Chapter 3

# Existing Biological Databases

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## HIGHLIGHTS

- **No national inventory of biological resources exists, and national databases cannot be easily consolidated into a comprehensive biological database because of incompatibilities in definitions, terminology, and data collection efforts.**
- **Steps have been taken to begin formulating standards for biological data and to increase the coordination of Federal activities related to collecting and maintaining biological data.**

## OVERVIEW

Data on biological resources are abundant and varied because of the different objectives perceived within each agency and the number of agencies collecting data. A 1977 survey of ecological monitoring activities indicated that the Federal Government had at least 1,600 monitoring projects underway (12). Many of these efforts have generated data and, hence, created the need for databases. The databases discussed in this section are primarily those field-collected biological data maintained by Federal agencies.

A Federal resource agency's responsibilities for biological conservation are reflected in the kind of data and database most useful to the agency or the data users. The objectives and responsibilities of the resource scientists and managers dictate the kinds of databases created and maintained. Scientists interested in mapping ecotypes, for example, would not be interested in maintaining data on nutrient cycling within each ecotype as part of the databases. Scientists attempting to manage animal populations for maximum production of offspring, however, might require databases containing very specific information on reproduction and genetic characteristics of individuals within the populations,

Few Federal biological databases are created or designed specifically to measure biological diversity, partly due to the lack of congressional or administrative direction to consider biological diversity in data collection. Notable exceptions exist, however. For example, the Wildlife Habitat Relationships Programs[1] developed by the Forest Service (FS) are designed to help biologists maintain terrestrial vertebrate diversity in National Forests. The endangered species files maintained by numerous Federal land-managing agencies also aid efforts to reduce the loss of biological diversity on lands or in waters under the agencies' stewardship. The Fish and Wildlife Service (FWS) maintains a "candidate species list" and The Nature Conservancy (TNC) maintains a database on the location of Research Natural Areas found on Federal, State, and private lands. These databases help Federal employees identify specific aspects of diversity that could be considered in on-site resource planning and management. In the future, the Endangered Species Information System (see app. A) will provide information and management guidelines to a number of Federal agencies working to conserve endangered species and their habitats.

Generally, biological databases incorporate wide arrays of information on organisms, populations, species, habitats, or ecosystems. Data on an organism or population range from a

[1]This database and others can be found in app. A.

scientific name (genus and species) to a full complement of life history information (e. g., age, sex, behavior, food habits, and habitat affiliations and uses). Databases devoted to species may simply include physical characteristics or may contain detailed information on local populations or even individual behaviors. Databases focused on habitats and ecosystems include specific information on the species that are present and their interactions or simply provide the locations of the ecosystems or habitats.

Biological data are the least standardized forms of natural resource information (9). Although collectors of data on water and the atmosphere appear to have adopted standardized names and units of measure, collectors of biological data have few standards for data terminology, measures, or even names of given organisms. In many cases, different standards exist within individual Federal agencies. For example, each of the 33 ecosystem identification surveys conducted under the National Park Service (NPS) in its National Natural Heritage Program was based on a different land classification system (11). The result is incompatibility in the terms used to identify ecosystems within the different regions,

Another factor contributing to the incompatibility of databases is the goal-oriented nature of data collection. Data generated in surveys and monitoring projects tend to be site-specific and designed to meet single goals. Because of this narrow goal orientation, little consideration is given to standardized formats or potential compatibility with other systems, and little effort is made to apply existing data to other uses, although the range of applicability may be wide, These factors limit the ability to consolidate data to provide information about wide geographic areas.

## EXISTING DATABASES

Appendix A lists Federal databases containing biological data, Most of the databases were created in the past 5 to 7 years. The list provides a general description of each database, including the content, purpose, geographic coverage, taxonomic coverage, status, users of the data, and a contact person (if known or available). The list is not a comprehensive survey of Federal databases, but it provides examples of the kinds of biological data that Federal agencies collect or maintain. Table 3 is a summary of appendix A.

### Geographic Coverage

The list in table 3 is biased towards databases of regional or national coverage, (See discussion of methodology in app, A.) Databases with national coverage are specific to single biological resources or to a few resources (e. g., FWS' National Wetland Inventory; see app. A), or provide only cursory information on a broad range of resources (e. g., the National Resources Inventory compiled by the Soil Conservation Service), No national inventory of biological resources exists.

In addition, databases listed as national or regional generally do not cover all land areas of the United States. The Forest Inventory conducted by the FS is national in scope but does not cover all land area in the United States, Similarly, although NPS' Endangered Species Data Base (see app. A) will be national in coverage, it is restricted to NPS lands.

