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Nature Conservancy and Earth Day Initiatives] [Loose]

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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

April 15, 1993

MEMORANDUM FOR KATIE MCGINTY

FROM: NANCY G. MAYNARD *NM*

SUBJECT: The Nature Conservancy and Earth Day Initiatives

After reviewing more material related to the Earth Day Initiatives, OSTP would like to recommend that, if you have not already done so, you include a close cooperative effort with The Nature Conservancy and the Institute for Biodiversity Information in your development of the National Network for Environmental Information and Technology. As you are aware, there is already some very fine work under way under this initiative and that work could, indeed, provide our Earth Day activities with a good example of Federal-State cooperation on a quality environmental program. I have attached some material on that institute for your information and reference. (Tab A) In addition, I have included a short paper, "An Overview of the Biological and Conservation Data (BCD) System", which describes a state-of-the-art system used by The Nature Conservancy for information management, which may be of use to you in the initiative development.

We hope that this information will be useful to you in the formulation of these important initiatives.

*David C. Coughlin -
Pls keep or
forward to Lovejoy, etc
at Interior
Cathy
4/19*

Institute for Biodiversity Information:
Using Scientific Information to Advance Biodiversity Conservation

Governmental Agencies:

National Park Service, Yellowstone
Michigan Division of Land and Water

Corporations:

Georgia Power
ARKLA

Citizen Groups:

Lower Poultney River Committee, VT

Research -- Institutions and Individuals:

Electric Power Research Institute
Amateur Lepidoperist

Collaborative Projects:

Merck, Sharpe & Dohme/ INBio
Panama Canal Commission/ ANCON/ University of Panama

The **Institute for Biodiversity Information (IBI)** and its affiliate biodiversity data centers responded to more than 200,000 information requests this year. The users -- researchers, engineers, conservation groups, state agencies, universities, consultants, and federal agencies -- vary as much as the uses -- natural resource inventories, land development sitings, environmental impact assessments, transportation routing, water development projects, and reserve selection and design. A recent survey of several state biodiversity centers disclosed the following patterns of network consultation:

- 34% federal agencies
- 38% state and local agencies
- 14% private consultants and engineers
- 14% universities, museums, researchers, individuals and conservation groups

Public education and dissemination of biodiversity information is an ongoing goal of IBI. Consequently, the Institute will continue to communicate its work to an expanding audience of potential network users. It is our goal to ensure that decisions are made with an appreciation of the scarcity of resources and an understanding of the consequences of such conclusions.

The following pages highlight case examples of how public and private groups use network information to guide decisions concerning conservation and development. In a situation where two interests are often at odds, the Institute's inventory system helps to inform and validate decisions involving rare and threatened species and appropriate land management.

**Federal Agency:
National Park Service**

Situation: There are three operating Heritage Programs in the western region (WY, ID, MT) that track rare species and communities, land ownership and management plans. But, there is no combined program specific to the Greater Yellowstone Ecosystem (GYE) -- including Yellowstone National Park, Grand Teton National Park, and seven adjacent National Forests.

Problem: The GYE is threatened by intensifying recreational use and resource development. There is a growing need for more unified management of the ecosystem to permit animals to live without being disturbed by mineral exploration and extraction, recreation, home development, and other activities.

Objective: To establish a Yellowstone Conservation Data Center in cooperation with the National Park Service. This CDC will merge biodiversity information from the WY, ID, MT Heritage Programs and help federal agencies coordinate management activities. It will also access data on rare plants and animals from the manual files of the park and incorporate them for the first time into computer files.

Network Assistance: The three regional Heritage Programs will provide a copy of their computer files and transfer all of their plant and animal records for occurrences within the GYE. The Yellowstone program will record Park Service information on plants, animals, federal ownership, and management plans on computer.

Results/Outcome:

- Combining information from the state heritage data bases and identify gaps.
- Confirming the global, state and regional status of special plant and animal lists.
- Generating a list of rare plants and animals in the GYE.
- Linking the Heritage data bases directly to a compatible Geographic Information System in Yellowstone Park.
- Developing a cohesive set of computer, map and manual files.
- Responding to information requests from cooperating federal agencies.
- Evaluating the effect of planned developments and management activities on lands under federal authority.
- Coordinating regular information exchanges with the state heritage programs.

In the future:

- Complete plant community classifications and rank them according to global and regional rarity.
- Identify potential threats to plant communities in the GYE.

State Agency:
Michigan Division of Land and Water

Situation: A local developer designed a condominium project along the shoreline of Lake Michigan believed to support the Michigan monkey flower, a Federal and State endangered species known globally on only 13 sites in northern Michigan. In order to receive the permit to begin development, the MDNR requested a biological survey for the Michigan monkey flower and other potentially listed shoreline species.

Problem: During the biological survey, the scientists discovered two monkey flower colonies in the proposed development area, and one state listed plant species (Lake Huron tansy) along the beach.

Objective: To build a condominium complex in a sensitive shoreline area that supports Federal and State listed plant species; and to coordinate development activities in a way that provides a sustainable environment for the sensitive plant populations.

Network Assistance: The Michigan DNR reviews all wetland permits in their CIWPIS (Coastal and Inland Waters Permit Information System) data base of natural feature locations for potential natural features (plants, animals, communities) that may be adversely affected by proposed projects. When natural features are flagged within or near a project area, the State Endangered Species Coordinator often consults the Michigan Heritage Program for a more detailed examination of their data base. Coordinators may require a field survey to determine the status and precise location of listed species, or they may find sufficient Heritage information -- records of endangered and threatened species and their distribution -- to make project recommendations or alternative development plans.

Results/Outcomes:

- Heritage biologists conducted a plant survey and generated species distribution maps to indicate where the monkey flower existed within the condominium development site.
- Developer avoided legal conflicts with the State and Federal governments.
- Developer modified site plans and established a naturalist area within the condominium project to educate visitors about protecting rare plants and their habitats.
- Developer will fence in the monkey flower colonies and build a viewing board walk around the plant community to minimize foot traffic in the wetland areas.
- Developer cooperated with the State and Federal agencies to conserve the plant species while still developing the condominium project.
- Improved community support of business and environmental compatibility.

Corporation: Georgia Power

Situation: Until 1986, there was little recorded information on the rare, unique or threatened plant and animal species, and natural community types in Georgia. Now, Georgia Power consults the Heritage data base before developing transmission lines, re-routing power lines, or beginning construction projects.

Problem: A power line or construction project in danger of disturbing rare or threatened plants, animals or communities or their habitat.

Objective: To develop transmission lines and routing projects in the Southeast without interfering with rare or sensitive species.

Network Assistance: The Georgia Natural Heritage Program identifies the known locations of sensitive plant and animal species in the proposed project area. Scientists supply Georgia Power with a list of these species, their vulnerability, state and federal rank, and habitat requirements. Heritage staff also suggest potential habitat where a ground survey may be useful to indicate additional species occurrences.

Results/Outcomes:

- Protects plant and animal populations susceptible to disturbance.
- Avoids costly delays (in some cases 1 year).
- Facilitates permit reviews.
- Assists with corporate strategic planning; this saves hundreds of thousands of dollars in re-routes or special construction practices well into the project.

Corporation:
Natural Gas and Transmission Company – ARKLA

Situation: The company planned to build a major interstate pipeline from Oklahoma to Arkansas.

Problem: ARKLA was concerned, however, that there may be some sensitive species along the designated route, which would interfere with the permit process.

Objective: To obtain the necessary permits from United States Fish and Wildlife Service to build a 225 mile natural gas pipeline.

Network Assistance: The Oklahoma Natural Heritage Inventory provided information at two stages of the pipeline development -- the planning stage and the mitigation stage. Staff scientists generated reports on threatened and endangered species and ecological communities along the proposed corridor, and identified large tracks of forest land. The scientists also suggested appropriate sites for a mitigation project and inventoried an area called Cucumber Creek (ca. 2,000 acres) as a potential Nature Conservancy Preserve.

Results/Outcome:

- Determined threatened and endangered species along the proposed site.
- U.S. Fish & Wildlife Service recommended alternate routes around known populations of threatened and endangered species, and large forest tracks (to prevent habitat fragmentation).
- Shortened the environmental review process.
- Identified the site for a mitigation project - Cucumber Creek Preserve, ca. 2,000 acres.
- Inventoried the mitigation site.
- Purchased Cucumber Creek and established a stewardship endowment for The Nature Conservancy Oklahoma Field Office.
- Prevented a conflict with the National Forest, ie. destruction or loss of endangered species on USFS land.
- Improved community support of business and environmental compatibility.

Citizen Group:
Lower Poultney River Citizens Committee, VT

Situation: The Lower Poultney River in Vermont and New York is a biologically diverse system that supports an array of rare mussel and fish species and natural communities found in Vermont and New England.

Problem: The river system is subject to stresses created by an artificial water level control at a hydroelectric facility located nearby. River sedimentation from careless land use practices and organic and chemical pollution may harm the aquatic species.

Objective: To protect and enhance the ecological values of the Lower Poultney River.

Network Assistance: The Nongame & Natural Heritage Program of Vermont Fish and Wildlife Department provided records, reports, and testimony regarding the outstanding biological resources associated with the river system. With science expertise and support, the Lower Poultney River Citizens Committee issued a petition before the Vermont Water Resources Board to designate the Lower Poultney River an "Outstanding Resource Water."

Results/Outcomes:

- Designated the Lower Poultney River an "Outstanding Resource Water" due to its outstanding ecological value, including diverse fish and mussel populations.
- Increased the buffer zone surrounding the river.
- Prompted The Nature Conservancy in Vermont and New York to protect the river corridor.
- Helped The Nature Conservancy obtain funding for the Bald Mountain Preserve.
- Increased state and local awareness and funding for better management of the Poultney River.

**Research Institution:
Electric Power Research Institute**

Situation: Climate change such as global warming may threaten many plant species with extinction, however, the extent of its possible effects is still unknown.

Problem: Species that cannot adapt locally to increased temperatures and other climatic changes may become extinct unless they disperse and establish latitudinally or altitudinally.

Objective: To estimate the possible effects of climate change on North American plant species to help make better informed conservation and land management decisions.

Network Assistance: The Science Division is providing extensive research and drafting a detailed report on the potential effects of climate change on native North American vascular plant species -- for example rare plants versus abundant plants, based on federal status and global rank. The project staff developed additional data bases to maintain a constant set of information on species biology, rank, and distribution. Project botanists are studying species vulnerability in states and provinces using these traits to quantify results: geographic range and rarity, special habitat requirements (especially wetlands), and dispersal and colonizing ability.

Results/Outcomes:

- Analyzed species vulnerability by state and province; results suggest that many areas of North America may have significant numbers of vulnerable species.
- Determine resource conservation priorities for utility companies' land holdings and rights of way.
- Address plant vulnerability to climate change as a factor in establishing conservation priorities and informed land management options.
- Develop long range plans to consider ecological information when expanding facilities and siting plants, substations, and transmission lines.
- Improve understanding of possible consequences of climate change on native North American plant species.

Research: Amateur Lepidopterist

Problem: Incomplete state records and/or published material on Rhode Island butterfly populations.

Objective: To produce a technical book for an academic audience -- text, maps and photography -- documenting the butterflies of Rhode Island. Text and a distribution map will be devoted to each species. The book may be available by Spring 1994.

Network Assistance: The Rhode Island Heritage Program provided site information to help locate rare and common butterfly species. Based on extensive field work, they supplied a state map with records of all known butterfly populations.

Results/Outcomes:

- Obtained financial support from the Non-Game Program, Division of Fish and Wildlife, to publish the technical book.
- Prompted a several year relationship with an independent researcher who contributed his field work on rare butterfly species to the Heritage data base.
- Enabled the Rhode Island Heritage Program to more accurately determine the status of rare butterflies.

Collaborative Project: Merck Sharpe & Dohme and INBio

Challenge: To increase the number of plants that Merck screens for effective biomedical ingredients.

Objective: To discover potentially useful chemicals that may be reproduced synthetically for pharmaceutical purposes. Additionally, to reinvest money back into science and conservation to support sustainable development.

Network Assistance: The Costa Rican Conservation Data Center (operates within INBio, a partner organization) provides Merck with records of the status and locations of plant species in Costa Rica. CDC scientists and other INBio staff will identify, collect, and process various plant extracts and send them to Merck laboratories to determine their medicinal value. In return, Merck plans to train INBio's scientists (including the CDC) in biochemistry techniques specific to plant screening, train locals in plant classification and ultimately increase Costa Rica's self-sufficiency and opportunities.

Results/Outcomes:

- Guarantee Merck's access to an enormous variety of plants.
- Train INBio/CDC scientists in biochemistry techniques specific to plant screening.
- Continue to train Costa Ricans in a plant classification program.
- Exchange technical expertise between Merck and INBio, enhancing the capacity of both.
- Identify active plant substances with potential medical values.
- Share the profits with INBio through a royalty agreement.
- Reinvest money back into science and conservation.
- Exchange access to screen Costa Rica's biological resources for an opportunity to invest Merck's financial resources in conservation.
- Promote sustainable use of natural resources by training locals, and safeguarding forest resources.

Collaborative Project:
University, Government & Conservation Organization

University of Panama
Panama Canal Commission (Panama, United States, Japan)
ANCON (Association for Conservation of Nature in Panama)

Situation: Several development alternatives are being considered for improving the Panama canal: modifying the existing canal, building a new sea level canal, and adding a land connection along the canal (roads, railroads).

Problem: Scientists are concerned about potential environmental effects of the different development options on marine plant and animal species and their surrounding ecosystems.

Objective: To demonstrate which areas are most sensitive to development in and around the Panama Canal, and to identify the canal improvement that is least disruptive to resident marine and terrestrial species.

Network Assistance: The Conservation Data Center in Panama (operated by local partner ANCON) is providing scientific expertise on the status of threatened and endangered species, as well as information on natural resources. Scientists at the central data base office also contributed GIS (Geographic Information System) technology and recently installed a MIPS system in ANCON.

Results/Outcomes:

- Assisting with the Panama Canal development decisions.
- Providing a set of recommendations, based on scientific information, to the Panama Canal Commission, ANCON, and the University of Panama.
- Demonstrating the integrity of CDC information on sensitive species and natural resources.
- Installed a MIPS (Map and Image Processing System) in ANCON.
- Improved the scientific and GIS (Geographic Information Systems) capacity of our local partner, ANCON.

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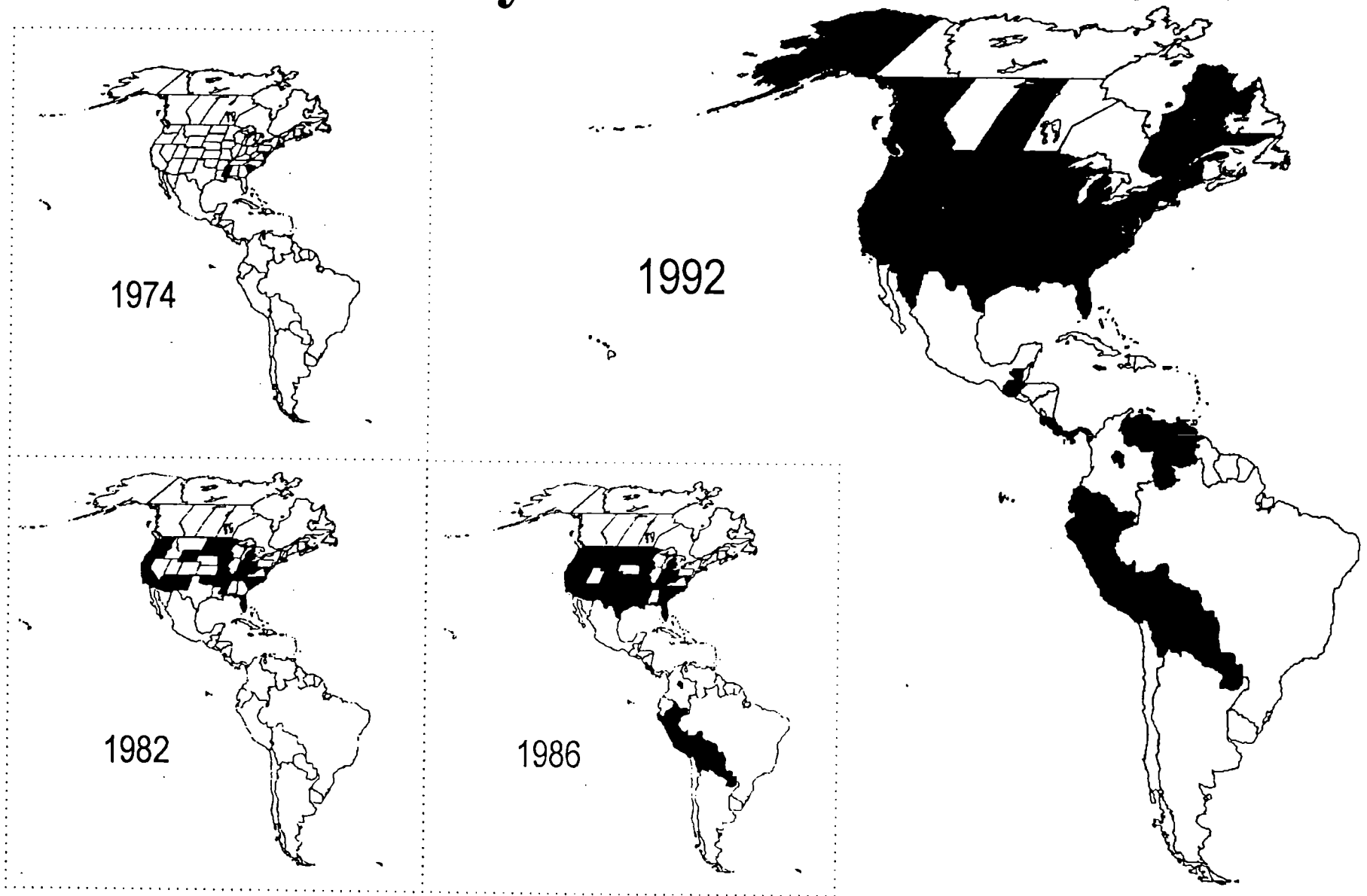
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Institute for Biodiversity Information

