC) was created in 1997 to promote activities and standards that improve collection, use, sharing, and dissemination of biological resources data among government agencies and other interested parties. Working under the auspices of the FGDC, the Working Group helps to increase understanding of and participation in the National Spatial Data Infrastructure (NSDI) and the National Biological Information Infrastructure (NBII) among individuals and organizations involved in research, inventory and monitoring, and management of biological resources.

The Working Group includes members from several different Federal agencies (including the U.S. Geological Survey, the U.S. Fish and Wildlife Service, U.S. Forest Service, Natural Resources Conservation Service, Environmental Protection Agency, National Science Foundation, and the Smithsonian Institution), as well as from non-government organizations, including the Nature Conservancy, the Long-Term Ecological Research (LTER) Network, and the National Center for Ecological Analysis and Synthesis. Each of the member agencies and organizations of the Working Group is responsible for programs and activities that focus on various aspects of the collection, use, sharing, and/or dissemination of biological resources data. Brief descriptions and key examples of several of these biological data programs and activities are provided below.



National Center for Ecological Analysis and Synthesis

(NCEAS): NCEAS embodies a national effort to synthesize existing ecological information and use it in new and innovative ways to advance ecology and allied

sciences while simultaneously serving to inform policy and decision makers. Over its brief existence since 1995, almost 1700 scientists from 49 states and 39 countries have participated in NCEAS research activities. This intense collaboration at a single site is unique in the ecological community, and consequently it raises new issues pertaining to the management and utilization of ecological and environmental data for scientific research. Broad-scale and synthetic research is stymied because ecological data are largely inaccessible due to their spatial dispersion across many field stations and universities, extreme structural and semantic heterogeneity, and complexity. Consequently, the focus of development activities at NCEAS is to improve discovery, access, interpretation, integration, and analysis of ecological data by minimizing these problems of dispersion and heterogeneity through software tools and infrastructure.

The principal vehicle for tackling these problems is a recent NSF grant to build a knowledge network for ecological information <<http://www.nceas.ucsb.edu/kdi>>. The research involves a consortium of institutions including NCEAS, LTER, the University of Kansas, Texas Tech University, and the San Diego Supercomputer Center. This consortium has proposed to integrate distributed and heterogeneous ecological information into a standards-based, open architecture, knowledge network. This network will extend metadata use to provide conceptually sophisticated access to integrated data products drawn from distributed, autonomous data repositories. Our initial prototype test sites include the LTER network of sites, sites from the Organization of Biological Field Stations, and from the University of California Natural Reserve System.

NCEAS researchers are also conducting projects to create software tools and infrastructure that facilitate data exchange by the Multi-Agency Rocky Intertidal Network. Data in this project are drawn from a diverse set of agencies that maintain long-term monitoring efforts along the California coast. In addition, NCEAS is collaborating with the Ecological Society of America's Vegetation Classification Panel to create a suite of integrated databases to support the emerging National Vegetation Classification (another FGDC standard), and the UC Natural Reserve System to create an advanced management infrastructure for data collected at each of the participating reserves.

Cumulatively, we expect that these projects will produce a new class of integrated ecological data that is easily accessible and interpretable, and thereby will facilitate the type of synthetic advances in ecology that are at the core of NCEAS' mission.



National Oceanic and Atmospheric Administration (NOAA): Besides the weather, climate, oceanographic, and satellite data, NOAA <<http://www.noaa.gov>> collects and archives a variety of biological data. The data are maintained in a variety of media and current concern is the stewardship of the data for use in the future.

The National Marine Fisheries Service (NMFS) <<http://www.nmfs.gov>> administers NOAA's programs which support the domestic and international conservation and management of living marine resources. NMFS provides services and products to support domestic and international fisheries management operations, fisheries development, trade and industry assistance activities, enforcement, protected species and habitat conservation operations, and the scientific and technical aspects of NOAA's marine fisheries program. NMFS maintains fishery data ranging from taxonomy and biology to statistics and fishing fleet information.