Regional databases appear to contain greater detail than national databases. For example, the FWS regional databases provide specific data on several selected fish or bird species, whereas the national databases contain more generic information on a wide range of organisms. Similarly, the regional FS wildlife databases (see app, A) contain more specific information on wildlife species than the national Resources Planning Act Wildlife Data Base (see app. A).

Geographic gaps in biological databases are not readily apparent, judging from the infor-

**Table 3.–Taxonomic Coverage of Federal Agency Databases (summary of app. A)**

| Database | Vegetation | Trees | Mammals | Birds | Amphibians/ reptiles | Aquatic animals |
|---|---|---|---|---|---|---|
| ***U.S. DEPARTMENT OF THE INTERIOR*** | | | | | | |
| ***National Park Service*** | | | | | | |
| *National databases:* | | | | | | |
| NPFLORA | x | x | | | | |
| Nationwide Rivers Inventory | x | x | x | | | x |
| Natural Landmarks Program | x | x | x | x | | x |
| Endangered Species Data Base | x | | x | x | x | x |
| COMMON | | | | | | |
| *Regional databases:* | | | | | | |
| Coastal Barriers Inventory | | | | | | |
| North Atlantic Region Resource Data | x | x | | | | |
| *State/sub-State databases:* | | | | | | |
| Wild and Scenic Rivers | x | x | | | | x |
| Biosphere Reserve Data Files | x | x | x | x | x | x |
| Bear Information System, Yellowstone | | | x | | | |
| Ground Cover System | x | x | | | | |
| Vegetation Data, Great Smoky Mountains National Park | x | x | | | | |
| Channel Islands Information System | x | | x | x | x | x |
| ***Bureau of Land Management*** | | | | | | |
| *Regional databases:* | | | | | | |
| Range Site Inventory | x | x | | | | |
| SVIM | x | x | | | | |
| IHICS | x | x | x | x | x | x |
| RAIDS | x | x | | | | x |
| Wild Horse and Burro Inventories | | | x | | | |
| *State/sub-State databases:* | | | | | | |
| Extensive Forest Inventory | x | x | | | | |
| Forest Operations Inventory | x | x | | | | |
| TPCC | | x | | | | |
| STORMS | | x | | | | |
| Wilderness Inventory | x | x | x | x | | x |
| Fire Management Data | x | x | | | | |
| Threatened and Endangered Species Data Bases | x | x | x | x | x | x |
| ***U.S. Fish and Wildlife Service*** | | | | | | |
| *National databases:* | | | | | | |
| Winter Waterfowl Survey | | | | x | | |
| North American Breeding Bird Survey | | | | x | | |
| Mourning Dove Call-Count Survey | | | | x | | |
| River Reach Fish Data Base | | | | | | x |
| Wildlife Refuge Management Information System | x | | x | x | x | x |
| National Wetlands Inventory | x | x | x | x | x | x |
| Wetland Plant Species Data | x | x | | | | |
| Endangered Species Information System | x | x | x | x | x | x |
| Candidate Species List | x | | x | x | x | x |
| Habitat Suitability Index Models | | | x | x | x | x |
| Fish and Wildlife Reference Service | | | x | x | x | x |
| *Regional databases:* | | | | | | |
| Waterfowl Breeding Ground Surveys | | | | x | | |
| Woodcock Singing Ground Survey | | | | x | | |
| Sandhill Crane Surveys | | | | x | | |
| Great Lakes Commercial Catch Data | | | | | | x |
| Great Lakes Research Fish Data | | | | | | x |
| FISHNET | | | | | | x |
| Coastal and Marine Bird Data Base | | | | x | | |
| Coastal Area Characterization Studies | x | | x | x | x | x |
| Coastal Ecological Inventory | x | | x | x | x | x |
| Coastal and Estuarine Species Profiles | | | x | x | x | x |