Using Scientific Information to Advance Biodiversity Conservation



Geographic Spread of Biodiversity Data Center Network



Biodiversity Data Network

Mission:

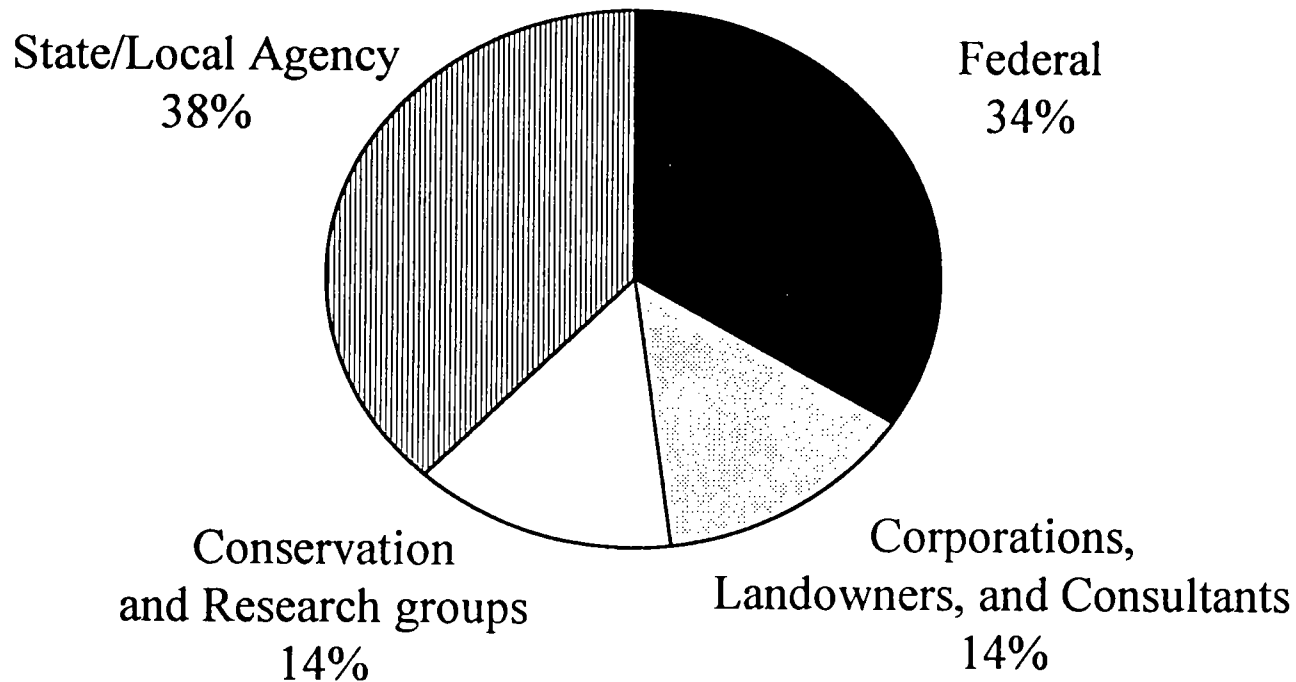
Establish and maintain a unique information resource - an integrated network of data centers - on plants, animals, natural communities, and critical protected areas. Make this information available throughout the network for conservation and development planning, impact assessments, natural resource management, and scientific research.

Network data is used for...

- Environmental Impact Assessments
- Threatened Species Management
- Natural Resource Inventories
- Natural Resource Management Plans
- Water Development Projects
- Reserve Selection and Design
- Land Development Siting
- Conservation Administration
- Transportation Routing
- Animal & Plant Research
- Regulatory Permit Review

200,000 Data Responses Annually

Who is using the network?

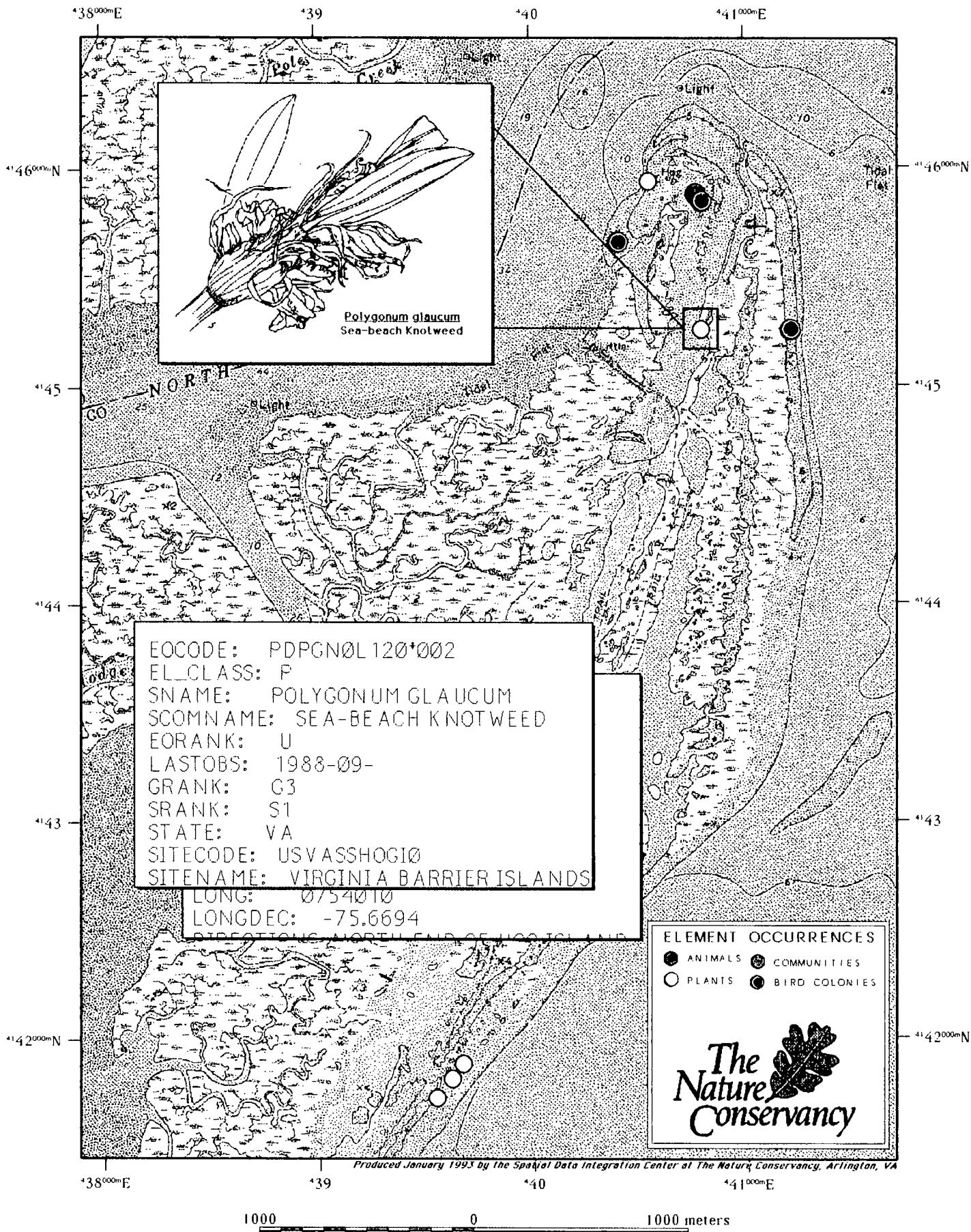


Uses

> 200,000 - possibly > 300,000 per year (U.S.)
mostly Fed. compliance.

What information is available?

Elements	<i>species, ecological communities</i>
Element Occurrences	<i>localities of species or communities</i>
Sites	<i>significant land areas</i>
Tracts	<i>land ownership parcels</i>
Managed Areas	<i>protected or specially managed areas</i>
Projects	<i>land conservation actions</i>
Information Sources	<i>literature, voucher specimens, imagery</i>
Contacts	<i>individuals, institutions</i>