The National Ocean Service (NOS) <<http://www.nos.noaa.gov>> is the primary Federal agency working on the observation, measurement, assessment, and management of the Nation's coastal and ocean areas, as well as conducting response and restoration activities to protect vital coastal resources. As a national leader for coastal stewardship, NOS promotes a wide range of research activities to build the strong science foundation required to advance the sustainable use of our coastal systems. NOS contributes significantly to achieving three of NOAA's seven Strategic Plan Goals; Sustain Healthy Coasts, Promote Safe Navigation, and Build Sustainable Fisheries. NOS provides improvements in the quality, quantity, geographic distribution, and timeliness of ocean and coastal observations. NOS also develops and manages marine sanctuaries and, in partnership with the coastal states, helps manage the Nation's valuable coastal zones and nationally significant estuarine reserves. Understanding of the coastal environment is enhanced through coastal ocean activities which support science and resource management programs. NOAA produces and maintains numerous biological data sets such as the Harmful Algal Blooms and National Status and Trends data bases.

The Office of Oceanic and Atmospheric Research (OAR) <<http://www.oar.noaa.gov>>, as the primary research arm of NOAA, conducts and directs research in atmospheric, coastal, marine, and space sciences through its own laboratories and programs, and through networks of university-based programs. An example of biological data in OAR: the OAR Environmental Research Laboratory funds the Cooperative Institute for Limnology and Ecosystems Research (CILER) <<http://www.engin.umich.edu/center/ciler>>. Established in 1989, CILER is the only institute of the current nine NOAA joint/cooperative institutes with direct responsibilities for research in fresh water. CILER activities are not limited to the limnetic environment; they also support research in estuarine and coastal marine environments. CILER research in coastal and nearshore processes has focused on both the marine and limnetic nearshore environments. To date, CILER projects have studied coastal processes in the Great Lakes, Gulf of Mexico, Florida Bay, and the northwestern coast of the United States. A particular emphasis of CILER studies has been the investigation of exchanges of materials from tributaries into the nearshore zone. Those investigations have covered a wide variety of disciplines including physical, chemical, and biological oceanography and limnology, and in many cases have combined all three fields. This variety of research is viewed as a major strength for CILER, because comparison among different coastal environments provides unique opportunities for insight into ecosystem structure and function.

The National Oceanographic Data Center (NODC) <<http://www.nodc.noaa.gov>> is one of the national data centers within the National Environmental Satellite, Data, and Information Service (NESDIS) <<http://www.nesdis.noaa.gov>>. The National Oceanographic Data Center (NODC) is the U.S. repository and distribution facility for global ocean data. The NODC ensures that oceanographic data collected at great cost are preserved and maintained in a permanent archive where they are available for use by scientists, engineers, resource managers and planners, and others.

The NODC is one of the discipline-oriented components within the family of the NOAA National Data Centers. The other members are the: National Climatic Data Center (NCDC) <<http://www.ncdc.noaa.gov>>, in Asheville, North Carolina and National Geophysical Data Center (NGDC) <<http://www.ngdc.noaa.gov>> in Boulder, Colorado. These centers work cooperatively to make the vast environmental data and information holdings of NOAA more easily accessible and useful. The NODC holds physical, chemical, and biological oceanographic data collected by U.S. Federal agencies, including the Department of Defense (primarily the U.S. Navy); State, and local government agencies; universities and research institutions; and private industry. NODC does not conduct any data collection programs of its own; it serves solely as a repository and dissemination facility for data collected by others.



Natural Resources Conservation Service (NRCS): The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, was born of adversity, a national response to the Dust Bowl catastrophe of the mid-

1930's. The NRCS mission is to provide leadership in a voluntary partnership effort to help conserve, improve, and sustain our natural resources and environment.