**Table 3.—Taxonomic Coverage of Federal Agency Databases (summary of app. A) —Continued**

| Database | Vegetation | Trees | Mammals | Birds | Amphibians/ reptiles | Aquatic animals |
|---|---|---|---|---|---|---|
| Marine and Waterbird Colony Data | ... | ... | ... | x | ... | ... |
| Threatened and Endangered Species Sighting List | | ... | x | x | ... | ... |
| Plant Information Network | "X" | x | ... | ... | ... | ... |
| RAPTOR | ... | ... | ... | x | ... | ... |
| Terrestrial Species Data Base | ... | ... | ... | x | ... | ... |
| U.S. ***Geological Survey*** | | | | | | |
| *National database:* | | | | | | |
| Land Use/Land Cover | X | x | ... | ... | ... | ... |
| *Regional database:* | | | | | | |
| Coastal Ecological Inventory ... , | X | x | x | x | x | x |
| ***U.S. DEPARTMENT OF AGRICULTURE*** | | | | | | |
| ***Soil Conservation Service*** | | | | | | |
| *National databases:* | | | | | | |
| NRI | x | **x** | **...** | **...** | **...** | **...** |
| National Forest-Soil Data Base | **x** | **x** | **...** | **...** | **...** | **...** |
| National Range Data Base | **x** | **...** | **...** | | **...** | **...** |
| *Regional database:* | | | | | | |
| *New* England Animal Species Data | ... | ... | **x** | x | x | ,.. |
| ***U.S. Forest Service*** | | | | | | |
| *National databases:* | | | | | | |
| Forest Inventory and Analysis ., | x | x | ... | ... | ... | ... |
| Range Analysis | x | x | ... | ... | ... | ... |
| FSRAMIS | x | x | ... | ... | ... | ... |
| RPA Range Data | x | x | ... | ... | ... | ... |
| Research Natural Areas | x | x | ... | .,. | ... | ... |
| RPA Wildlife Data | x | x | x | x | x | x |
| *Regional databases:* | | | | | | |
| RUNWILD | ... | ... | x | x | x | x |
| WILDHAB | ... | ... | x | x | x | x |
| RARE Phase II | x | x | x | x | ... | x |
| *State/sub-State databases:* | | | | | | |
| Inventory Data for Timber Management Planning | x | x | ... | ... | ... | .,. |
| Fuels Inventory | x | x | ... | ... | ... | .,. |
| Timber Stand Analysis and Silviculture Prescription | x | x | ... | ... | ... | ... |
| Western Sierra WHR Program | ,.. | ... | x | x | x | ... |
| North Coast Cascades WHR Program | ,.. | ... | x | x | x | ,.. |
| North East Interior WHR Program | ,.. | ... | x | x | x | ... |
| Southern California WHR Program | ... | ... | x | x | **x** | **...** |
| ***U.S. DEPARTMENT OF COMMERCE/NATIONAL OCEANIC AND Atmospheric ADMINISTRATiON*** | | | | | | |
| ***National Ocean Service*** | | | | | | |
| *Regional databases:* | | | | | | |
| Marine Living Resource Data | | ... | x | x | x | x |
| National Estuarine Inventory | | ... | x | x | x | x |
| ***National Marine Fisheries Service*** | | | | | | |
| *Regional databases:* | | | | | | |
| Fisheries Statistics Data Base | | ... | ... | ... | ... | x |
| Marine Recreational Fishery Statistics | | ... | ... | ... | ... | x |
| Bowhead Whale Census | | ... | x | ... | ... | ... |
| Icthyoplankton Survey Data Base | | ... | ... | ... | ... | x |
| RACE Ground Fish Data Base | | ... | ... | ... | ... | x |
| *State/sub-State database:* | | | | | | |
| Northern Fur Seal Study | | ... | x | ... | | **...** |

**Table 3.—Taxonomic Coverage of Federal Agency Databases (summary of app. A)–Continued**

| Database | Vegetation | Trees | Mammals | Birds | Amphibians/ reptiles | Aquatic animals |
|---|---|---|---|---|---|---|
| ***National Environmental Satellite, Data and Information Service*** | | | | | | |
| National Environmental Data Center. . . . . | X | | x | x | x | x |
| ***MISCELLANEOUS AGENCIES*** | | | | | | |
| ***U.S. Army Corps of Engineers*** | | | | | | |
| Benthic Resource Assessment . . . . . | | . . | . . | ... | . . | x |

SOURCE Office of Technology Assessment. 1986

mation in appendix A. Identification of specific geographic gaps would require consolidation of known databases on different biota. In some cases, gaps within databases are not widely recognized because of limits in mapping or tabulating capabilities. Alternatively, gaps in regional or national databases may be known only to the individual data collectors within a specific geographic area, as is the case with the Bureau of Land Management's (BLM's) Integrated Habitat Inventory and Classification System (see app. A) (10).