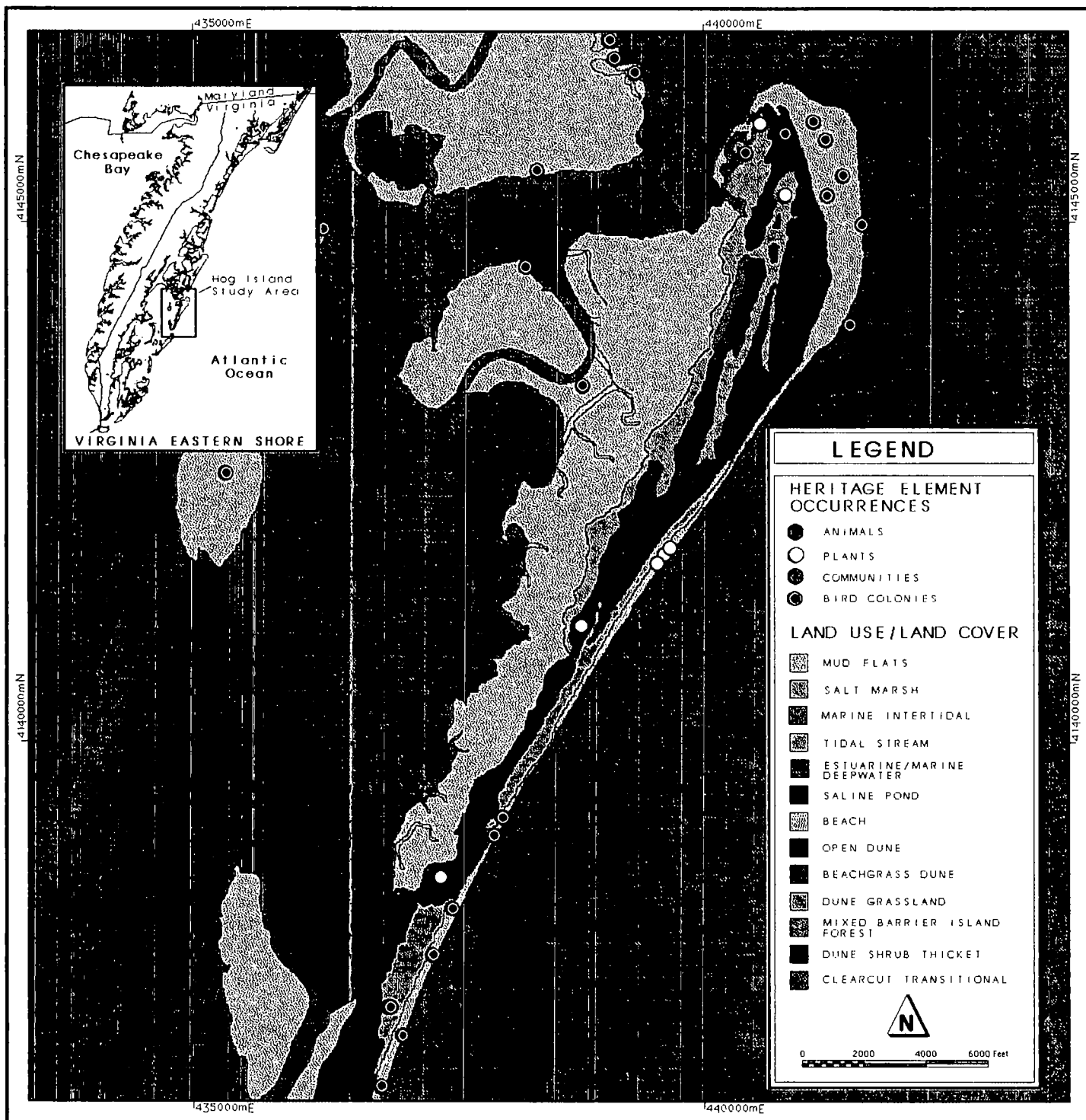


ELEMENT OCCURRENCES

- ANIMALS
- COMMUNITIES
- PLANTS
- BIRD COLONIES

The Nature Conservancy

SCALE 1:24000
UTM zone 18

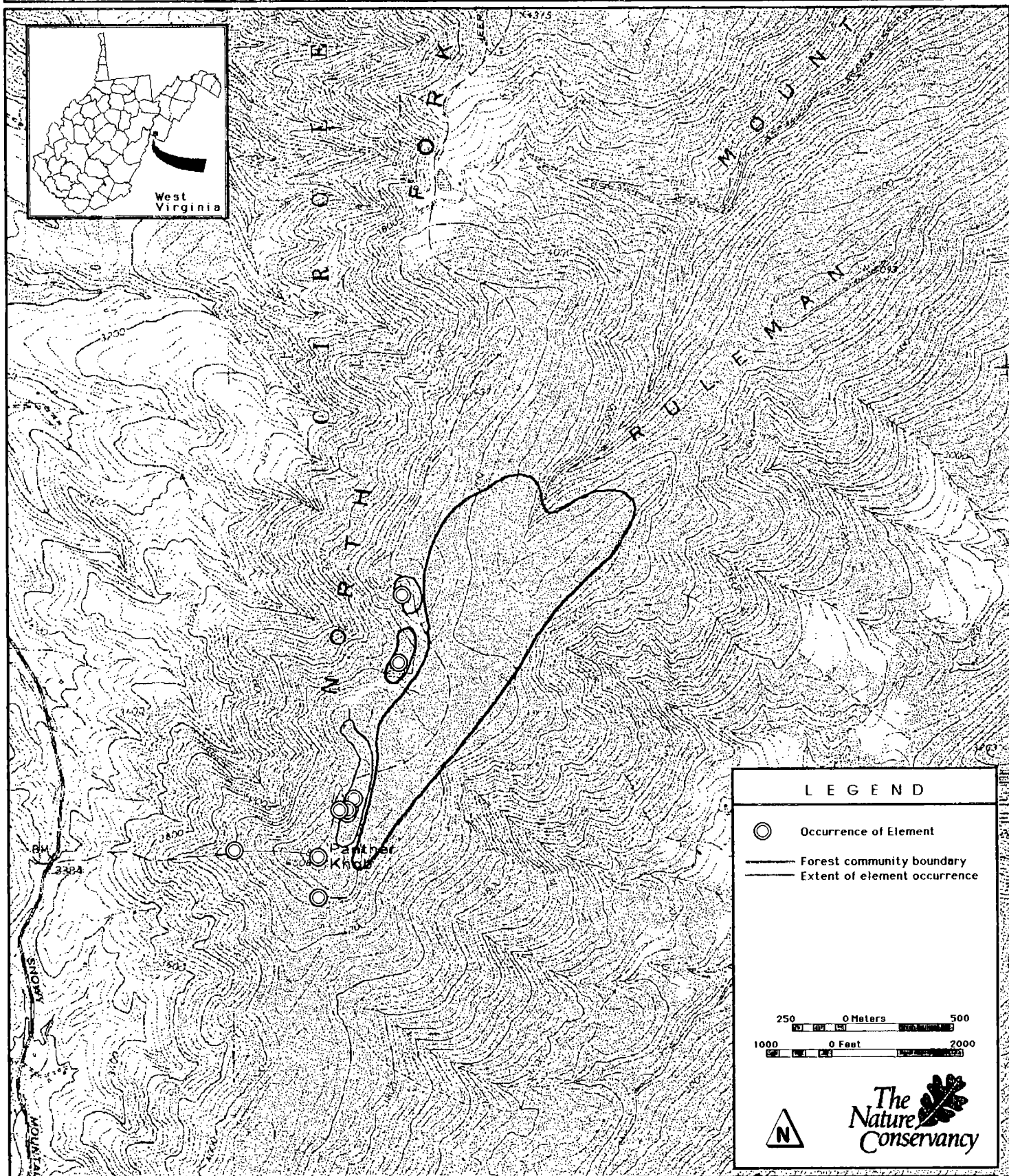


RARE SPECIES, NATURAL COMMUNITIES, AND LAND USE/ LAND COVER OF HOG ISLAND

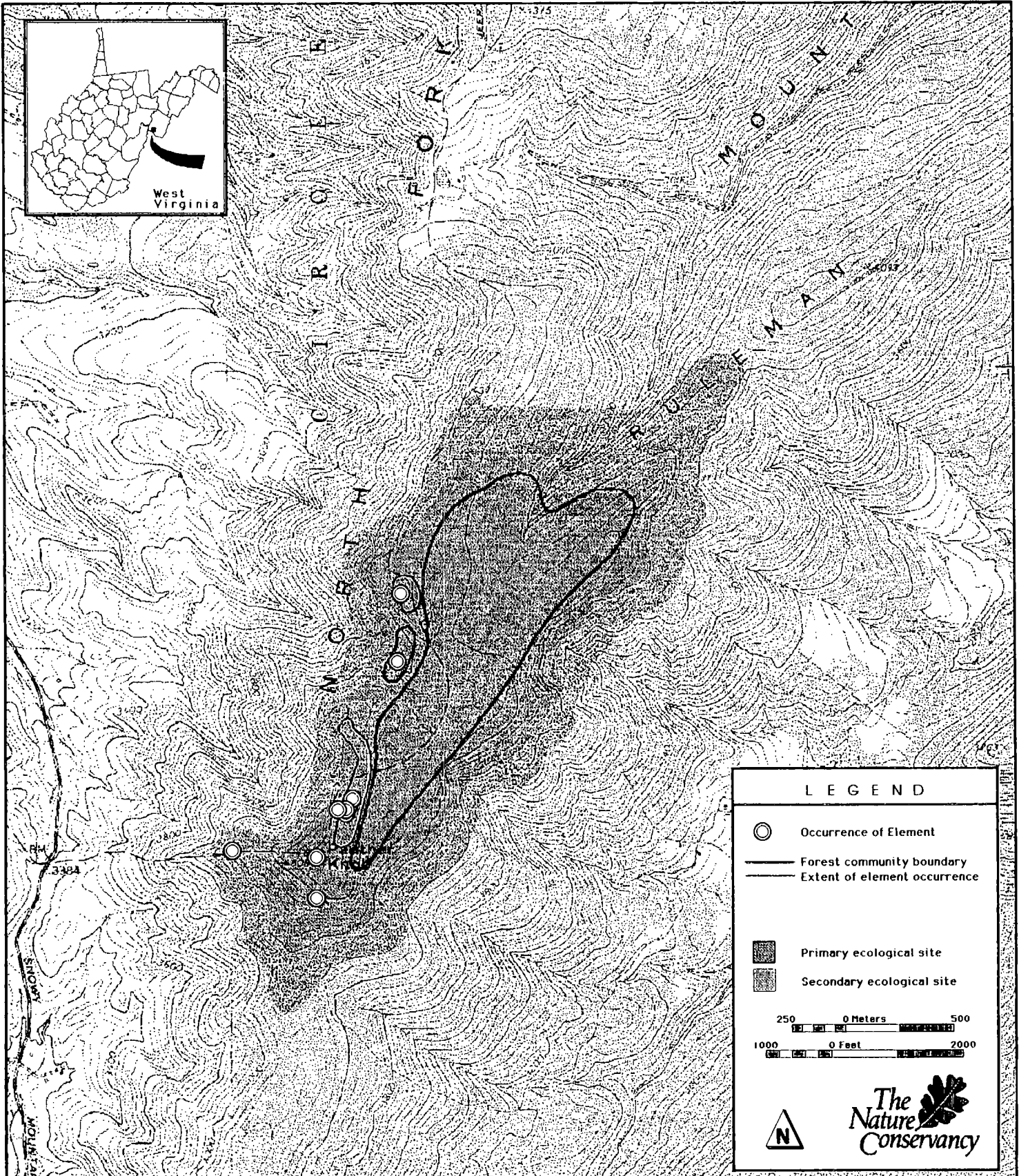


SOURCES: Landsat TM - 7/89
SPOT Panchromatic - 5/89
CIR Aerial Photography - 7/90
Field verification - 6/90, 8/90
Virginia Natural Heritage Program - 2/91

Panther Knob Site, West Virginia



Panther Knob Site, West Virginia



West Virginia

Goshen Ridge Properties

Warner

Raines

Bennett

Colaw
(Registry Site)

Hariman

Simmons

Byrd Estate

Chestnut Woods Association
(Registry Site)

The Nature Conservancy
Forestry

Legend

- Occurrence of Element
- Forest community boundary
- Extent of element occurrence
- Project boundary
- Tract boundary
- Managed area boundary
- Primary ecological site
- Secondary ecological site

250 0 Meters 500

1000 0 Feet 2000

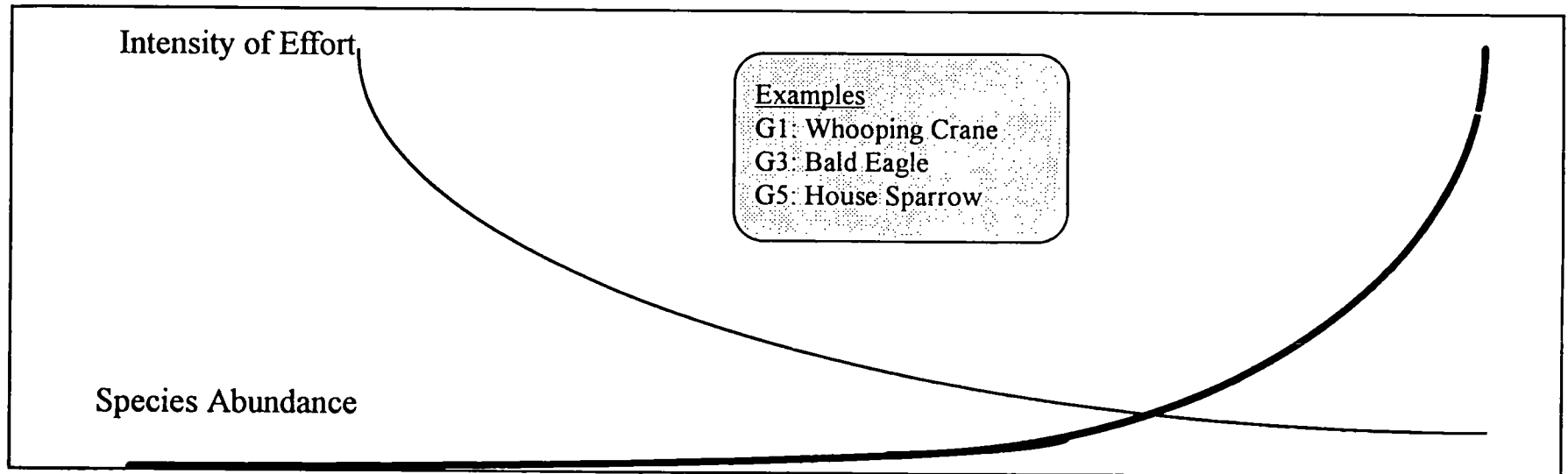
The Nature Conservancy

Coverage of the Biodiversity Data Network:

- All vertebrates of the western hemisphere and Hawaii
(excluding fishes in Latin America)
ca. 15,000 tracked
- Vascular plants of North America and Hawaii
ca. 35,000 tracked
- Selected groups of invertebrates and nonvascular plants of
North America and Hawaii (e.g. crayfish, butterflies, mosses)
ca. 7,000 tracked
- Selected vascular plants of Latin America
ca. 9,000 tracked
- Projected community types in a national classification
ca. 6,300 tracked

72,300 species, subspecies and communities tracked

Conservation and Research Priorities

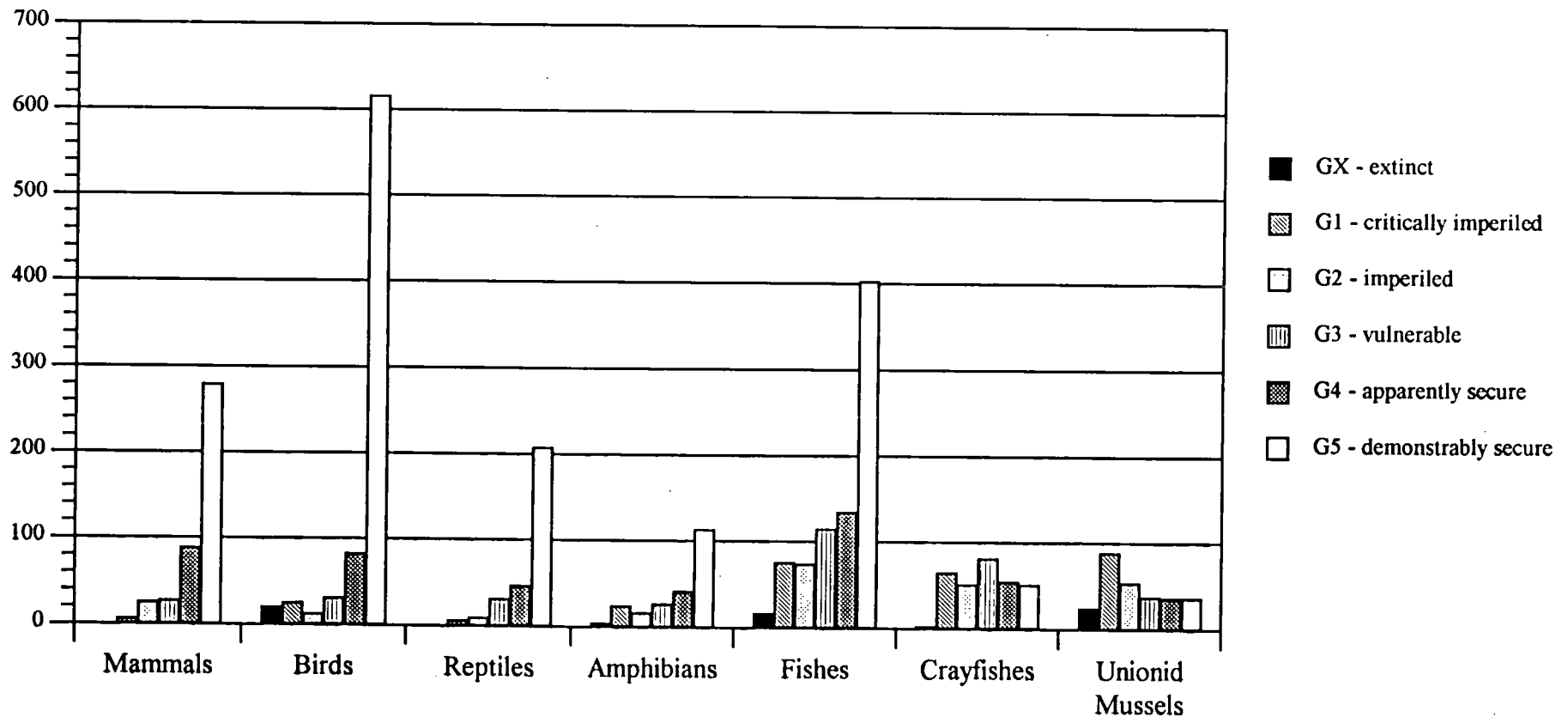


Element	GX	G1	G2	G3	G4	G5
Occurrences	0	<6	<20	<100	>100	many
Total Number of Individuals	0	<1000	<3000	<10,000	>10,000	abundant

Conservation Rank

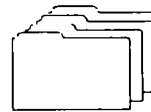
Status of Selected North American Animal Groups

No. Species

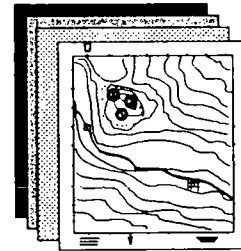


How do we manage our information?

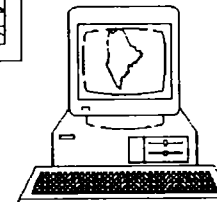
Structured manual files



Manual map files

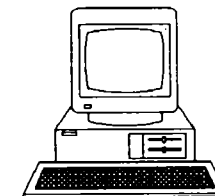


Geographic Information Systems



Computer database management system

(BCD)



Biological & Conservation Data System—BCD

(the Network's software system)

Facilitates collection, distribution and exchange of biological information.

Records species, community types, sites, land ownership, managed areas, and sources.

Uses standard methods for managing and exchanging biodiversity data on a global, national, and subnational level.

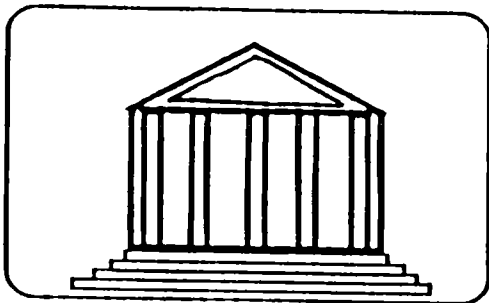
Provides a flexible, powerful, state-of-the-art database management system.

Fifth generation of evolving TNC-developed data management software.

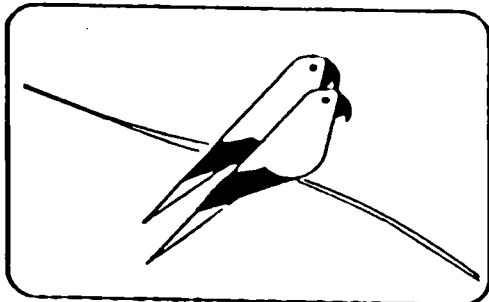
DATA EXCHANGE



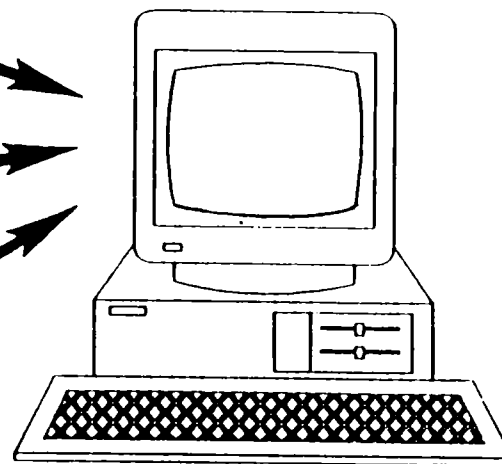
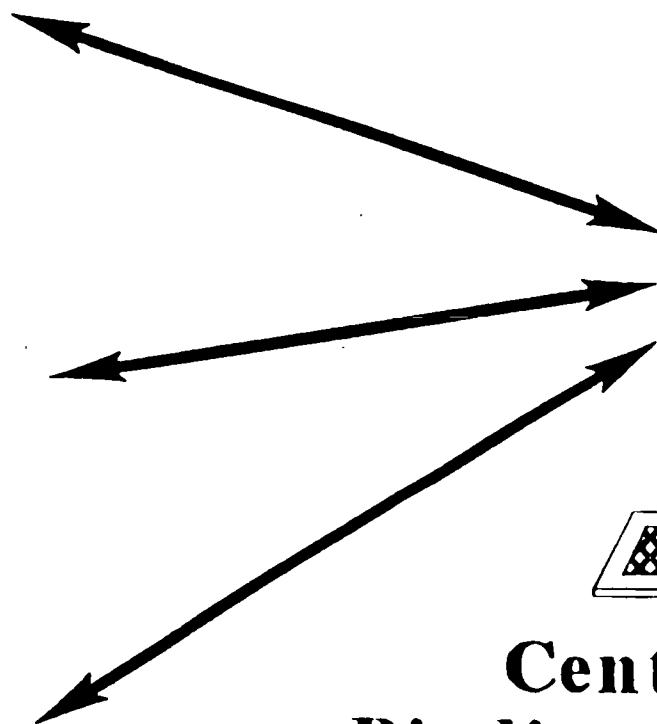
Botanical Gardens



Universities



Research Centers



**Central Databases
Biodiversity Data Centers**

Network Scope

85	primary biodiversity data centers
110	cooperating data centers
930	staff scientists/information managers
1,000s	cooperating experts/ information suppliers
70,500	species, subspecies, and communities tracked
350,000	locations of rare species mapped & computerized
20,000	U.S. reserves mapped & computerized
140,000	information sources abstracted

The Science Division of The Nature Conservancy provides:

- training and workshops
- data exchange
- central files and databases
- scientific and technical support
- standard methods and information management systems
- tools for establishing Biodiversity Data Centers

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Divider Title: _____

*An Overview of the
Biological and Conservation Data (BCD) System*

October 1992 Edition



*The Biological and Conservation Data (BCD) System is a product of the
Conservation Systems Department,
Science Division of the Nature Conservancy.*

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Appendix I—BCD System Data Relations Diagram

Purpose

Good conservation depends on good information!

- Where does that species occur?
- Who owns that tract?
- When does that option expire?
- How should that land be managed?

The Biological and Conservation Data (BCD) System developed by The Nature Conservancy is a powerful state-of-the-art information management tool designed to help answer these kinds of questions. With applications in biological diversity inventory, real estate protection, land management, and general administration, the BCD System offers an integrated approach to biodiversity conservation.

The BCD System may be used to track information on elements of biological diversity (i.e., plants, animals, and communities), occurrences of those elements (i.e., location), conservation sites, projects for protecting sites, real estate tracts and transactions (including ownership, interests, rights, and legal requirements), property tax obligations, ecological monitoring programs and observations, plans for land management actions, individual and institutional contacts, etc.

Computers and conservation may seem an incongruous pair, as if high technology had invaded the natural order. Computers however, and the BCD System in particular, provide an opportunity for conservation to survive and to work in concert with a developing world. By virtue of the fact that the BCD System represents a standardized, integrated approach to biological diversity inventory, protection, and land management, it is possible to establish operational continuity in different offices and different times and to build a common vocabulary that fosters multi-institutional cooperation and efficient data exchange. The BCD System unites the work of many individuals from all parts of the world and preserves their combined knowledge in a coherent, organized fashion for their colleagues and future generations. The BCD System has the potential to provide the best, most current and comprehensive information for the benefit of science and research, prudent development, and good conservation.

Structure

The BCD System is designed with a readily visible architecture; the file structure is, for all practical purposes, exposed. Each of the data entry windows used to store and retrieve data reflects a particular basic logical entity, or type of information. Unlike some database applications which provide data entry screens that mask file structure, the BCD System relies on more direct entry and greater user knowledge of the data structure. This may at first be intimidating, since it requires an understanding of the different types of information (or basic logical entities) and the relationships between those entities. In the long run however, an understanding of these relationships is essential (after all, the biological diversity inventory protection/land management business is complex) and the lucid structure of this System offers the user greater power and flexibility to manipulate data and design custom ad hoc reports.