NRCS relies on many partners to help set conservation goals, work with people on the land, and provide assistance. The Nation's 3,000 conservation districts—virtually one in every county—are the heart of the conservation delivery system. These units of local government, organized by citizens under state law, operate on the premise that local people know the most about local needs. They link NRCS with their neighbors and with local priorities for soil and water conservation. They also augment the work of NRCS conservationists with district programs and with their own technical and support staff.

The NRCS relies upon access to a broad spectrum of biological information to provide assistance to landowners. Generally, biological information utilized is related to the following areas: Agroecology, Agronomy, Biology, Climate, Engineering (Bioengineering), Forestry, Natural Resource Inventory (NRI), Plant Materials, Range, Soils, Watersheds, and Wetlands. Information is acquired from a multitude of sources. Within the agency, the principal databases containing biological data are PLANTS, Soils, Water and Climate, and NRI. The NRCS National Cartography and Geospatial Center <<http://www.ftw.nrcs.usda.gov/ncg/ncg.html>> provides assistance to all agency disciplines in the development of geospatial data.

Plant information sources include the following; PLANTS <<http://plants.usda.gov>>, Ecological Site Information System <<http://plants.usda.gov/plantproj/esis/index.html>>, and Plant Materials <<http://Plant-Materials.nrcs.usda.gov/>>. Plant information from PLANTS is contributed to the Integrated Taxonomic Information System (ITIS). NRI data, the collection of which is mandated by Congress, is collected on non-Federal lands <www.nhq.nrcs.usda.gov/NRI/intro.html> nationwide.

The NRCS is involved with the mapping of soils throughout the U.S. Soils data sources include the following: MapUnit Interpretation Database <<http://www.statlab.iastate.edu/soils/muir>>, Official Soil Series Descriptions <<http://www.statlab.iastate.edu/soils/osd>>, Soil Series Classification <<http://www.statlab.iastate.edu/soils/sc>>, National Soil Characterization Database <http://www.statlab.iastate.edu/soils/ssl/natch_data.html>, State Soil Geographic Database (STATSGO) <http://www.ftw.nrcs.usda.gov/stat_data.html>, Soil Survey Geographic Database (SURGO) <http://www.ftw.nrcs.usda.gov/ssur_data.html>, National Soils Information System (NASIS) <<http://www.itc.nrcs.usda.gov/nasis/index.html>>.



Nature Conservancy (TNC): For the past 25 years, The Nature Conservancy (TNC) <<http://www.tnc.org>> has been cooperating with an international network of locally operated programs to assemble data on the fauna, flora, and ecological communities within their respective jurisdictions. Using a standardized methodology, the members of the Network of Natural Heritage Programs and Conservation Data Centers, which currently comprises 82 data centers operating in 15 different countries and territories of the Western Hemisphere, have gathered

and organized data on over 84,000 vertebrate and invertebrate animals, vascular and nonvascular plants, fungi, and terrestrial and freshwater communities, each one a distinct “element of biological diversity.” These data include scientific names, local and global conservation status, basic biological and ecological characteristics, management requirements, and the location and condition of populations (for species) or patches (for communities). Detailed information on managed and protected areas is also tracked by each data center. The data are housed in customized database systems within the local programs. In addition, range-wide information and certain locally collected data are compiled in central databases at The Nature Conservancy. A regular, voluntary data exchange procedure enables the central and local levels to maintain the most up-to-date information in their database systems.

The large majority of heritage data centers are operated by public sector institutions, mostly state/provincial natural resource or wildlife agencies. They have a close working relationship with TNC, both individually and through the Association for Biodiversity Information (ABI) <<http://www.abi.org>>, the Network’s formal representative. Network information is used by national, state/provincial, and local government agencies, corporations, conservation organizations (including The Nature Conservancy), researchers, consultants, and private landowners. Data are often shared with partner agencies through scheduled data distributions. In addition, members of the Network respond to over 80,000 ad hoc requests for information each year, both general and project- or site-specific.