## Taxonomic Coverage

Each land management agency listed in appendix A maintains data on vegetation or land cover for lands under its jurisdiction. In addition, the Soil Conservation Service (SCS) and the FS maintain data on land cover on all lands within the contiguous United States. Plants of economic importance (e. g., timber and range species) generally receive the primary attention when vegetation inventories are compiled. Aquatic plant species are inventoried by a number of Federal agencies, including FWS, FS, and the National Ocean Service of the National Oceanic and Atmospheric Administration.

Data on mammals, birds, and fish also are stored by each of the Federal agencies in the list. In some databases, available data cover only species of economic or Federal significance—those species that are commercially harvested, federally listed as threatened or endangered, or protected by international treaty. Other databases, such as the Resource Assessment and Conservation Engineering Ground Fish Data Base compiled by the National Marine Fisheries Service (see app. A), contain data on a number of species.

Taxa that are not as clearly defined as mammals and birds generally receive less attention in biological databases. For example, database coverage of amphibians and reptiles is smaller than that of birds and mammals. Aquatic animals, with the exception of fish, receive even less attention than do amphibians and reptiles. Data on insects (class Insecta) were not available in the databases listed,

The lack of data on insects is the most obvious gap in taxonomic coverage of data collected on-site. The Animal and Plant Health Inspection Service maintains an extensive museum collection of insect species, which may be sufficient to fill apparent gaps in biological knowledge in field inventories (6). However, museum specimens must be identified relative to their native habitats, using a classification system compatible with on-site inventories, if they are to be of use in evaluating on-site diversity.

Aquatic plants currently are receiving considerable attention, but aquatic animals are not. Few Federal agencies inventory and maintain data on aquatic animals other than fish, partly because of the costs of field inventories and identification, and because of the lack of specific mandates to consider these organisms in on-site inventories.

The taxonomic categories used in appendix A are broad, precluding detailed analysis of further taxonomic gaps in biological data coverage. For example, some databases containing data on fish species cover only single species or a few species (e. g., FWS' FISHNET; see

app. A) whereas others cover large numbers of species (e.g., FWS' River Reach Fisheries Data Base; see app, A). Data on a taxa may vary by location within a regional or national database, which is the case with BLM's Integrated Habitat Inventory and Classification System (IHICS; see app. A). BLM State and District files included in the IHICS vary considerably in the coverage of mammal, bird, or amphibian and reptile taxa. In the Shoshone District in Idaho, for example, the data predominantly concern game species, whereas the Elko District in Nevada provides comprehensive coverage of vertebrates (10).

### Data Overlap

In response to a congressional mandate that threatened and endangered species be considered in agency activities, all Federal agencies maintain data on species that are federally listed as being threatened or endangered. Such data may be duplicative.

Coastal and estuarine resources also are inventoried by a number of Federal agencies. Comprehensive databases have been developed regarding birds, vegetation, habitats, and ecosystems. (See, e.g., the Coastal Ecological Inventory, Marine and Waterbird Colony Data, National Estuarine Inventory in app. A.) Although data vary among these databases, overlap appears to exist for some of the resources. Consolidation of these inventories could provide a comprehensive database of biological diversity in coastal areas.

Defining specific areas of overlap or gaps in biological data coverage would be extremely difficult currently because databases from different sources generally are not consolidated. Agencies and individuals have their own terms, definitions, and scientific names for biological data, which renders databases incompatible and hinders data consolidation. Even if common data elements were adopted, database administrators would be faced with high manpower costs for the time needed for manually bringing existing databases into compliance with the new standards. However, developers of future databases could adopt common standards to allow wide distribution of available data among agencies and individuals, increasing the applicability of the data.

## DATABASE COORDINATION

Questions of data compatibility among Federal agencies have been raised for many years. For data to be compatible, those who collect and compile data must use consistent terminology and definitions for each data element. Such standards, spelled out in a "data dictionary, " allow data to be interpreted and used by persons other than those who collected the data or created the database.

Making databases compatible among and within agencies would increase the potential for sharing information, thereby increasing the utility of all data generated. If agencies could pool their data resources, comprehensive regional and national information might be available on biological diversity in the United States. At the least, it would be possible to determine where gaps occur in the information that is available currently, and priorities could be established for future data collection.

Steps have been taken within the past decade or so to formulate standards for biological data. The motivation to establish compatible databases came partly in response to congressional mandates for national inventories and assessments (e.g., the Forest and Rangeland Renewable Resources Planning Act, Federal Land Policy and Management Act, Soil and Water Resources Conservation Act, and Forest and Range Research Act). Budgetary and manpower shortages for biological inventories provided additional motivation for sharing data. Coordination among institutions increases their abilities to share knowledge of biological resources.