The BCD System files are organized according to the types of information they record. These types of information, alternatively called the "major logical entities", include:

- Sources
- Elements
- Element Occurrences
- Sites
- Managed Areas
- Tracts
- Projects
- Transactions
- Tract Transactions
- Taxes
- Actions
- Contacts

Brief definitions for these entities are given below.

Source:

A unit of information about an Element, Element Occurrence, Site, Managed Area, etc..., (e.g., a book, article, thesis, field notes, etc.).

Element:

A unit of natural biological diversity. Fine "filters" of diversity include plants and animals; coarse filters include communities (repeatable assemblages of species that share a common environment) and "other" types (e.g., migratory bird concentrations, breeding bird concentrations, etc.). Some data centers also define geologic and aesthetic Element types.

Element Occurrence (EO):

A specific example of an Element at a specific geographic location that represents a habitat capable of sustaining or contributing to the survival of that Element. This is the fundamental unit which drives all further protection and land management activities.

Site:

A land unit of ecological or other scientific interest, usually defined for purposes of conservation planning (but may be defined for any area for which ecological or other scientific information is needed).

Managed Area (MA):

A land unit, generally a natural area, that is under distinct protective or potentially protective natural resource management.

Tract:

A unit of land ownership, defined by the current legal owner and the surface boundaries.

Project:

A proposed or approved plan for one or more real estate Transactions (involving one or more Tracts) for the protection of one or more conservation Sites. The set of financial and legal commitments and the estimated expenses and source of funds needed to carry out that plan.

Transaction:

A real estate "deal", voluntary or legally binding, involving a transfer of interests and rights between a grantor and a grantee that affects or involves a specific organization (e.g., The Nature Conservancy). Common Transactions include purchases, sales, leases, licenses, management agreements, easements, mortgages, mortgage releases, assists, dedications, public land designations, registrations, etc. A Transaction may involve one or more Tracts of land but always has a specific closing date.

Tract Transaction:

A real estate Transaction interpreted from a Tract-specific perspective. The transfer of interests and/or rights on a particular Tract independent of any other Tracts that may be involved in the Transaction.

Tax:

A unit that refers to either an assessment or charge imposed by a legal authority on a property owner or to the payment made or the exemption filed. The tax bill or exemption will generally be associated with a particular parcel of land. (The boundaries of that parcel may not correspond exactly with those of an ownership Tract.)

Action:

A planned activity or set of related tasks defined for the achievement of a particular objective, usually land management, biological diversity inventory, or administrative. An Action is generally categorized by type and characterized by a scheduled date, personnel to carry it out, and an estimate of cost and time.

Contact:

A person or organization (institution, department, or office) whose activities, interests (including legal interests), or knowledge in some way relate to biological diversity inventory, protection, land management, or administrative information needs.

The terms and definitions for these entities serve as the building blocks of the BCD System. They form the basic vocabulary for conservation information management. It is important to under-

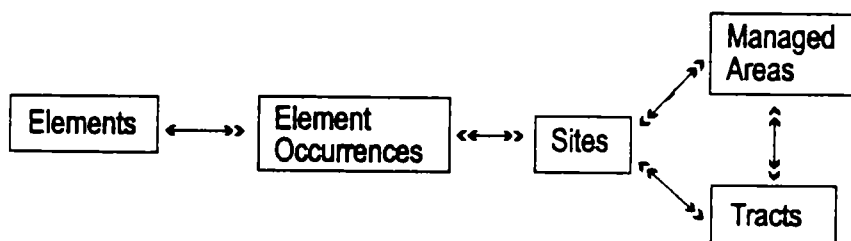
stand these terms; they mean specific things and should be used with discrimination. A Site is not necessarily the same as a Managed Area, nor is it the same as a Project; and a Project is not the same as a Transaction, nor a Tract Transaction. Understanding the difference between these terms and their relationships will make the BCD System easier and more efficient to use.

Four of these entities are unique in that they have geographic characteristics. In other words, they may be mapped. These include:

- Element Occurrences
- Sites
- Managed Areas
- Tracts

Because these entities sometimes cover overlapping geographic areas, it is especially important to understand their differences. Whereas a Geographic Information System can separate these entities onto different overlays, a database system, such as the BCD System, relies on conceptual distinctions to segregate data: scientific and ecological data goes in the Site files, management data in the Managed Area files, and legal ownership data in the Tract files. The BCD System provides a tool for sorting out data for a complex conservation geography of rare Element Occurrences, conservation Sites, protected Managed Areas, and legal ownership patterns.

These geographic entities, together with the Elements, form the backbone of the BCD System. All other entities that characterize the biological diversity inventory, protection, and land management endeavor revolve around these fundamental entities representing biodiversity itself, and the land that supports it. Their relationships may be sketched as follows:



Any one Element may have one or more occurrences; an Element Occurrence (EO) however, may be represented by only one Element. Elements and EOs may be said to have a one-to-many relationship. EOs and Sites, on the other hand, have a many-to-many relationship. A single EO may be included in several different Site designs and a Site may encompass one or more EOs. In general, the geographic entities all share a many-to-many relationship. An ownership Tract may include several different Managed Areas and a Managed Area may cover a complex of different ownership Tracts. These relationships are tracked in the BCD System through special fields that allow a user to cite a related entity.

Each entity has one or more files in the BCD System which are used to record information on that entity. Many of these files have acronyms. A list of these files and their acronyms is provided below:

Entity	File	Acronym
Sources	SOURCE ABSTRACT	SA
Elements	ELEMENT TRACKING	ET
	ELEMENT GLOBAL RANKING	EGR
	ELEMENT NATIONAL RANKING	ENR
	ELEMENT STATE RANKING	ESR
	PLANT CHARACTERIZATION ABSTRACT	PCA
	VERTEBRATE CHARACTERIZATION ABSTRACT	VCA
	INVERTEBRATE CHARACTERIZATION ABSTRACT	ICA
	COMMUNITY CHARACTERIZATION ABSTRACT *	CCA
	<i>(The CA files include global, national, and state data entry windows)</i>	
	ELEMENT STEWARDSHIP	ES
Element Occurrences	ELEMENT OCCURRENCE RECORD	EOR
	ECOMONITORING	-
	ECO.VISITS	-
Sites	SITE BASIC RECORD	SBR
Managed Areas	MANAGED AREA BASIC RECORD	MABR
Tracts	TRACTS	-
	TRACT.DETAIL	-
Projects	PROJECT BASIC RECORD	PBR
Transactions	TRANSACTION TRACKING	TTRACK
	TRANSACTION ARCHIVE	TA
Tract Transactions	TRACT TRANSACTION TRACKING	TTTRACK
	TRACT TRANSACTION ARCHIVE	TTA
Taxes	TAXES	-
Actions	ACTIONS	-
	ACTCODE	-
Contacts	CONTACTS	-
	EXPERTS	-

*Currently available in WordPerfect prototype; planned for release in the next major edition of the BCD System.

Miscellaneous supporting files include: STATES, COUNTIES, QUADS (a table of topographic quadrangle map codes and names), and DESIGNATIONS (a table of special government or Nature Conservancy administrative designations for Sites).

In addition to the files listed above, the BCD System also supports a set of associated optional files—in general, one for each of the basic entities. These optional files give individual offices or installations the flexibility to track their own optional data (i.e., data for which standard fields have not been defined in the parent files). Each office (or group of cooperating offices) may define the optional fields in these files according to their specific needs.

The optional files include:

Entity	File
Sources	SA.OPT
Elements	ET.OPT PCAN.OPT PCAS.OPT VCAN.OPT VCAS.OPT ICAN.OPT ICAS.OPT CCAN.OPT * CCAS.OPT *
Element Occurrences	EOR.OPT
Sites	SBR.OPT
Managed Areas	MABR.OPT
Tracts	TRACTS.OPT
Projects	PBR.OPT
Transactions	TTRACK.OPT
Tract Transactions	TTTRACK.OPT
Taxes	TAXES.OPT
Actions	ACTIONS.OPT
Contacts	CONTACTS.OPT

**Currently available in a WordPerfect prototype; planned for release in the next major edition of the BCD System.*

Different installations generally use different sets of files based on individual objectives. It is important to note that while all of the files presented here are not always used at a single installation, they are all available.

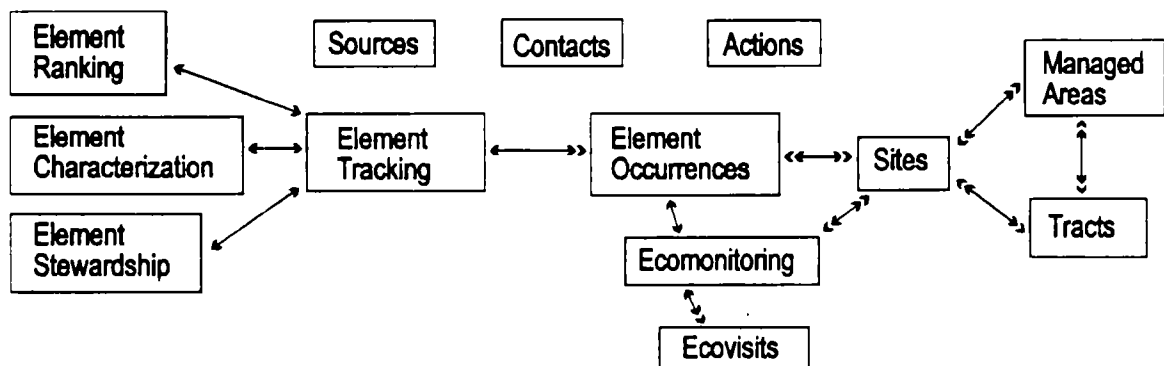
Applications

The various BCD System files have diverse applications in biological diversity inventory, land management, protection, and general administrative activities. Examples of some of the more common applications are listed below:

i) *Biological Diversity Inventory/Land Management Applications*

- Biodiversity inventories
- Indexes to maps, field notes, original Sources, manual files
- Environmental assessments
- Bibliographic citations and abstracting
- Directory of scientific and land management expertise
- Natural Diversity Scorecards (Element and EO priority lists)
- Biological/environmental monitoring
- Element Stewardship Abstracts (ESAs)
- Ecological Site designs
- Site Tracking Reports (Site priority lists)
- Site Action planning
- Preserve portfolios
- Conservation education
- Legal monitoring (restrictions, requirements, interests, and rights)

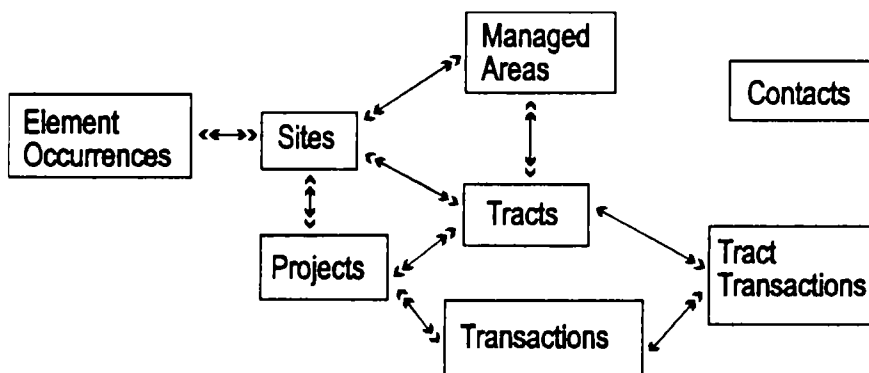
The relationships between the various biological diversity inventory and land management files may be sketched as follows:



ii) Protection Applications

- Tracking landowner contacts
- Tracking registries
- Directory of legal, real estate, and business expertise
- Project planning, review, and approval (Project Packages)
- Legal tracking, option due dates, real estate negotiations, etc.
- Corporate archives (Project resolutions; closed Transactions)
- Land accounting (Land Saved reports)
- Reporting Project activity and Transactions completed to executive staff and state and national Boards

The relationships between the various protection files may be sketched as follows:



iii) General Administrative Applications

- Directory of individual and institutional contacts
- Indexes to correspondence and manual files
- Producing mailing lists and labels
- Responding to public inquiries
- Providing information for membership, communications, newsletters, public relations
- Scheduling office work
(weekly, monthly, quarterly, annual "to-do" lists)
- Coordinating volunteer activities
- Tracking tax obligations, payments, and exemptions

The relationships between the various administrative files may be sketched as follows:



Standards and Options (Suggesting Changes for System Design)

The BCD System is built upon a set of standard fields and files. These are the basic structures which make it possible for different offices and data centers in different parts of the world to collect, exchange, and disseminate information. By establishing this set of standard data fields and files, the BCD System helps to promote a common vocabulary that unites people and purposes.

Information, however, is dynamic and in order to meet the diverse and growing needs of an extensive network of users, the BCD System must be flexible. Toward this end, the System has been equipped with a set of accessory files known as the Optional files (described above in Section B. Structure). When standard fields cannot support specific local needs, these optional files will generally provide the flexibility needed.

In addition, the BCD System is constantly evolving. Only through constant improvements and enhancements can it keep pace with a growing set of information needs. With each new edition of the BCD System, changes are made and new features added. Some of these changes may be simple: adopting a new field name, a new popup value, or a new index. Other changes may be more complex: adding a new field, a new set of fields, or a new file. In order to provide an efficient, orderly process for the best logical design and the most coherent evolution of the BCD System, a design team, called the Operating Procedures Group (OPG), reviews all proposals for changes and decides whether to accept, modify, or reject them.

The OPG is chaired by the Director of The Nature Conservancy's Science Division and managed by the Conservation Data Administrator and the Director of Conservation Systems. Members of the central and regional heritage task forces and representatives from various other divisions and departments—Site Information Management, Stewardship, Accounting, Legal, etc—frequently serve on the OPG. In a broad sense, all users may consider themselves members of the OPG. In fact, the OPG depends upon the knowledge and insight of BCD System users.

Any user may submit a proposal for a technical or methodological change in the BCD System (or for a change in related standard operating procedures for biological diversity inventory, protection, or land management information) to the OPG at The Nature Conservancy's headquarters. Proposals are accepted on an ongoing basis and kept in a Central BCD System file. Users may also comment on any outstanding proposals. A list of pending proposals will usually be distributed to all offices with a BCD System at the beginning of each new development cycle for new editions of the BCD System.

Users in field or state offices, should discuss any proposal they may have with a regional information manager (RIM) or regional project/legal coordinator before formally submitting it

Additional Information

For further information regarding the Biological and Conservation Data (BCD) System, licensing, costs, technical specifications, network membership, and user support, please contact:

The Nature Conservancy
Science Division
Conservation Systems Department
1815 North Lynn Street
Arlington, VA 22209
(703) 841-5354

to the OPG. The regional representatives may be aware of similar proposals or alternative solutions that already exist. They will also provide users with the appropriate forms for submitting a proposal if the office does not already have them.

User input in the design process is highly valued. Those proposals which are most explicit in suggesting design specifications, which clearly evaluate advantages, disadvantages, and alternatives, and which assume a universal perspective, will be especially helpful during the OPG review process.

User Responsibilities

All BCD System users are part of an extensive, global conservation data network. Participation in the network provides many benefits, most importantly, the ability to communicate information on biodiversity and conservation. This ability represents the network's strength--and information its principal asset. In light of this, it is each user's responsibility to maintain the integrity and scientific accuracy of the data. All data should be entered so as to be clear and understandable to users elsewhere in the network (whether they represent The Nature Conservancy, a government agency, or other organization) as well as to users in future generations.

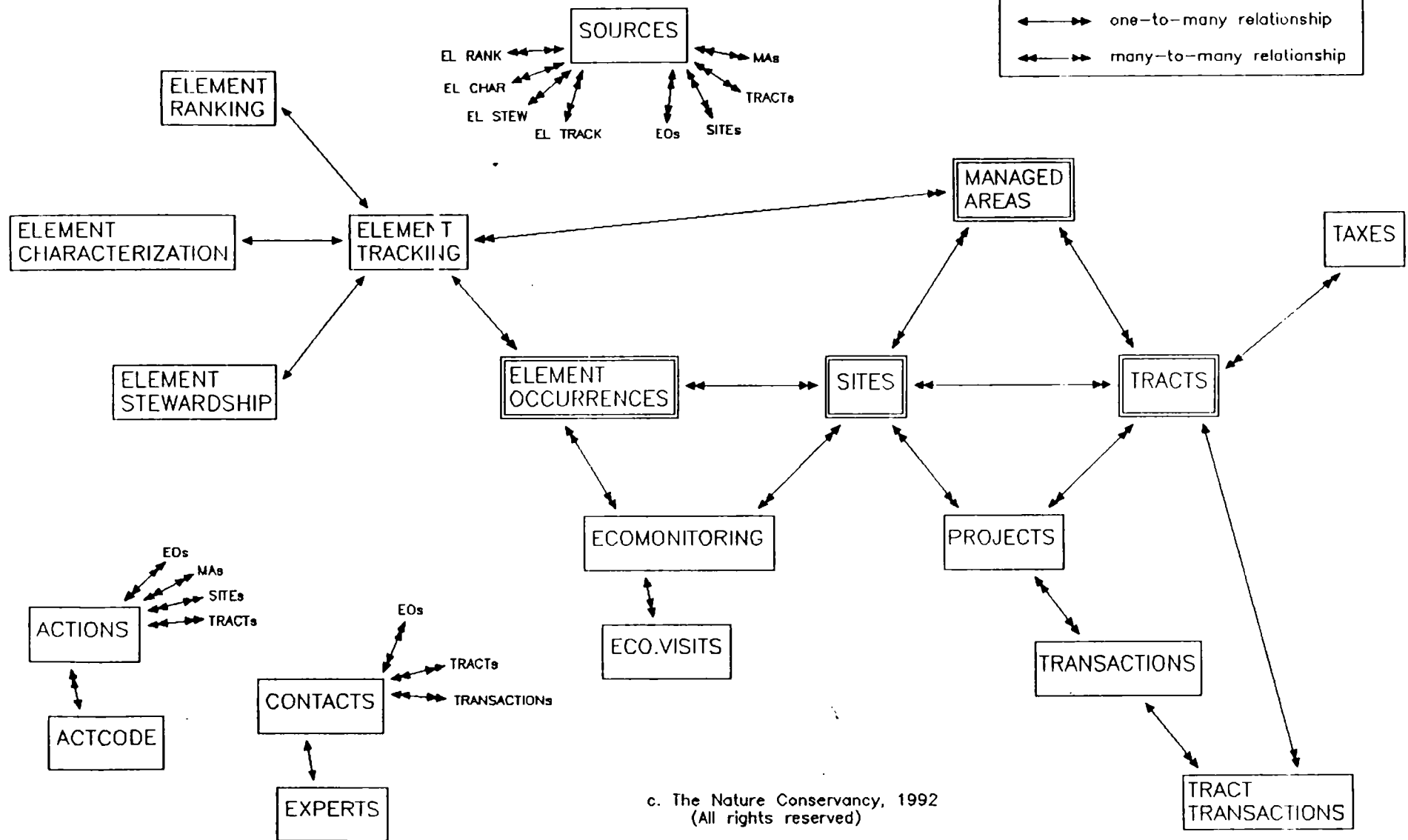
Since any one record may be shared by users in different offices throughout the network, each record is equipped with a LEADRESP field to designate which office has lead responsibility for the data in that record. Generally, whenever the BCD System is installed in a new data center, the users in that office should meet with existing users in other offices in the state to coordinate which office will maintain the master record. This will prevent any possible divergence in data between offices for that record. No user should ever delete a record or make substantive changes without notifying the office that has lead responsibility for that record.