A number of heritage data centers have begun to deliver a subset of their data over the Internet. The Nature Conservancy's public web site currently offers some information from the central databases on vertebrates and selected invertebrates of the United States and on selected rare vascular plants of Latin America and the Caribbean. A new public web site sponsored by TNC and ABI will soon provide expanded access to central databases information on U.S. and Canadian plants, animals, and communities. In addition, the heritage data centers, TNC, and ABI have embarked on a project to aggregate a national multi-jurisdictional data set for Canada and the United States that includes data on the location of elements on the landscape (known as "element occurrences"), which previously were not compiled at the central level. Summarized locational information will eventually be available through the new public web site, while finer-level information will be available to certain partner organizations through limited-access web sites.

A significant recent data product developed by The Nature Conservancy, in conjunction with the Natural Heritage Network, is the U.S. National Vegetation Classification (USNVC) system for natural and semi-natural terrestrial ecological communities of the United States. The classification framework has won broad acceptance inside and outside the Network and, with minor modifications, was endorsed in 1997 by the FGDC as the U.S. Federal standard. Information on USNVC communities is being compiled and managed in a pilot database system and is being used by federal and state agencies as the basis for community inventory and mapping, monitoring, trends tracking, and management needs assessment.

TNC has also developed an ecoregional classification scheme for the contiguous United States to serve as the bases for assessing, planning, monitoring, and performing conservation actions. TNC is identifying portfolios of conservation sites in each ecoregion that collectively could protect the entire suite of native species and community types.



Smithsonian Institution: The Smithsonian Institution (SI) is dedicated to "the increase and diffusion of knowledge." The National Collections of

SI are both vast and diverse. The total number of objects and specimens that are preserved on behalf of the public is currently estimated at more than 140 million. When the holdings of SI libraries and archives are added to that number, the estimate increases to over 268 million.

The National Museum of Natural History is dedicated to the understanding of the natural world and humankind's place in it. To fulfill its mission, the Museum undertakes and presents research and educational programs, and develops, preserves, and provides access to the National Collections and associated information so that the integrity and beauty of our natural and cultural heritage can be valued, sustained and enjoyed. Supplemental collections are curated by staff of several Federal agencies who are duty stationed at SI facilities, including: the USDA Systematic Entomology Lab (Entomology Department), the Biological Resources Division of the USGS (Vertebrate and Invertebrate Zoology Departments), the Geologic Division of the USGS (Paleobiology and Mineral Sciences Departments), and the National Marine Fisheries Service (Vertebrate Zoology Department). The Museum's current programs are focused in five areas of emphasis: 1) Collections as World Resources; 2) Biological Diversity: Systematics, Evolution, and Ecology; 3) Ecosystem History and Global Change; 4) Earth and Planetary Processes; and 5) Human Cultural and Biological Diversity.

In support of these areas of emphases, the Museum has undertaken a program to develop a modern, integrated Collections and Research Information System (CRIS) and foster similar efforts within the international collections community. CRIS is a distributed, multimedia system supporting the documentation, management, analysis, and delivery of the collections and research resources held and produced by the Museum. The foundation of the system is a series of databases describing specimens and

their current and past uses; observations taken in the field; collecting sites and habitats; geographic areas; species and higher taxa; cultural groups; and, relevant literature. The system is based on a multi-server architecture, integrating text databases, digital image and sound recordings, files containing results of scientific analyses, geographic information, and data thesauri.

The primary goals of the CRIS development program are to:

- (1) Develop a CRIS target architecture that will ensure adequate performance and ease of use; be expandable to enable integration of new data types, system modules, and technologies over time; and enable collaborations, interoperability, and shared biological and cultural information across Museum departments and within the external collections and scientific communities;
- (2) Increase the comprehensiveness and quality of the CRIS automated information;
- (3) Develop and maintain museum and biological informatics tools and procedures useful to the entire collections community; and
- (4) Address the issues involved in electronic outreach, including rights management, cost recovery, and ethical matters related to making museum collections data accessible.