## Existing Institutional Coordination

A number of formal interagency cooperative agreements were signed in response to congressional directives and State of the Environment Addresses by President Jimmy Carter in the late 1970s. Among these, the Interagency Assessment and Appraisal Liaison Committee (IAALC) and the Interagency Agreement Relating to Classification and Inventory of Natural Resources (5 WAY) have taken action directly related to the collection and maintenance of biological data.

The IAALC was formed to coordinate resource assessment activities between the SCS and the FS under the authority of the Soil and Water Resources Conservation Act (RCA) and the Forest and Rangeland Renewable Resources Planning Act (RPA) assessments. Because the RCA assessment requires inventories mostly on non-Federal lands, and the RPA assessment requires inventories mostly on Federal lands, coordination between the two assessments could establish comprehensive data on most of the contiguous United States. One of the achievements of the IAALC was standardization of permanent plots in areas where the assessments are overlapping or adjacent. By using the same permanent plots for data collection, the two agencies could work cooperatively to collect data at those sites, reducing the duplication of agency effort.

Members of the IAALC also are working on standardizing terminologies for land cover to use in the assessments so that data can be interchanged between the RCA and RPA assessments. An effort to develop standard classifications for rangeland vegetation types is in the planning stages. The committee members plan to produce a joint RCA-RPA assessment report on wildlife habitats in conjunction with the 1989 assessments (5). This coordination of major national biological inventories could provide important insight into the status of wildlife and their habitats—one aspect of biological diversity in the United States.

The other major cooperative effort between Federal agencies, the 5 WAY, was formed to develop standards for land and water classifications and terminology in natural resource inventories, including biological inventories (4), The cooperative agreement was signed by five agencies (BLM, FWS, U.S. Geological Survey, FS, and SCS), which gives the agreement its nickname. Working groups were established to address specific areas of interest, such as land-cover terminology, vertebrate-species nomenclature, and land or water classification. Standards adopted by the 5 WAY were sent to the signatory agencies with recommendations that the standards be adopted into official agency policy.

The 5 WAY adopted a common nomenclature for vertebrate species in the United States and a common terminology for types of land use and land cover (e. g., definition of a forest land). However, neither of these standards for inventories has been incorporated into agency policy by all of the agencies represented by the 5 WAY. Other efforts towards standardizing inventories include an analysis of a common classification system for land use and land cover (3) and an evaluation of the FWS wetland classification system (2). The vegetation-classification system is under informal review or “field truthing” to determine whether the system is applicable to any given field location (8), A wetland plant species list and classification of hydric soils will be formulated to complement the wetland classification system.

Except for the vegetation classification group, all of the working groups under the 5 WAY were disbanded in 1985 (7). However, the policy groups will continue to meet and exchange information on activities that may be of interest to other agencies and to provide opportunities to coordinate their limited manpower and financial resources,

The success of the IAALC and the 5 WAY coordination efforts depends on whether the agencies officially endorse the committee recommendations and integrate them into existing programs, Adoption of these standards could increase the utility of future databases by allowing agencies to interchange data. Standards that improve the potential for data consolidation also promote efforts to develop

national coverage of data on biological diversity,

Another cooperative effort is occurring in the Multi-State Fish and Wildlife Information System project, in which several Federal agencies have provided financial and technical assistance to coordinate statewide databases of fish and wildlife species. These databases are designed to have compatible formats and data sets as the core portion of the State databases, so that the same kinds of information will be available from each of the databases. Beyond adopting this core of data standards, States add into the system the data they feel will be useful to their needs. Federal agencies cooperating with the project hope to establish a comprehensive clearinghouse of information about fish and wildlife within each State. The clearinghouse would provide reliable baseline data for formulating projects' impact statements. Statewide information systems are currently operating or are under consideration in more than 12 States. If the systems in different States are compatible, regional or even national information on fish and wildlife diversity could be compiled,

Efforts at sharing information also occur between government agencies and private organizations. TNC provides information on biological diversity to Federal agency personnel. TNC and State Heritage Programs provide Federal agencies with inventory data and expertise in devising plans or developing management strategies that can help to maintain biological diversity.

Each of these information-sharing efforts can increase the ability of Federal agencies to maintain biological diversity. The efforts also help increase the utility of data being collected on biological resources. However, the lack of a nationwide database on U.S. biota may continue to hinder a comprehensive evaluation of biological diversity.