The power of the BCD System lies with the user. The BCD System is merely a tool, and like most tools, requires care and maintenance. The System is not a substitute for work; the data in it must be constantly modified and updated for a more accurate approximation of reality. Changes and events in the real world may quickly outpace the currency of information in the System unless staff resources are devoted to its maintenance. Investing the time and resources to maintain good data may seem an onerous burden. Doing so however, will ensure the maximum benefit of good conservation that comes with good information.

BIOLOGICAL and CONSERVATION DATA SYSTEM

(1992 Edition)

DATA RELATIONS DIAGRAM



Paul and Deborah Crosetti
34607 SR704 E.
Ashford, WA 98304
April 21, 1993

William J. Clinton
President of the United States
The White House
Washington, D.C.
20500

Dear President Clinton:

Subject: Appeals Regulations Tax Credit

We are opposed to the U.S. Forest Service's (USFS) proposed rule for commenting on and appealing "project level decisions". We have been involved in monitoring USFS projects for 3 years and have developed a working relationship with our Ranger district that would be undermined by this proposal. There are at least 4 areas of concern:

1. The proposed rule comment period of only 15 days is ludicrous. We have not even seen the proposal yet but have just received information about it from the Western Ancient Forest Campaign. It seems this is a ploy to minimize public comment.
2. The proposed rule allows the U.S. F.S. to declare an emergency and thereby avoid giving citizens any opportunity to comment or to appeal. The loosely defined "emergency" allows for many mistakes to be made where the public has a right to participate in the management of their lands. We have just as much right or more to influence emergency decisions

2. (cont.) as non-emergency decisions. It may be even more crucial to have public input before an emergency decision is made. We see this as a possible intent Congress had for not authorizing emergency exemptions for the comment period & for appeals in the law enacted last year. Therefore, we oppose the emergency provision.
3. Elimination of the "mailbox rule" would very definitely hamper our ability to participate in the public comment & appeals process. We live in a rural & more remote area where most of our correspondence is by mail. It takes more time for us to receive written material than in an urban area. We are also volunteers and have a family, so our volunteer time is limited. What has worked best is the "mailbox rule" where postmarking the envelope by the last day of the comment period gives us the certainty that our voice will be heard & counted.
4. The proposed rule fails to incorporate an express requirement of the law passed by Congress: anyone who has asked to be notified about timber sales or other projects & anyone who has participated in the early stages of project development (e.g. scoping on a timber sale), must be mailed a notice of the opportunity to submit comment on a proposal. Both of these requirements are in the current FS appeals rule & are expressly required by the new

4. (cont.) law- (which intentionally followed the current Forest Service rule). We are outraged that this express statutory requirement was not included in the new proposal. After all, the new rule is about public participation or as we view it, the restriction of public participation. In the wake of our forefathers' democratic ideals, this is taxation without representation. We have the right to participate in the management of our public lands for which we are being taxed and that right must be stated in the new proposed rule as a further guarantee.

We hope these comments will help to develop an improved process for public participation.

Sincerely,
Paul and Deborah Crosetti

TECHNICAL SPECIFICATIONS



Biological and Conservation Data System

The Biological and Conservation Data (BCD) System is a PC-based data management package that facilitates the collection, distribution, and exchange of information pertinent to the preservation of biological diversity. Major classes of data in the BCD System include information on species and community types and occurrences, sites, land ownership parcels, managed areas, and sources of information. The BCD System is extremely flexible with regard to data retrieval, report generation, and data manipulation, and it embodies the full power of a state-of-the-art database management system (Advanced Revelation). The BCD System represents The Nature Conservancy's sixth generation of biodiversity data management software; it is now the standard tool for managing and exchanging biodiversity inventory data in the Natural Heritage Data Center Network.

Features & Benefits

- Menu-driven operation
- Command-level operation
- Flexible reporting
- Full array of utility routines
- Large User Community
- Excellent performance with large data sets
- Standardization facilitates data exchange
- Data export capabilities for transfer of information to other standard GIS (ARC-INFO, GRASS, etc.) or other database applications

Software requirements

PC/MS DOS, Advanced Revelation database management system (version 2.0), BCD application package. PC Anywhere communications software is recommended. A memory management software package (386Max, QEMM) is required for PCs that are not using PC/MS DOS 5.0.

Hardware requirements

Computer: The BCD System runs on any IBM or compatible PC with an 80386-class or faster processor. A 80286 class processor can be used if the system is outfitted with a LIM 4.0 EMS memory expansion board and preferably a math coprocessor.

Hard Disk: A minimum of 70 Mb is recommended.

Monitor: The BCD System can be used with a monochrome or color monitor.

Printer: Laser printer or dot-matrix printer.

Tape Backup Unit: Mountain (or similar) unit is strongly recommended for backing up large amounts of data.

Memory: Two megabytes of RAM minimum.

Disk Caching: If a computer with disk caching is to be used with the BCD, the disk caching should have the ability to be disabled. An IDE type hard disk with disk caching should not be used.

The following are registered trademarks of the companies herewith: Advanced Revelation: Revelation Technologies, Inc.; IBM: International Business Machines Corporation.

PHOTOCOPY
PRESERVATION

The Nature Conservancy

**PHOTOCOPY
PRESERVATION**

*The
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PRESERVATION**

*The
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A black and white map of North and Central America. The map shows the outlines of the continents, with internal lines representing state or provincial boundaries. A stippled or dotted pattern is applied to the landmasses, while the surrounding oceans are left blank. The map includes Alaska, Canada, the United States, Mexico, Central America, the Caribbean islands, and northern South America.

Natural Heritage Program & Conservation Data Center Network

March 1993

NATURAL HERITAGE PROGRAM & CONSERVATION DATA CENTER NETWORK

Natural Heritage Programs (NHPs) and Conservation Data Centers (CDCs) are continually updated, computer assisted inventories of the biological and ecological features and biodiversity preservation of the country or region in which they are located. These data centers are designed to assist in conservation planning, natural resource management, environmental impact assessment and planning for sustainable development.

The Network: Where are The NHPs and CDCs

There are now 85 data centers operating in the western hemisphere including all 50 U.S. states (most are called Natural Heritage Programs), several U.S. Bioreserves and National Parks, Puerto Rico, three Canadian provinces, and 13 countries in Latin America (CDCs) and the Caribbean. Regional centers provide administrative and technical support to the individual programs.

Each data center is established within a local institution, most frequently as part of a government agency responsible for natural resource management and protection. While individual centers are under local control and are staffed by local scientists and conservationists, they also operate within a network. Tasks that only need be done once for all the CDCs and Heritage Programs, are apportioned to one unit with the results shared throughout the network.

Methodology: How the NHPs and CDCs Work

Each data center uses the Biological and Conservation Data System as the basis for its operation, a system developed and refined by The Nature Conservancy since 1974. The information is managed in more than 30 interrelated computer files, supported by extensive map and manual files, and a library. A trained staff of biologists, natural resource specialists and data managers interprets the data for use in local conservation and development planning, natural resource management and environmental impact assessment.

Information assembled and managed by data centers focuses on: ecosystems and species, their biology, habitats, locations, conservation status and management needs; managed areas such as National Parks, Forest Reserves, and watersheds; and on data sources.

Each center compiles information from existing sources such as scientific literature, knowledgeable people, and museum collections. The local staff also directs and conducts field inventories of species and natural communities of special concern, or may be contracted for biological assessments of specific sites. Each study and report benefits from earlier work in the same area and, through the network, related information gathered at other times and places multiplies the local effort. Central network databases are supported through cooperative agreements with academic and scientific institutions.

The Nature Conservancy's Role

The Nature Conservancy is involved in the establishment and operation of the CDCs by providing technical, scientific and administrative support and training. The Conservancy also makes available the computer technology, data inventory and management methodology, and procedure manuals used by CDCs and Natural Heritage Programs. The methodology constantly undergoes improvements as part of the partnership between the data centers and The Nature Conservancy. These continual advancements ensure that the entire network remains responsive to the needs of the conservation and development communities.

All told, there are over 400 biologists and computer technicians dedicated to the combined effort, with several hundred others working part-time on biological inventories and research. The Nature Conservancy is the administrative center of this network, promoting communications and the exchange of data, solutions and expertise throughout the network.

Applications: How NHPS and CDCs Are Used

Conservation Planning: The data center's integrated biological and land-use information is used to identify critical areas in need of protection, and to establish conservation priorities on a regional, national and global basis.

Development Planning: To help facilitate design and implementation of ecologically sound development projects, data centers provide biological and ecological information to multilateral development banks, bilateral development agencies, corporations both multi-national and local, as well as in-country governmental agencies.

Park and Protected Area Management: Wise stewardship of natural areas requires detailed knowledge of sensitive and endangered biological features. Information maintained by Heritage Programs and CDCs on parks, forest reserves, and wild areas, and the management requirements of their biological elements, is used to improve management practices.

Research and education: Results from each center's inventory work guides new basic applied scientific research. The biological databases represent an important resource for long-term environmental monitoring.

For more information contact the Science Division (703) 841-4888.

March 1993

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UNITED STATES (3/93)

State Heritage Programs

(Please use names & addresses when dialing FAX)

ALABAMA NATURAL HERITAGE SECTION

Dept. of Conservation & Natural Resources
Division of Lands

Folsom Administration Building

64 N. Union St., Room 421

Montgomery, AL 36130

205/242-3484 FAX: 205/242-0999

COORDINATOR/BOTANIST: Scott Gunn

ZOOLOGIST: Mark Bailey

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AQUATIC ZOOLOGIST: Jim Godwin

DATA MANAGER: vacant

BOTANIST: vacant

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Anchorage, AK 99501

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VEG.ECOL: Keith Boggs

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ZOOLOGIST: Ed West

DATA MANAGER: Julie Michaelson

ASST.DATA MGR: Randall Collins

ADM.ASST: Marilee Clack Tande

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602/789-3612 FAX: 602/789-3920

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COORDINATOR: Barry Spicer

DATA MANAGER: Sabra Schwartz

SYSTEMS MGR: Dale Ward

DATA MGMT. ASST: Dusti Ide

DATA MGMT. ASST: vacant

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323 Center Street

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DEPUTY DIRECTOR: Mina Marsh

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PR/EDUCATION: Bill Shepherd

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OFFICE MANAGER: Peggy Gibson

CALIFORNIA NATURAL HERITAGE DIVISION

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Dept. of Fish & Game

1416 9th Street, 12th floor

Sacramento, CA 95814

916/322-2493 FAX: 916/324-0475

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ASST BOTANIST: Tim Nosal, 327-0715

ZOOLOGIST: Darlene McGriff, 322-2494

ASST ZOOLOGIST: Dee Warenycea, 322-7307

ASST ZOOLOGIST: Eric Kleinfelter, 323-0449

ECOLOGIST: Todd Keeler-Wolf, 324-6857

ASSOC ECOLOGIST: Cyndi Roye, 324-3818*

ASSOC ECOLOGIST: Kari Lewis, 322-1869

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LNAP

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ASST PROT PLANNER: Michael Byrne, 322-1950*

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*TNC Contract Staff

COLORADO NATURAL HERITAGE PROGRAM

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Hunter 115
Campus Box 315
Boulder, CO 80309-0315
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ECOLOGIST/BOT: Steve Kettler -4637
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Natural Resources Center
Department of Environmental Protection
State Office Building, Rm. 553
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BOTANIST: Les Mehrhoff
ECOLOGIST: Ken Metzler
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89 Kings Hwy
Dover, DE 19903
302/739-5285 FAX: 302/739-3817
COORDINATOR: vacant
ECOLOGIST/BOT: Keith Clancy -3421
BOTANIST: Bill McAvoy
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DISTRICT OF COLUMBIA

(Contact Headquarters Heritage Task Force)

FLORIDA NATURAL AREAS INVENTORY

1018 Thomasville Rd.
Suite 200-C
Tallahassee, FL 32303
904/224-8207; 224-0626 FAX: 904/681-9364
COORDINATOR: Jim Muller
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ECOLOGIST: Steve Orzell
SENIOR BOTANIST: Richard Hilsenbeck
RES.SCI BOT/ECOLOGY: Ann Johnson
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RES.ASST/DATA HNDLR-EGLIN: Angela Crook
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GIS MANAGER/SCIENTIST: Chengxia You
GIS SCIENTIST: Scott Taylor
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SECRETARY: vacant

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HERITAGE INVENTORY**

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2117 U.S. Highway 278 S.E.
Social Circle, GA 30279
706/557-2514 FAX: 706/557-2770
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GIS SPECIALIST: Christopher Canalos
SPECIAL PROJ. BOTANIST: James Allison
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HAWAII HERITAGE PROGRAM

The Nature Conservancy of Hawaii
1116 Smith St., Suite 201
Honolulu, HI 96817

808/537-4508 FAX: 808/545-2019

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BOTANICAL SPEC: Joel Lau
BOTANIST: Joan Yoshioka
ASSOC.BOTANIST: Gail Chun
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ASSOC.ECOLOGIST: Bill Garnett
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SECTION MGR/MAMMALOGIST: Jim Garner

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DATABASE PROJ.MGR: Jean Karnes

DB PROJ.MGR (TNC): Susan Holmes 782-2685

DATABASE OFFICE ASSOC: Robin Casson

Endangered Species Conservation Program

PROGRAM MANAGER: Deanna Glosser

PROJECT MGR: Glen Kruse

OFFICE ASSOC: Louise Myers

Natural Areas Program

PROGRAM MANAGER: Don McFall

PROJECT MGR: Bill McClain

Botany Program

PROGRAM MANAGER: John Schwegman

Avian Ecology Program

PROGRAM MANAGER: Vernon Kleen

INDIANA NATURAL HERITAGE DATA CENTER

Div. of Nature Preserves

Department of Natural Resources

402 W. Washington St., Rm. W267

Indianapolis, IN 46204

317/232-4052 FAX: 317/232-8036

COORDINATOR/BOT: Cloyce Hedge

ECOLOGIST/BOT: Mike Homoya

ECOLOGIST: Roger Hedge

ENV.REV/ECOL: Hank Huffman

DATA MGR/ZOOL: Michelle Martin

IOWA NATURAL AREAS INVENTORY

Bureau of Preserves & Ecological Services

Dept. of Natural Resources

Wallace State Office Bldg.