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U.S. Environmental Protection Agency: President Clinton, Vice President Gore, and EPA Administrator Carol Browner have proposed an ambitious agenda to reinvent environmental protection. This agenda highlighted a need for standard ways to record and report common information across the EPA. One of six areas selected for standardization efforts was biological taxonomy. A staff team, reviewing Agency programs, found that species of interest had been given various names among different information systems; this inconsistency made relating information from several sources difficult. Development of an Agency biological nomenclature and taxonomy standard would make such information more accessible.

The basis for EPA's new biological nomenclature and taxonomy standard is the Integrated Taxonomic Information System (ITIS) <<http://www.itis.usda.gov>>. EPA's interim data standard consists of an ITIS Number (or an alternate EPA Biological Identification Number, if an ITIS Number is unavailable) and a Name (a systematic name, a vernacular name, or a group name) for identifying a biological substance. More information about the EPA Biological Taxonomy data standard can be found in the Agency's Environmental Data Registry (EDR) <<http://www.epa.gov/edr/ibiology.htm>>.



U.S. Fish and Wildlife Service (FWS): The mission of the U.S. Fish and Wildlife Service is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The Service's trust responsibilities are for migratory birds, endangered species, national wildlife refuges, certain marine mammals, and anadromous and interjurisdictional fish.

The FWS Ecological Services Program, in cooperation with the USGS Biological Resources Division's Midcontinent Ecological Science Center, is developing the Environmental Conservation Online System (ECOS). This new, integrated web-based system <<http://ecos.fws.gov>> will provide single point access to spatial and tabular data, information, reports, web pages, and documents related to Ecological Services activities, including Endangered Species, Habitat Conservation, and Environmental Contaminants. Two basic capabilities of the system are (1) the ability to

conduct user-specified queries within a data system, and (2) the capability to map data from cross-program areas into one comprehensive online map using Geotract, the online mapping tool of ECOS. Once the prototype system is fully functional, users will have the ability to access, query, and analyze spatial and tabular data on individual species, current habitat conservation plans, the contaminant status of a particular refuge, and contaminant-related data for Service trust lands and species. In addition, the system will permit authorized users to add and update data on the Internet for real-time reporting of the most current data available. The only tools needed are Internet access and an Internet web browser, such as Internet Explorer 4.01 or Netscape Navigator 4.05 or later. A modified version of Geotract that focuses on mapping wetlands is also available from the FWS National Wetlands Inventory <<http://wetlands.fws.gov>>.

The FWS and the National Marine Fisheries Service (NMFS) are responsible for providing the guidance necessary to expedite the Habitat Conservation Plan (HCP) process under the Endangered Species Act. The HCP program provides for conservation of endangered species during development on privately owned lands. At its best, the program can integrate development activities with endangered species conservation, provide a framework for broad-based conservation planning, and foster a climate of cooperation between the public and private sectors. Non-Federal agencies and the private sector throughout the country are turning increasingly to the HCP process as an innovative means of conserving endangered species habitat in their areas while meeting their growing social and economic needs. Reports on individual HCP's are available on the ECOS web site <<http://ecos.fws.gov>>; select the *Report-Endangered Species* menu options on the ECOS home page.

The HCP handbook, developed jointly by the FWS and NMFS, contains guidelines designed to streamline and expedite the HCP permit process. A draft addendum to the handbook, published in the *Federal Register* on March 9, 1999, incorporates five conservation tools that are already components of the HCP program: biological goals, adaptive management, monitoring, permit duration, and public participation. Copies of the HCP Handbook and draft addendum may be viewed and printed from the HCP web site at <<http://endangered.fws.gov/hcp/index.html>>.