## Suggestions for a National Biological Database

Federal and State agencies, private organizations, professional biologists, and legislators are joining in the discussion on the need for a national effort to coordinate biological data. The suggestions for what a national biological database should be, how it could be organized, and how it could be funded, are as varied as the people discussing the effort (1).

A national database for biota could be a catalog or list of organisms that reside permanently or temporarily in the United States. The database could incorporate existing taxonomic information from field and lab identifications of each species. A national database also could include existing ecological information on each species (e. g., food and reproductive requirements, habitat affinities, and interspecific interactions). In addition, it could include information on species interactions by identifying and cataloging ecosystems throughout the country.

Each of these approaches to a national database would incorporate different kinds of data and would serve different purposes. No agreement has been reached yet on what purpose a national database should serve. A species listing could be used to help determine the biological diversity within the United States as well as to help identify taxonomic categories where little is known about the diversity of species. A taxonomic database could be a centralized source of data for field manuals and synthesized reports to assist biologists in identifying species on-site, The inclusion of ecological data could help people making decisions about on-site planning and management activities to maintain biological diversity.

Most observers agree that a national biological database should incorporate existing databases and institutions. Questions remain unresolved as to how they should be incorporated and what institutional arrangements would be needed. No division of institutional responsibilities has been proposed.

One approach would be to establish a central clearinghouse or distribution point for information on existing biological databases. The clearinghouse could provide basic information on the availability of biological data and the compatibilities with other databases having similar kinds of data. The clearinghouse could

use a bibliographic database to store and manage descriptions of the multitude of biological databases that currently exist. With a bibliographic information system, existing sources of information and any new sources could be accessed in an easily searchable format,

Another approach would be to create a network of satellite databases around the United States to provide actual data on biological resources. The network could serve a centralized computer facility for accessing data, without the need for a large mainframe computer or series of mainframe computers to handle all available biological data. Data managers from regional locations could feed data into the system and retrieve data out of the system, provided some standards were established for entering data into the network. Either approach would allow managers and decisionmakers access to information that could be used to effectively maintain biological diversity.

Establishment of a clearinghouse or database network would require designation of a central coordinating institution—either a new institution or an existing institution. To assign coordination responsibilities to a new institution would require an act of Congress, The new institution would need authority to work with existing Federal agencies to obtain information about their databases or to obtain data from the databases. Delegating authority to an existing institution to coordinate data activities might also require an act of Congress. In the absence of legislative action, several institutional mechanisms for interagency cooperation exist, including formal interagency agreements and memoranda of understanding. If existing institutional mechanisms were used, the interagency efforts would need enough authority to affect agency programs and policies, Although previous interagency cooperative efforts to coordinate data and data collection, including the 5 WAY, made strides in the direction of cooperation and standardization, the agencies did not follow through on recommendations from these efforts. Legislation may be necessary to ensure that such cooperative efforts affect agency activities,

Lack of funding would constrain the development of a national database that identified what information was available on biological diversity and provided access for effectively using that information, Federal agencies might be reluctant to finance a database coordination effort unless the products of the database were directly applicable to the agencies' missions. A survey funded and supported exclusively by private efforts might preclude access to some government agency data, The use of Federal funding, however, would require that trade-offs be made with existing programs in order to finance a new one,

Another negative aspect of a centralized approach to data access might be the need to develop lines of communication with data collectors and administrators. Information on any databases that were developed would have to be provided to an agency's central office for that office to be effective. This would increase the paperwork associated with database development, In addition, establishing a centralized office to transfer data would require trade-offs with existing programs within the agency, However, the dollar savings from increased compatibility of data and better access to data appear to outweigh the costs of developing these functions within and among agencies,

Prior to the development of a national database on sources of biological information or biological data, a national assessment of existing biological data is necessary. To date, no comprehensive national assessment of biological data or of existing Federal databases has been undertaken. Based on the results of a national assessment of biological data, decisions could be made on the best way to manage existing information. A national assessment also would delineate gaps in geographic or taxonomic knowledge of U.S. biological diversity that could be used to set priorities for future data collection,

Although there are technological barriers to creating a national database, they are not insurmountable. Many technological problems may be overcome if the users of the database

are willing to compromise as to the objectives and methodologies chosen to link existing databases or to develop a new database. In any event, technological innovations already are facilitating the collection and use of biological data for the maintenance of biological diversity. Chapter 4 discusses those technological innovations relevant to biological data.

## CHAPTER 3 REFERENCES


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