Des Moines, IA 50319

515/281-8524 FAX: 515/281-8895

COORDINATOR/ZOOL: Daryl Howell -8524

ECOLOGIST: John Pearson -3891

BOTANIST: vacant

DATA HANDLER: John Fleckenstein -8967

KANSAS NATURAL HERITAGE INVENTORY

Kansas Biological Survey

2041 Constant Ave.

Lawrence, KS 66047-2906

913/864-3453 FAX: 913/864-7789

COORD/BOTANIST: Craig Freeman -3453

ZOOLOGIST/DATA MGR: Bill Busby -7692

ECOLOGIST: Chris Lauver -7691

ECOLOGIST: Kelly Kindscher -7698

KENTUCKY HERITAGE PROGRAM

KY Nature Preserves Commission
407 Broadway
Frankfort, KY 40601
502/564-2886

ACTING DIRECTOR/BOT-ECOL: Marc Evans
SEC 6 COORD/BOTANIST: Margaret Shea
SPECIAL PROJECTS/BOTANIST:
Deborah White
AQUATIC BIOLOGIST: Ronald Cicerello
LAND PROTECTION SPECIALIST:
Landon McKinney
TERRESTRIAL ZOOLOGIST:
Brainard Palmer-Ball
STEW COORD: Joyce Bender
STEW ASST: Cynthia Campbell
ASST PRESERVE MGR: Kristin Snyder
DATA MGR/BOTANIST: Tom Bloom
ASST DATA MGR: Laurel McNeil
EXEC SEC/OFFICE MGR: Linda Pollock
SECRETARY: Melissa Shramm

LOUISIANA NATURAL HERITAGE PROGRAM

Department of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000

504/765-2821 FAX: 504/765-2607
COORDINATOR: Gary Lester -2823
BOTANIST: Julia Larke -2975
ECOLOGIST: Latimore Smith -2976
ZOOLOGIST: Steve Shively -2820
NONGAME BIOL: Bill Vermillion -2976
SECRETARY: Audry Cashio -2821
FT.POLK INV.COORD: Barbara Hart -2643
DATA MGR: vacant

MAINE NATURAL HERITAGE PROGRAM

Office of Community Development
State House Station 130
219 Capitol Ave.
Augusta, ME 04333
207/624-6800 FAX: 207/624-6810
COORDINATOR/ZOOL: John Albright -6807
ECOLOGIST: Susan Gawler -6847
DATA TECHNICIAN: Molly Docherty

MARYLAND NATURAL HERITAGE PROGRAM

Dept. of Natural Resources
Tawes State Office Bldg., E-1
Annapolis, MD 21401
410/974-2870 FAX: 410/974-5592
DIRECTOR: Janet McKegg
C.REG.ECOLOGIST: Rodney Bartgis, 301/416-2503
W.REG.ECOLOGIST: Ed Thompson, 301/689-8215
W.ENV.SPECIALIST: Dan Feller
W.ENV.SPECIALIST: Ashton Berdine
W.REG.REGISTRY: Ken Hotopp
END.SPEC.BIOLOGIST: Laurie MacIvor
ENV.SPECIALIST: Richard Wiegand
E.REG.ECOLOGIST: Katharine McCarthy
E.REG.REGISTRY: Doug Samson
E.REG.REGISTRY: Julie Modlin
DATABASE COORD: Lynn Davidson
DATABASE BOTANIST: Gene Cooley
DATABASE ZOOLOGIST: Judy Harding
DATABASE ASST: Christine Simoes
CHESAPEAKE BAY ECOLOGIST: Wayne Tyndall
ENV.REV.COORD: Cynthia Sibrel
EVN.REV.SEC'Y: Dorothy Crowner
SECRETARY: Deborah Brooks

MASSACHUSETTS NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM

Div. of Fisheries & Wildlife
100 Cambridge St.
Boston, MA 02202
617/727-9194 FAX: 617/727-7288
ASSISTANT DIRECTOR: Tom French
COORDINATOR: Henry Woolsey
BOTANIST: Paul Somers, 508/792-7270
ZOOLOGIST: Scott Melvin, 508/792-7270
ORNITHOL: Brad Blodget, 508/792-7270
ECOLOGIST: Pat Swain
ENVIR.REVIEW: Jay Copeland
WETLANDS ENVIR.REVIEW: Pat Huckery
INFO.SYSTEMS MGR: Gretchen Eliason
SEC'Y/ENVIR.REVIEW ASST: Diane Lauber
EAGLE PROJECT LDR: Bill Davis, 508/792-7270
ASST DATA MGR: Kelly Slater
NEWSLETTER WRITER/EDITOR: Sally Carroll

MICHIGAN NATURAL FEATURES INVENTORY

Mason Building, 5th floor

Box 30028

Lansing, MI 48909

517/373-1552 FAX: 517/373-6705

(COORDINATOR: Leni Wilsmann, 373-7565 on temporary assignment)

ACTING COORDINATOR/RESEARCH BIOL:

Judy Soule, 335-4581

FIELD COORDINATOR/ECOLOGIST: Dennis Albert, 335-4580

ZOOLOGIST: Mary Rabe, 335-4843

ASSOC. ECOLOGIST: Patrick Comer, 335-4581

BOTANIST: Mike Penskar, 335-4582

ASST.BOTANIST: Elaine Chittenden, 335-3973

INFORMATION MGR: Lyn Scrimger, 373-1599

ASST. INFO MGR: Teresa Leibfried, 373-1599

PROTECTION SPECIALIST: Kim Herman, 373-1263

ASST. PROTECTION SPEC: Will MacKinnon

LANDOWNER CONTACT ASST: John Paskus, 373-9405

ADMIN.ASST: Suzanne Ridge, 373-1552

MINNESOTA NATURAL HERITAGE PROGRAM

Department of Natural Resources

500 Lafayette Rd., Box 7

St. Paul, MN 55155

612/296-3344 FAX: 612/297-4961

ACT.COORDINATOR: Robert Dana

BOTANIST: Welby Smith

BOTANIST/ECOLOGIST: Nancy Sather

ECOLOGIST: Kurt Rusterholz

ECOLOGIST: Jan Wolff

INFO.SYST.MGR: Al Epp

GRAPHICS ART: Tom Klein

PUBLIC RELATIONS COORD: B.J. Farley

Nongame Wildlife Research Program:

ACTING SUPV: Bonita Eliason

GRANTS COORD: Richard Baker

DATABASE MANAGER: Mary Miller

DATA MGMT.ASST: Cindy Thurston

DATA MGMT.ASST: Sharron Nelson

County Biological Survey:

COORDINATOR: Carmen Converse

ECOLOGIST/BOT: Norm Aaseng

ECOLOGIST/BOT: Robert Dana

ECOLOGIST/BOT: Barb Delaney

ECOLOGIST/BOT: Hannah Dunevitz

ECOLOGIST/BOT: Fred Harris

ECOLOGIST/BOT: Donna Sheridan

ECOLOGIST/BOT: Scott Zager

ANIMAL COORD: Gerda Nordquist

ANIMAL SURVEY: Steve Stucker

ANIMAL SURVEY: Carol Dorff

ANIMAL SURVEY: Karl Bardon

TECHNICAL WRITER: Dan Wovcha

MISSISSIPPI NATURAL HERITAGE PROGRAM

Museum of Natural Science

111 N. Jefferson St.

Jackson, MS 39201-2897

601/354-7303 FAX: 601/354-7227

COORDINATOR/BOTANIST: Ken Gordon

ECOLOGIST: Ronald Wieland

ZOOLOGIST: Tom Mann

NATURAL AREAS STEWARD: vacant

DATA HANDLER: Brigitte Cliburn

MISSOURI NATURAL HERITAGE INVENTORY

Missouri Dept. of Conservation

P.O. Box 180

FedEx: 2901 W. Truman Blvd.

Jefferson City, MO 65102

314/751-4115 FAX: 314/893-6079

PROGRAM ADMINISTRATOR: Rick Thom-x193

END.SPEC.COORDINATOR: Dennis Figg-x309

WILDLIFE ECOLOGIST: Rozalynn Johnson -x647

ECOL/BOTANIST: Tim Nigh-x296

BOTANIST: Tim Smith-x200

COMPUTER SPECIALIST: Rick Wolters-x310

DATABASE MGR: Dorothy Butler-x310

SECRETARY: Diana Munsterman-x204

MONTANA NATURAL HERITAGE PROGRAM

State Library Building

1515 E. 6th Ave.

Helena, MT 59620

406/444-3009 FAX: 406/444-5612

COORDINATOR/ZOOL: David Genter -3019

ZOOLOGIST: Jim Reichel -2546

BOTANIST: Bonnie Heidel -0536

ECOLOGIST: vacant

DATA MGR: Margaret Beer -3009

ASST. DATA MANAGER: Cory Craig -3488

MAPPING/GIS SPEC.: Cedron Jones -3488

USFS Region 1

Federal Bldg. PO Box 7669

Missoula, MT 59807

BOTANIST (WLF): Steve Shelly-406/329-3041

NATURAL AREAS ECOL (RAWE): Steve Chadde
406/329-3141

NEBRASKA NATURAL HERITAGE PROGRAM

Game and Parks Commission

2200 N. 33rd St.

P.O. Box 30370

Lincoln, NE 68503

402/471-5421 FAX: 402/471-5528

ZOOLOGIST: Mary Kay Clausen -5421

BOTANIST: Mike Fritz -5419

ECOL/DATA MGR: Gerry Steinauer -5469

DATA CLERK: Jan Hyngstrom

NEVADA NATURAL HERITAGE PROGRAM

Dept. of Conservation & Natural
Resources
123 W. Nye
Carson City, NV 89710
702/687-4245 FAX: 702/885-0868
COORDINATOR/ZOOL: Glenn Clemmer
BOTANIST: Jim Morefield
DATA MANAGER: Kevin Cooper

**NEW HAMPSHIRE NATURAL HERITAGE
INVENTORY**

Dept. of Resources & Economic Development
172 Pembroke St.
P.O. Box 856
Concord, NH 03301
603/271-3623 FAX: 603/271-2629
COORDINATOR/BOT: David Moore
ECOLOGIST: Dan Sperduto
DATA MANAGER/BIOLOGIST: Andy Cutko

NEW JERSEY NATURAL HERITAGE PROGRAM

Office of Natural Lands Management
501 E. State St., CN404
Trenton, NJ 08625
609/984-1339 FAX: 609/984-1427
COORD/ECOL: Tom Breden, 984-0097
BOTANIST: David Snyder, 984-7849
ZOOLOGIST: Rick Dutko, 984-0059
ASSOC.ECOLOGIST: Andy Windisch, 984-7370
DATA MGR: Elena Williams, 633-2765

NEW MEXICO NATURAL HERITAGE PROGRAM

University of New Mexico
2500 Yale Blvd., SE, Suite 100
Albuquerque, NM 87131-1091
505/277-1991 FAX: 505/277-7587
DIRECTOR/RES.ZOOL: Pat Mehlhop -5600
RES.ECOLOGIST: Esteban Muldavin -1982
RES.BOTANIST: Ellen DeBruin -1983
DATA MGR: Tina Carlson -1991

NEW YORK NATURAL HERITAGE PROGRAM

Dept. of Environmental Conservation
700 Troy-Schenectady Rd.
Latham, NY 12110-2400
518/783-3932 FAX: 518/783-3916
COMPUTER: 518/783-3946
COORD/ZOOL: Kathryn Schneider
ECOLOGIST: Carol Reschke
BOTANIST: Stephen Young
INFO MGR: Rachel Pleuthner -3944
INFO MGMT ASST: Nicholas Conrad
INFO MGMT ASST: Nancy Davis-Ricci
ASSOC.ECOL/BOTANIST: Kathleen Strakosch
ASSOC. ZOOL: Paul Novak
MIGRATORY BIRD PROJ COORD: Kris Agard
716/546-8030

NORTH CAROLINA NATURAL HERITAGE

Dept. of Environment, Health &
Natural Resources
Div. of State Parks & Recreation
Box 27687
Raleigh, NC 27611
919/733-7701 FAX: 919/733-2622
COORDINATOR: Linda Pearsall -7701
BOTANIST/ASST COORD: Alan Weakley -7701
PROTECTION SPEC: Ann Prince
ZOOLOGIST: Harry LeGrand, Jr. -4181
ECOLOGIST: Mike Schafale -4181
INVERT.ZOOL/DATA MGR: Steve Hall -7701
INV.SPEC/BOTANIST: Ann Kelly -7701
STATE PARK INVENTORIES: Benson Kirkman

**NORTH DAKOTA NATURAL HERITAGE
INVENTORY**

N.D. Parks & Tourism Department
604 East Boulevard Avenue
Bismarck, ND 58505
701/224-4892 FAX: 701/224-4878
PLANNING & NAT.RES.COORD: Jesse Hanson
NATURE PRESERVES COORD: Kathy Armstrong
ZOOLOGIST: Randy Kreil
N.D. Game & Fish Dept.
100 N. Bismarck Expressway
Bismarck, ND 58501
701/221-6321

OHIO NATURAL HERITAGE PROGRAM

Div. of Natural Areas & Preserves
Dept. of Natural Resources
Fountain Square, Bldg. F
Columbus, OH 43224
614/265-6453 FAX: 614/267-3096
DIV.CHIEF: Ralph E. Ramey -6452
Data Management Unit:
SUPERVISOR: Pat Jones -6472
DATA SPEC: Debra Woishke -6818
DATA SPEC: Jennifer Hillmer -6409
Botanical Inventory Unit:
CHIEF BOTANIST: Allison Cusick -6471
BOT. (Marietta,OH): Marilyn Ortt 373-3372
Zoological Inventory Unit:
CHIEF ZOOLOGIST: Dan Rice -6469

OKLAHOMA NATURAL HERITAGE INVENTORY

Oklahoma Biological Survey
2001 Priestly Ave., Bldg. 605
Norman, OK 73019-0543
405/325-1985 FAX: 405/325-7702
COORD/BOTANIST: Linda Watson -5357
DATA MGR: Ian Butler -5386, 7599
TERRESTRIAL ZOO: Mark Lomolino -2440
AQUATIC ZOO: Caryn Vaughn -2753
PLANT COMM ECOL: Bruce Hoagland -5374
SEC/ACCOUNTANT: Karla Anderson -1985
Main Biological Survey office
405/325-4034
DIRECTOR: Gary Schnell
ADMIN ASST: Marsha Womack
RECEPTIONIST: Pam Pogorelc

OREGON NATURAL HERITAGE PROGRAM

Oregon Field Office
1205 NW 25th Avenue
Portland, OR 97210
503/229-5078 FAX: 503/228-3153
COORD/ECOLOGIST: Jimmy Kagan
ZOOLOGIST: Mark Stern
ZOOLOGY DATA HANDLER: Eleanor Gaines
FIELD BOTANIST: Peter Zika
DATA MGR/BOTANIST: Sue Vrilakas
WETLANDS/AQ.ECOL: John Christy

PENNSYLVANIA NATURAL DIVERSITY INVENTORY

PNDI-EAST

The Nature Conservancy
34 Airport Dr.
Middletown, PA 17057
717/948-3962 FAX: 717/948-3957
COORDINATOR: Anthony Wilkinson
ECOLOGIST: Anthony Davis
ECOLOGY RES.ASST: Julie Lundgren
BOTANIST: John Kunsman
INFO. MANAGER: Jill Belfonti
ZOOLOGIST: Barbara Barton

PNDI-WEST

Western Pennsylvania Conservancy
Natural Areas Program
316 Fourth Ave.
Pittsburgh, PA 15222
412/288-2777 FAX: 412/281-1792
COORDINATOR/BOT: Paul Wiegman -2774
ECOLOGIST: Charles Bier
DATA MGR: Chris Boget
DATA HANDLER: Bernie Beck

BUREAU OF FORESTRY

PA Dept. of Environmental Resources
P.O. Box 8552
Harrisburg, PA 17105-8552
717/783-0388
STATE COORD/BOT: Kathy McKenna -0388
BOTANIST: Edward Dix -0392

RHODE ISLAND HERITAGE PROGRAM

Dept. of Environmental Mgmt.
Div. of Planning & Development
83 Park St.
Providence, RI 02903
401/277-2776 FAX: 401/277-2591
COORDINATOR/BOT: Rick Enser
ENVIR.PLAN/DATA MGR: Joanne Michaud

SOUTH CAROLINA HERITAGE TRUST

S.C. Wildl. & Marine Resources Dept.
P.O. Box 167
Columbia, SC 29202
803/734-3893 FAX: 803/734-4086 (CALL 1st)
SECTION CHIEF: Tom Kohlsaas, 734-3912
COORDINATOR: Steve Bennett -3930
LAND PROT.COORD: Stu Greeter -3918
LAND PROT.ASST.: Mike Smith
BOTANIST: Albert Pittman -3920
DATA MANAGER: Kathy Boyle -4032
PRESERVE MGR: Jim Sorrow, 654-6738
PRESERVE MGR: Mary Strayer 654-6738
PRESERVE MGR: Jeffrey McLeMore 4037

SOUTH DAKOTA NATURAL HERITAGE

S.D. Dept. of Game, Fish & Parks
Wildlife Division
523 E. Capitol Ave.
Pierre, SD 57501-3182
605/773-4227 FAX: 605/773-6245
BOT/ECOLOGIST: Dave Ode -4227
NONGAME BIOL: Eileen Dowd -4229
DATA MGR: Doug Backlund -4345

ECOLOGICAL SERVICES DIVISION

Tennessee Dpt Environ. & Conserv.
Life and Casualty Tower
401 Church Street
Nashville, TN 37243-0447
615/532-0431 FAX: 615/532-0120
DIRECTOR: Reggie Reeves -0434
NAT.AREAS & HER.COOR: Daryl Durham
ZOOLOGIST: Paul Hamel
BOTANIST: vacant
DB MGR/COMM ECOL: Andrea Shea
ENV.REV.COORD: Betsy Bunting
ADM.SECRETARY: Sandy Poole

TEXAS PARKS AND WILDLIFE DEPARTMENT

Endangered Resources Branch
3000 IH-35 Wouth, Ste.100
Austin, TX 78704
512/448-4311 FAX: 512/440-8887
BRANCH CHIEF: Gary Graham
HERITAGE COORD: David Diamond, -20
BRANCH SEC'Y: Jeannette Martinez, -40
END.SPECIES BIOL: LeeAnn Linam, -18
END.SPECIES BIOL: David Hernandez, -26
ZOOLOGIST: Andy Price, -22
ZOOLOGIST: Dean Keddy-Hector, -25
ADMIN.TECH.I: Linda F. Moales, -11
BOTANIST: Jackie Poole (2/93)
BOTANIST: Bill Carr, -24
DATA MGR: Dorinda Sullivan, -23
ASST.DATA MGR: Shannon Breslin, -21
RTC REVIEW COORD: Paul Turner, -46