U.S. Forest Service (USFS): Biological data are the life blood of the USFS. Movement towards improved consistency for what is collected, how it is collected, and the corresponding management of information is leading the agency to greater standardization. Active participation in and support of FGDC has accelerated this movement. Here are some of the myriad USFS activities pertinent to the goals of the Biological Data Working Group:

Forest Inventory and Analysis (FIA) <<http://www.srsfia.usfs.msstate.edu/wo/wofia.htm>> provides information on the status and trends of forest resources for the U.S. National standards exist for plot design, variables to be measured or estimated, analytical applications, sampling errors, data base tables, and reporting formats. A closely related program, Forest Health Monitoring (FHM) <http://willow.ncfes.umn.edu/fhm/fhm_hp.htm>, addresses productivity, ecosystem health and vitality, biodiversity, carbon cycle, and soil conservation. FHM has national uniformity of core indicators, standardized field protocols, and a centralized information management system.

The Inventory and Monitoring Institute (IMI) <<http://www.fs.fed.us/institute>> facilitates and supports the collection and management of compatible, scientifically reliable resource information at multiple levels to support natural resource management. One of its functions is to standardize protocols, eliminate redundancy and inconsistency, and promote quality assurance.

A history of inconsistent standards, different approaches, and lack of reliable data on the status and trends of the nation's rangelands led to a 1997 memorandum of understanding among USFS, Bureau of Land Management (BLM), and NRCS to develop, standardize, and implement methods to inventory, monitor, and assess the status of rangeland health.

The USFS is moving forward with corporate standards for inventory and monitoring data needed to meet agency business requirements and customer needs <<http://www.fs.fed.us/emc/rig/iim>>. The Natural Resource Information System (NRIS) <<http://www.fs.fed.us/emc/nris>> is designed to corporately manage USFS resource information collected in the field. The exchange of such information freely between land management agencies is essential, which has led to collaboration with a wide variety of partners. Another standardization effort identified core GIS data layers, which includes biological attributes.

The Remote Sensing Applications Center <<http://www.fs.fed.us/eng/remsense/rem/index.htm>> helps set standards for consistent products from remotely sensed data (such as vegetation mapping, change detection, and consistent use of digital imagery). Vertical consistency is needed to meet simultaneously needs for a variety of scales (e.g., from small project to large river basin assessment). Horizontal consistency is needed to permit integration across administrative boundaries and ecological units.

USFS botanists are using a protocol (described in *Bioscience* 45(5):339-345) as a standard to compile floras (i.e., inventory of the plants of a definite area) in diverse ecosystems. These are useful in managing lands for biological diversity and well as conserving threatened and endangered species.

The USFS is structuring many of its business functions on the criteria and indicators (C&I) for the conservation and sustainable management of temperate and boreal forests <http://www.fs.fed.us/land/sustain_dev/sd/sfmsd.htm> in an endeavor to report on the status and trends of the sustainability of the nation's forests. Within this context, actions are underway to standardize biological indicators.



U.S. Geological Survey (USGS): As the nation's largest water, earth and biological science and civilian mapping agency, the USGS works in cooperation with more than 2,000 organizations across the country to provide reliable, impartial, scientific information to resource managers, planners, and other customers. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disasters, contribute to the sound conservation, economic and physical development of the nation's natural resources, and enhance the quality of life by monitoring water, biological, energy and mineral resources.

The USGS Biological Resources Division <<http://biology.usgs.gov>> is leading the collaborative development of the National Biological Information Infrastructure (NBII). Because much biological resources data is also geospatially referenced, the NBII and NSDI programs collaborate in many ways, including use of common standards and protocols, cooperative funding of selected projects, and reliance on a network of public and private partners and collaborators. USGS has led the development of the FGDC's Biological Data Profile of the FGDC Content Standard for Digital Geospatial Metadata (CSDGM) and cooperates extensively with the FGDC to provide metadata training at sites around the U.S. The USGS operates the NBII Metadata Clearinghouse <<http://www.nbii.gov/search/clearinghouse/index.html>> as a participating node of the NSDI Clearinghouse that provides online searchable descriptions (metadata) on thousands of different biological data sets and information products. The USGS works with several other Federal agencies, and with non-Federal taxonomic scientists around the world to develop and maintain the Integrated Taxonomic Information System <<http://www.itis.usda.gov>>, and is an active participant in the