UTAH NATURAL HERITAGE PROGRAM

1636 West North Temple, Ste.316
Salt Lake City, UT 84116-3193
801/538-7201 FAX: 801/538-7315
COORDINATOR: Doug Stone
BOTANIST: Ben Franklin -7223
ZOOLOGIST: Robin Toone -7247
DATA MANAGER: Joel Peterson -7246

VERMONT NATURAL HERITAGE PROGRAM

Agency of Natural Resources
Center Building
103 S. Main St.
Waterbury, VT 05671-0501
802/244-7331 FAX: 802/244-1102
INV.COORDINATOR/ZOOL.: Chris Fichtel
WILDLIFE BOTANIST: Bob Popp
DATA MANAGER/BIOL.: Everett Marshall

VIRGINIA DIVISION OF NATURAL HERITAGE

Dept. of Conservation & Recreation
Main Street Station
1500 E. Main St., Suite 312
Richmond, VA 23219
804/786-7951 FAX: 804/371-2674
DIV. DIRECTOR: Tom Smith, 371-6206
INVENTORY COORD: Leslie Trew, 371-6206
EXEC.SEC'Y: Pat Jarrell, 371-2671
SEC/RECPT: Faye McKinney, 786-7951
ZOOLOGIST: Steve Roble, 786-8633
BOTANIST: Chris Ludwig, 225-4855
BOTANY SPEC: Nancy VanAlstine, 786-8646
FIELD BOTANIST: Allen Belden
ECOLOGIST: Chris Clappitt, 225-4856
VEG.ECOLOGIST: Tom Rawinski, 371-6203
FIELD ECOLOGIST: Gary Fleming
FIELD ZOOLOGIST: vacant, 371-6202
ZOOLOGY SPEC: Phil Stevenson, 786-8646
INFORMATION MANAGER: Steve Carter-Lovejoy,
786-8377
INFORMATION MGMT ASST: Sarah Holbrook
INFORMATION SPEC: Tracy O'Connell, 786-7951
ENVIR.REV.COORD: Tim O'Connell, 786-8646
ENVIR.PROG.SPEC: Megan Rollins, 786-8646
NATURAL AREAS MGR: Larry Smith, 371-6205
FIELD ORNITHOLOGIST: Sarah Mabey
STEW. COORD: Caren Caljouw, 371-6204
STEW. ASST: Kennedy Clark, 371-2672

WASHINGTON NATURAL HERITAGE PROGRAM

Department of Natural Resources

1111 Washington St. SE

Olympia, WA 98504-7047

206/902-1650 FAX: 206/902-1788

COORDINATOR/BOT: Mark Sheehan -1664

WETLAND ECOLOGIST: Linda Kunze -1662

PLANT ECOLOGIST: Rex Crawford -1660

PLANT ECOLOGIST: Chris Chappell -1671

ZOOLOGIST: Sandy Andelman -1672

BOTANIST: John Gamon -1661

BOTANIST: Debra Salstrom -1674

INFO.SYSTEM MGR: Deborah Naslund -1666

ASST INFO MGR: Jack McMillen -1673

ENV.REVIEW COORD: Sandy Norwood -1667

SECRETARY: Dorian Smith -1701

Natural Areas Program

Dept. of Natural Resources

P.O. Box 47046

Olympia, WA 98504-7046

206/902-1650 FAX: 206/902-1788

MANAGER: Michael Perez-Gibson -1653

NATURAL AREA SCI: Reid Schuller -1679

CONSERVATION BIOL: Janie Friebaum -1655

NAT.RESOURCE TECH: Birdie Davenport -1677

WEST VIRGINIA NATURAL HERITAGE PROGRAM

Dept. of Natural Resources

Operations Center

Ward Road

P.O. Box 67

Elkins, WV 26241

304/637-0245 FAX: 304/637-0250

COORDINATOR: Brian McDonald, x55

BOTANIST: P.J. Harmon, x42

DATA MANAGER: Barbara Sargent

ECOLOGIST/WVFO: Paul Trianosky

WISCONSIN NATURAL HERITAGE PROGRAM

Endangered Resources/4

Dept. of Natural Resources

101 S. Webster St., Box 7921

Madison, WI 53707

608/266-0924 FAX: 608/267-3579

BUREAU SECTION CHIEF: Charles Pils, 266-2625

ACTING COORDINATOR: Randy Jurewicz, 267-7507

ECOLOGIST: Eric Epstein, 267-5038

BOTANIST: June Dobberpuhl, 267-5037

DATA MGR/BOTANIST: Thomas Meyer, 266-0394

ZOOLOGIST: Bill Smith, 266-0924

ENV.REVIEW SPEC: Chris Reynolds

ENV.REVIEW SPEC: Diane Mochon, 267-4585

ENV.REVIEW SPEC: Cathy Bleser

ENV.REVIEW SPEC: Karen Agee, 266-3336

ENV.REVIEW SPEC: John Pohlman, 264-6263

ENV.REVIEW TECH: Elizabeth Spencer

ENV.REVIEW SPEC/MAPPER: Rebecca Isenring

MAPPING SPECIALIST: Julie Bleser

WYOMING NATURAL DIVERSITY DATABASE

3165 University Station

Laramie, WY 82071

307/766-3441 FAX: 307/766-2271

COORDINATOR/ECOL: George Jones -2720

ZOOLOGIST: Chris Garber

RIPARIAN ECOLOGIST: Jill Walford

BOTANIST: Walt Fertig

DATA MGR/BOT.RES.ASST: Mary Neighbours

Regional Heritage Data Centers

NAVAJO NATURAL HERITAGE PROGRAM

Navajo Fish & Wildlife

P.O. Box 1480

Window Rock, AZ 86515-1480

602/871-6472 FAX: 602/871-6177 or 7040

COORD./ECOLOGIST: Mike Tremble -7059

BOTANIST: Bill Hevron -7639

SYSTEM ANALYST I: Annette Polt -7603

SYSTEM ANALYST II: Carol Yazzie -7061

BIOLOGIST II: John Nystedt -7060

ZOOLOGIST: Patrick Ryan -7638

ZOOLOGIST: Gregory Aldrich -7638

ZOOLOGIST: vacant

ENVIRONMENTAL SPEC: vacant

WILDLIFE TECH: Steven P. Bahe -7070

STEWARDSHIP/CONS.ED: Steve Chischilly -7070

NATURAL RES.TECH: Ruby Hale -7061

SECRETARY: Rosemary Haskie -6472

TVA REGIONAL HERITAGE

River Basin Operations

Wildlife & Natural Heritage Resources

Norris, TN 37828

615/632-1593 FAX: 615/632-1612

COORDINATOR: William H. Redmond,
632-1593

BOTANIST: Joseph L. Collins, 632-1594

BIOL/BOT: Terri Smith, 632-1576

NAT.AREAS COOR: Judith Bartlow, 632-1592

ZOOL: Charles P. Nicholson, 632-1590

ZOOL.(AQUATIC): Peggy Shute, 632-1661

DATA MGR: Susan Jeffers, 632-1598

WETLANDS SCIENTIST: Burline Pullin, 632-1642

National Park Data Centers

NATIONAL PARK SERVICE

c/o Trish Patterson

75 Spring Street, SW

Atlanta, GA 30303

404/331-4916

REGIONAL DATA MGR: Clifton Eakes

BLUE RIDGE PARKWAY

700 Northwestern Plaza

Ashville, NC 28801

704/259-0760

NAT.RESOURCE MGMT. SPEC: Bambi Teague

EVERGLADES RESEARCH CENTER

EVERGLADES NATIONAL PARK

c/o Biology Department

P.O. Box 249118

University of Miami

Coral Gables, FL 33124

305/284-3013 FAX: 305/284-3039

MARINE ECOLOGIST: Kathleen Sullivan

DATA MANAGER: Mark Chiappone

GREAT SMOKY MTNS. NATIONAL PARK

Natural Resources Management

ATTN: Janet Rock

107 Park Headquarters Rd.

Gatlinburg, TN 37738

615/436-1250

COORD/RES MGMT SPEC: Keith Langdon -1250

GIS COMPUTER OP: Sue Powell -1298

BOTANIST: Janet Rock -1254

SCI/DATA MANAGER: Andy Finton -1254

GULF ISLANDS NATIONAL SEASHORE

1801 Gulf Breeze Parkway

Gulf Breeze, FL 32561

904/934-2605

RES.MGMT. SPECIALIST: vacant

MAMMOTH CAVE NATIONAL PARK

Division of Science and Resource Mgmt.

Mammoth Cave National Park

Mammoth Cave, KY 42259

502/758-2238

CHIEF, SCIENCE & RES.MGMT: Jeff Bradybaugh

COMPUTER SPECIALIST: Anthony Gareau

GREATER YELLOWSTONE CONSERVATION DATA CENTER

c/o Stu Coleman @ Yellowstone National Park

P.O. Box 168

Yellowstone National Park, WY 82190

307/344-2157 FAX: 307/344-2158

COORDINATOR/ZOOLOGIST: Peter Feigley

BOTANIST/DATA MANAGER: Jennifer Whipple

National Forest Data Centers

NATIONAL FOREST IN FLORIDA

Dept. of Agriculture
227 N. Bronough St., Ste.4016
Tallahassee, FL 32301
904/681-7329 FAX: 904/681-7144
COORDINATOR/BOTANIST: Guy Anglin

NATIONAL FOREST IN NORTH CAROLINA

P.O. Box 2750
Asheville, NC 28802
704/257-4810
FOREST BOTANIST: Steve Simon

OUACHITA NATIONAL FOREST

P.O. Box 1270
Hot Springs, AR 71902
501/321-5323
DISTRICT WIDE BOTANIST: Susan Hooks

VIRGINIA COAST RESERVE

The Nature Conservancy
P.O. Box 158
Brownsville Road
Nassawadox, VA 23413
804/442-3049 FAX: 804/442-5418
DIRECTOR: John M. Hall
ASST.PRES.MGR: Barry R. Truitt
AA: Karen B. Hall
SECY: Lynn M. Badger
CARETAKERS: Charlie T. Farlow
Jacqueline M. Farlow
GRNDSKPR/HSEKPR: Anne Truitt

CANADA

Provincial Programs

BRITISH COLUMBIA CONSERVATION DATA CENTRE

Wildlife Branch

Ministry of Environment

780 Blanshard St.

Victoria, BC V8V 1X5

604/356-0928 FAX: 604/356-9145

COORDINATOR: Andrew Harcombe, 387-9798

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Biological and Conservation Data System

The Biological and Conservation Data (BCD) System is a PC-based data management package that facilitates the collection, distribution, and exchange of information pertinent to the preservation of biological diversity. Major classes of data in the BCD System include information on species and community types and occurrences, sites, land ownership parcels, managed areas, and sources of information. The BCD System is extremely flexible with regard to data retrieval, report generation, and data manipulation, and it embodies the full power of a state-of-the-art database management system (Advanced Revelation). The BCD System represents The Nature Conservancy's sixth generation of biodiversity data management software; it is now the standard tool for managing and exchanging biodiversity inventory data in the Natural Heritage Data Center Network.

Features & Benefits

- Menu-driven operation
- Command-level operation
- Flexible reporting
- Full array of utility routines
- Large User Community
- Excellent performance with large data sets
- Standardization facilitates data exchange
- Data export capabilities for transfer of information to other standard GIS (ARC-INFO, GRASS, etc.) or other database applications

Software requirements

PC/MS DOS, Advanced Revelation database management system (version 2.0), BCD application package. PC Anywhere communications software is recommended. A memory management software package (386Max, QEMM) is required for PCs that are not using PC/MS DOS 5.0.

Hardware requirements

Computer: The BCD System runs on any IBM or compatible PC with an 80386-class or faster processor. A 80286 class processor can be used if the system is outfitted with a LIM 4.0 EMS memory expansion board and preferably a math coprocessor.

Hard Disk: A minimum of 70 Mb is recommended.

Monitor: The BCD System can be used with a monochrome or color monitor.

Printer: Laser printer or dot-matrix printer.

Tape Backup Unit: Mountain (or similar) unit is strongly recommended for backing up large amounts of data.

Memory: Two megabytes of RAM minimum.

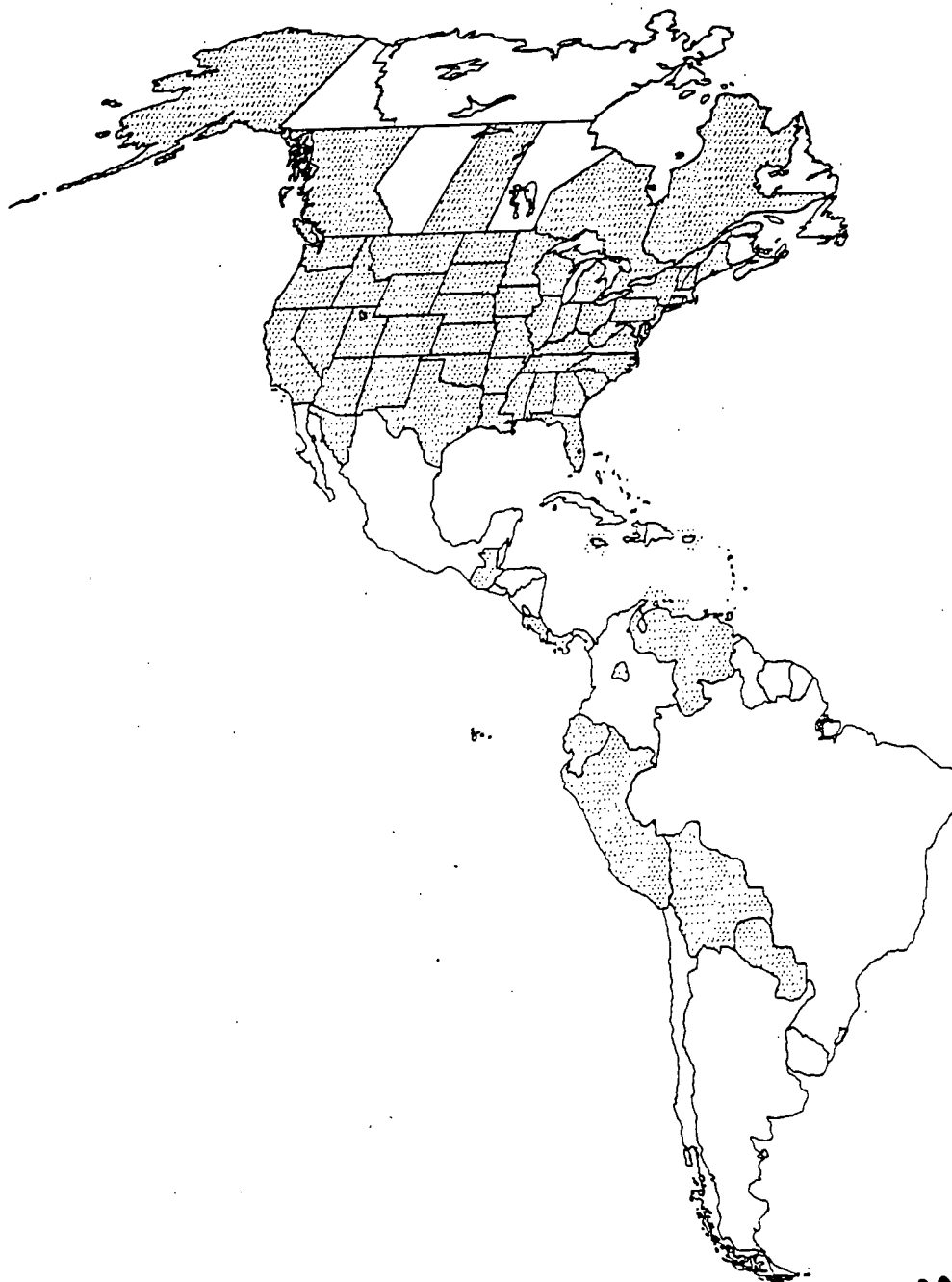
Disk Caching: If a computer with disk caching is to be used with the BCD, the disk caching should have the ability to be disabled. An IDE type hard disk with disk caching should not be used.

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Perspectives on Species Imperilment:

A Report from the Natural Heritage Data Center Network



The
Nature
Conservancy®
April 1, 1993

The Network of State Natural Heritage Data Centers
contains the most comprehensive and accurate
compilation of rare species information that exists for the United States.

Acknowledgements

The findings presented here draw primarily on 24,573 occurrence records of federally listed species, developed and maintained over the past two decades by the Natural Heritage Data Center Network in cooperation with The Nature Conservancy. Special thanks are due to the staffs of the fifty U.S. State Heritage Data Centers, and the Navajo Nation Heritage Program, for their prompt and thorough response to the detailed data request upon which the present report is based. Refer to the last section of this report for a brief description of the Natural Heritage Network and a list of individual Natural Heritage Data Centers.

Data analysis and interpretation, as well as report production, were conducted by the Science Division of The Nature Conservancy under Robert Jenkins, Vice President, Director of Science Programs.

The Project Coordinator was Richard Warner. Scientific analysis and data interpretation were conducted by: Virginia Crouch, Shara Howie, Lynn Kutner, Ellen Kwiatkowski, Kathy Lemon, Larry Master, Melissa Morrison, Larry Morse, Christa Russell, Leslie Seiger, Lesley Sneddon, Carolyn Thurman and Leni Wilsmann. Many of these individuals also assisted in the writing and editing of the report.