development of a proposed FGDC data standard for biological nomenclature and taxonomy. The USGS also administers several national level biological data collection and management programs including the National Gap Analysis Program <<http://www.gap.uidaho.edu/gap>>, the National Park Vegetation Mapping Program <<http://biology.usgs.gov/npsveg>>, and programs in the research and use of geospatial technologies <<http://biology.usgs.gov/geotech>> and decision support systems <<http://biology.usgs.gov/dss>>. Each of these programs adhere to FGDC data standards and protocols (for metadata, vegetation and wetlands classification, etc.) and also serve to expand participation in the NSDI/NBII federation.



U. S. Long Term Ecological Research Network (LTER): The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1,100 scientists and students investigating ecological processes operating at long time scales and over broad spatial scales. The LTER Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs. The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States. By 1999 the LTER Network has grown to 21 sites representing diverse ecosystems and research emphases. A network office coordinates communication, network publications, and planning activities. The overall goal of LTER information

management efforts is to promote ecological science by fostering the synergy of information systems and scientific research. To achieve that goal, LTER information managers:

- Pursue information systems development and implementation from the context of ecological research needs.
- Conduct information management in a nested context of site, research network, national, and international levels.
- Emphasize the timely and effective transformation of data into information and the ease of access to that information.
- Ensure the long-term preservation and availability of information;
- Ensure appropriate information system development through information management research.
- Develop human resources necessary for the continuing evolution of LTER information systems.

Details of an LTER vision for ecological information management are available at:

<http://www.lternet.edu/documents/Reports/Data-management-committee/1995-DM-committee-report/im_1995_report.htm>

The focus of LTER data systems is on the diverse ecological data generated at each of the LTER sites in five core areas (primary productivity, organic matter, nutrient movements, populations indicative of trophic structure and disturbance <<http://www.lternet.edu/network>>. Each independently funded LTER site operates an Internet-accessible information system <<http://www.lternet.edu/network/sites/webservers.html>> under a general policy promoting data access <<http://www.lternet.edu/research/data/netpolicy.html>>. The LTER Network provides an online data catalog of over 2,000 datasets available from sites in the LTER Network <<http://www.lternet.edu/DTOC>> and specialized databases for personnel, publications, general site information and climate data as part of the LTER Network Information System <<http://www.lternet.edu/research/data/nis>>.

Information standards development within the LTER network focuses on the network level. This allows individual sites to experiment with new technologies and techniques which may subsequently migrate to other sites or the network as a whole. LTER researchers have participated in a variety of standards groups and activities such as the Ecological Society of America's Future of Long-Term Ecological Data (FLED) committee, Institute of Electrical and Electronics Engineers (IEEE) metadata workshops, American Institute of Biological Sciences panels, and now as part of the FGDC Biological Data Working Group. Outreach activities include playing leadership roles in workshops aimed at the larger ecological research community (e.g., <<http://www.lternet.edu/ecoinformatics/guide/frame.htm>>) and in support of international LTER efforts <<http://www.lternet.edu/>>.

For More Information

Visit the FGDC Biological Data Working Group web site at:

<http://biology.usgs.gov/fgdc.bio/index.html>

Or learn more about the National Biological Information Infrastructure program at:

<http://www.nbi.gov>

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Selected Web Site References

National Center for Ecological Analysis and Synthesis:	
Knowledge Network for Biocomplexity	< http://www.nceas.ucsb.edu/kdi >
National Oceanic and Atmospheric Administration:	
National Marine Fisheries Service (NMFS)	< http://www.nmfs.gov >
National Ocean Service (NOS)	< http://www.nos.noaa.gov >
Office of Oceanic and Atmospheric Research (OAR)	< http://www.oar.noaa.gov >
Cooperative Institute for Limnology and Ecosystems Research (CILER)	< http://www.engin.umich.edu/center/ciler >
National Oceanographic Data Center (NODC)	< http://www.nodc.noaa.gov >
National Environmental Satellite, Data, and Information Service (NESDIS)	< http://www.nesdis.noaa.gov >
National Climatic Data Center (NCDC)	< http://www.ncdc.noaa.gov >
National Geophysical Data Center (NGDC)	< http://www.ngdc.noaa.gov >
Natural Resources Conservation Service:	
National Cartography and Geospatial Center	< http://www.ftw.nrcs.usda.gov/ncg/ncg.html >
National PLANTS database	< http://plants.usda.gov >
Ecological Site Information System	< http://plants.usda.gov/plantproj/esis/index.html >
Natural Resource Inventory	< www.nhq.nrcs.usda.gov/NRI/intro.html >
MapUnit Interpretation Database	< http://www.statlab.iastate.edu/soils/muir >
Official Soil Series Descriptions	< http://www.statlab.iastate.edu/soils/osd >
Soil Series Classification	< http://www.statlab.iastate.edu/soils/sc >
National Soil Characterization Database	< http://www.statlab.iastate.edu/soils/ssl/natch_data.html >
State Soil Geographic Database (STATSGO)	< http://www.ftw.nrcs.usda.gov/stat_data.html >
Soil Survey Geographic Database (SURGO)	< http://www.ftw.nrcs.usda.gov/ssur_data.html >
National Soils Information System (NASIS)	< http://www.itc.nrcs.usda.gov/nasis/index.html >
Nature Conservancy:	
Nature Conservancy	< http://www.tnc.org >
Association for Biodiversity Information	< http://www.abi.org >
U.S. Environmental Protection Agency:	
Biological Taxonomy Data Standard	< http://www.epa.gov/edr/ibiology.htm >
U.S. Fish and Wildlife Service:	
Environmental Conservation Online System (ECOS)	< http://ecos.fws.gov >
Habitat Conservation Plans (HCP)	< http://endangered.fws.gov/hcp/index.html >
National Wetlands Inventory (NWI)	< http://wetlands.fws.gov >

Selected Web Site References (continued)

U.S. Forest Service:	
Forest Inventory and Analysis (FIA)	< http://www.srsfia.usfs.msstate.edu/wo/wofia.htm >
Criteria and indicators (C&I) for temperate and boreal forests	< http://www.fs.fed.us/land/sustain_dev/sd/sfmsd.htm >
Forest Health Monitoring (FHM)	< http://willow.ncfes.umn.edu/fhm/fhm_hp.htm >
Inventory and Monitoring Institute (IMI)	< http://www.fs.fed.us/institute >
Remote Sensing Applications Center (RSAC)	< http://www.fs.fed.us/eng/remsense/rem/index.htm >
U.S. Geological Survey:	
Biological Resources Division	< http://biology.usgs.gov >
NBII Metadata Clearinghouse	< http://www.nbii.gov/search/clearinghouse/index.html >
Integrated Taxonomic Information System	< http://www.itis.usda.gov >
National Gap Analysis Program	< http://www.gap.uidaho.edu/gap >
National Park Vegetation Mapping Program	< http://biology.usgs.gov/npsveg >
Geospatial technologies and applications	< http://biology.usgs.gov/geotech >
Decision Support Systems	< http://biology.usgs.gov/dss >
U.S. Long Term Ecological Research Network:	
LTER Network	< http://www.lternet.edu/network >
LTER sites	< http://www.lternet.edu/network/sites/webservers.html >
Data access policy	< http://www.lternet.edu/research/data/netpolicy.html >
Online Data Catalog	< http://www.lternet.edu/DTOC >
Network Information System	< http://www.lternet.edu/research/data/nis >
Data Management Committee report	< http://www.lternet.edu/documents/Reports/Data-management-committee/1995-DM-committee-report/im_1995_report.htm >
Ecological Informatics	< http://www.lternet.edu/ecoinformatics/guide/frame.htm >
International LTER network	< http://www.ilternet.edu >