The maps and illustrations presented here are by Christina Erickson, Amy Melton, Melissa Morrison, Sherry Pittam, Megan Rollins and Josephine Toms. Base maps were developed by Ineke Dickman.

Production of the report was directed by Brandy Clymire, with assistance from Hilary Toma and Ron Leonard.

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Summarized information on the status of Federally listed threatened and endangered species on Federal lands in the United States.

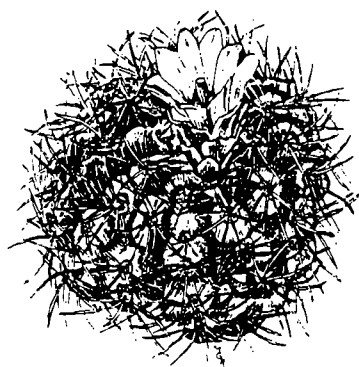
Submitted to the Subcommittee on Environment and Natural Resources of the House Merchant Marine and Fisheries Committee by The Nature Conservancy in cooperation with the network of State Natural Heritage Data Centers.

April 1, 1993

Introduction

In response to a request from Committee staff, the State Natural Heritage Data Centers have compiled and submitted information from their databases about the status of Federally listed plant, vertebrate, and invertebrate species¹ on Federal lands. All fifty State Data Centers and the Navajo Nation Data Center responded to the request. This information was combined with

rangewide data from the Natural Heritage Network's Central Scientific Database to produce this report. The data were cross-checked with a special national database on endangered and sensitive plant species that the Conservancy shares with the U.S. Forest Service, with information coming from both Heritage Data Centers and the Forest Service regional and National Forest offices.



Sclerocactus mesae-verdae occurs in the Four Corners region with sites on lands of the Navajo Nation and Ute Mountain Utes.

The Network of State Natural Heritage Data Centers contains the most comprehensive and accurate compilation of rare species information that exists for the United States. Beginning nearly 20 years ago, Heritage Programs have been continuously gathering and organizing information that is used for conservation and development planning in the public and private sectors. This information has played a key role in state and federal endangered species listing and delisting actions, as well as in identifying priority ecosystems for protection through federal, private, and joint conservation programs.

¹ "Species" under the Endangered Species Act include subspecies as well as full species; in the strict taxonomic sense these would be collectively referred to as "taxa."

The Heritage databases are not, of course, complete. Some information known by others has yet to be reported to them and new discoveries are made continuously. Many government and private land areas are still under-surveyed, and even on well-surveyed lands, previously unrecorded species continue to turn up, either because of recent colonization or prior lack of detection.

At the same time, some known populations are extirpated by habitat destruction, direct exploitation, or natural causes. For these reasons the Heritage databases are permanently operating and continuously revised to reflect current knowledge and reality. Many threatened, endangered, and candidate species are so extremely rare and vulnerable that the loss of a population or the discovery of previously unknown ones are crucial factors to their continued existence.

Since habitat destruction continues apace and the status of many species is still not well known, it is very important to continue and to expand coordinated field inventory efforts and the compilation, management, and utilization of the information generated from them.

Methods

In order to assess the status of federally listed endangered or threatened plant and animal species on Federal lands, we asked the 50 state Natural Heritage Programs and the Navajo Nation Natural Heritage Program to provide specified summaries of the information in their databases. All 51 programs responded to the request.

For each listed species in their jurisdiction, the data centers were asked to report the managing agency owner type for all occurrences observed since 1973. Nearly all of the data centers use the Conservancy-developed Biological and Conservation Data (BCD) System to maintain their information. For these BCD-based data centers, we provided a set of computer programs that produced the requested reports. The few states using other data systems were asked to perform comparable searches and tallies. In most cases, the data-center staff provided additional information not yet entered into their computers. This data-assembly strategy was generally successful because all the Natural Heritage Data Centers employ the same basic methodology for recording and maintaining their information.

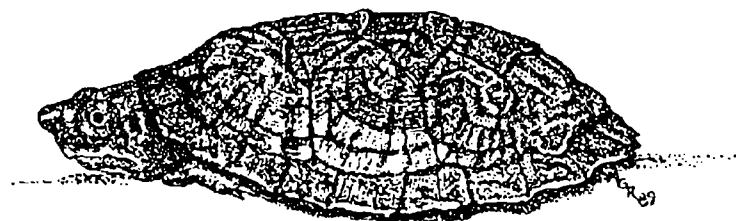
A few states were unable to provide complete responses in time for the present analysis. (Most of this missing information has now been received, and will be incorporated into future analyses.) Data for Iowa and eastern Pennsylvania were incomplete, but involved few federal lands. Only plant data were available from South Carolina and Washington, and California could not immediately provide data on listed threatened animal species. Species occurrences in Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, and the District of Columbia are not addressed in the present study.

Minor inconsistencies in the data arise whenever an individual occurrence (population, etc.) of a species ranges over lands of two or more agencies. Such occurrences are here recorded once for each agency. While this method captured the maximum possible involvement of the federal agencies, it slightly over-counts the number of occurrences. Also, a few species occurrences last verified prior to 1973 were included in data provided by some of the states. Where detected, these were removed, although it is possible that some remain in our national data set.

The Heritage Network's Central Scientific Databases, maintained by the Conservancy's Science Division, were used in various ways to check and add to the data provided by the Natural Heritage Data Centers. These databases include centrally developed species tracking databases containing overview information for each species such as scientific and common names, federal status and *Federal Register* date, Conservancy/Heritage imperilment rank, and a list of states from which the species is reported.

The state-level data in these central databases are maintained primarily through periodic data exchanges with the state data centers, which provide state ranks, protection statuses, and other state-level information. Differences in taxonomic treatments among the states are

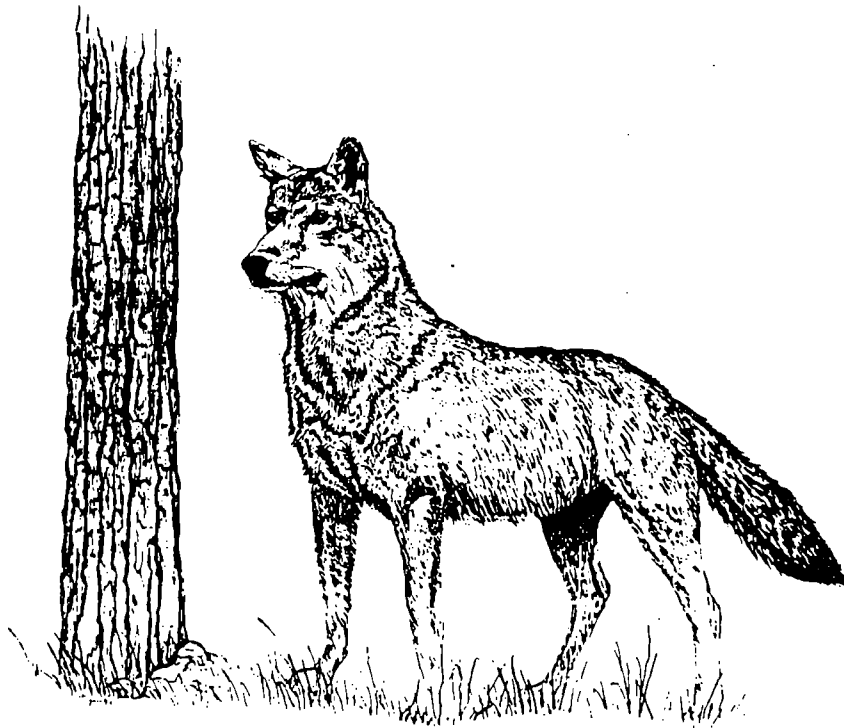
Flattened Musk-Turtle



resolved in the central databases through use of standard taxonomic classifications, such as the *Synonymized Checklist of U.S. and Canadian vascular plants* by John Kartesz of the North Carolina Botanical Garden.

The combined results provided a data set on about 24,573 occurrences of listed species for nearly 728 taxa. These data from the state Natural Heritage Data Centers were consolidated to create the national data set used in analysis for this report. Scientific staff of The Nature Conservancy reviewed the data to assure data quality and consistency. Information on numerous species was checked against the central databases, scientific literature, and expert knowledge. Heritage staff were contacted for clarification or additional information as needed. Also, information on plant species of National Forests, including designations of Sensitive Species status, were obtained from a database developed jointly by the Conservancy and the USDA Forest Service.

Species and occurrences found on lands and water owned or managed by federal agencies are not all recorded in our data set for four major reasons: (1) the Natural Heritage Data Centers may not yet be aware of all occurrences, (2) nearly all programs have a data-entry backlog, (3) not all data centers have completely recorded the land ownerships for all their occurrence records, and (4) species and species occurrences in lakes and rivers are generally not recorded by the data centers as under the jurisdiction of a federal agency except where they are entirely included in such areas as National Parks or Wildlife Refuges.



The red wolf exists in the wild only as reintroduced populations.

Listed Species and Federal Lands

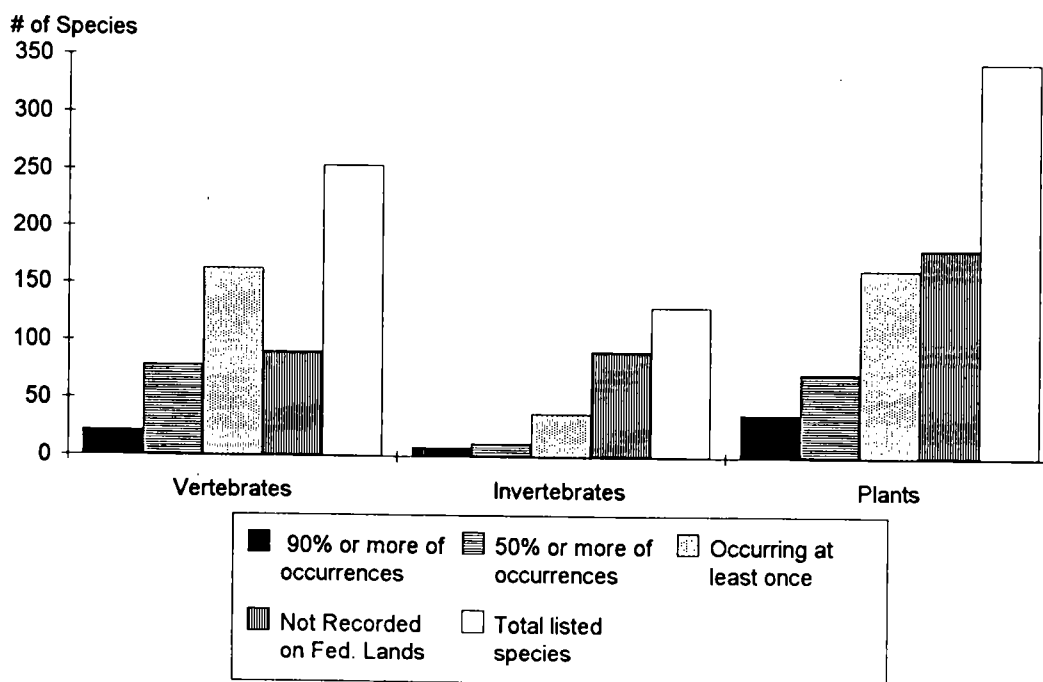
How many listed T & E Species occur on Federal lands?

This report covers the 728 species of vascular plants, vertebrate animals, and invertebrates that are listed as Endangered or Threatened under the Federal Endangered Species Act which are found in the 50 U.S. states—344 plants, 254 vertebrates, and 130 invertebrates.

Approximately 50% of all federally threatened and endangered species occur at least once on Federal lands (Figure 1). Of those, almost a quarter are found nearly exclusively there, with 90-100% of their occurrences restricted to Federal land. This small but significant number of currently listed species of vertebrates, invertebrates, and plants are virtually the sole responsibility of Federal management agencies. Examples include the plant Ruth's golden aster (*Pityopsis ruthii*) with 6 occurrences all on one National Forest, and rhizome fleabane (*Erigeron rhizomatus*) with nearly forty occurrences, of which one is on BLM land and the rest are on the National Forests. Animals found exclusively on Federal lands include the Laysan duck (*Anas laysanensis*) and the red wolf (*Canis rufus*), both of which currently exist only on National Wildlife Refuges.

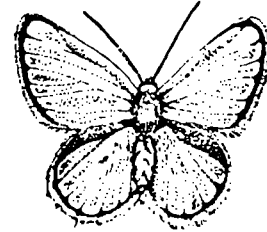
Federal agencies can provide for substantial, permanent conservation of the listed species with more than half of all occurrences on their lands. This represents nearly one-half of the listed species on Federal lands. These species can significantly benefit from Federal land management protection and recovery actions. For example, both white-haired goldenrod (*Solidago albopilosa*) and white birds-in-a-nest (*Machiridea alba*) have their majority representation on National Forest lands.

Figure 1. Listed Species Occurring on Federal Lands



For the many listed species with less than 50% of their occurrences on Federal land, Federal agencies can provide at least some conservation benefits by management actions on lands they currently administer.

For some species, like the Karner blue butterfly (*Lycaeides melissa samuelis*) with less than one-quarter of its occurrences on Federal land, the large landscape context and single ownership of Federal lands provide important recovery opportunities. Restoration and management of its pine and oak savanna habitat will also benefit many associated rare plant and animal species.



In other instances, although the Federal agency should do all it can for whatever populations exist on its property, successful conservation will depend primarily on others. Examples would include *Scutellaria montana*, the large-flowered skullcap, and *Etheostoma rubrum*, the bayou darter. The former has a single occurrence on a National Forest and a dozen on state and private lands. The latter has one occurrence on a National Park and over thirty on private ownerships.

Extent of Federal Management Responsibility for Listed Species

The U.S. Forest Service, with management responsibility for nearly 150 species, has the greatest known diversity of federally listed plant and animal species on its property of any Federal agency (Figures 2–5). The other major agencies have nearly 100 species each. The preponderance of species on Forest Service lands reflects not only the size and geographic extent of the landholdings, but also the intensive surveys that have been conducted on many National Forests. Since some species occur on more than one agency's land, the numbers in Figures 2–5 are different from those in Figure 1. For example, the Everglade kite (*Rostrhamus sociabilis plumbeus*), is found on both National Forest and National Park lands, and the bald eagle (*Haliaeetus leucocephalus*), has occurrences on the lands of every major agency. The heliotrope milkvetch (*Astragalus montii*), on the other hand, has only 3 occurrences, all on one National Forest. The Devil's Hole pupfish (*Cyprinodon diabolis*), exists in a single limestone pool in a National Monument, and the Magazine Mountain shagreen snail (*Mesodon magazinensis*) has a single occurrence on a National Forest (if it still exists at all).

With only about one-half of the federally listed species occurring on Federal land, the potential effect of Federal agencies on the protection and recovery of federally listed species is underestimated if land ownership is the sole criterion examined. Protection of multiple species in an ecosystem can be accomplished by protecting their habitat through minimizing impacts on air and water quality affecting wetlands, lakes and streams, navigable waterways, and coastlines. When combined with acquisition, recovery, and management partnerships with state and local agencies and private conservation organizations, the benefit to biological diversity extends far beyond federal landholdings.

Listed Species Occurring by Jurisdiction on Federal Lands

Figure 2. All Species

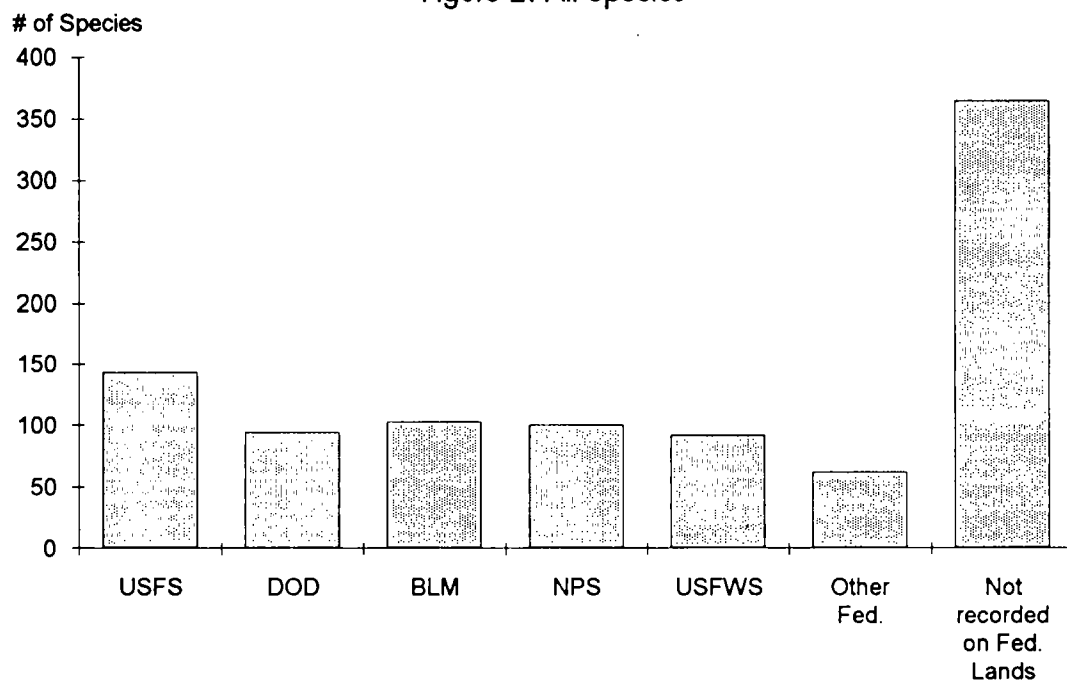
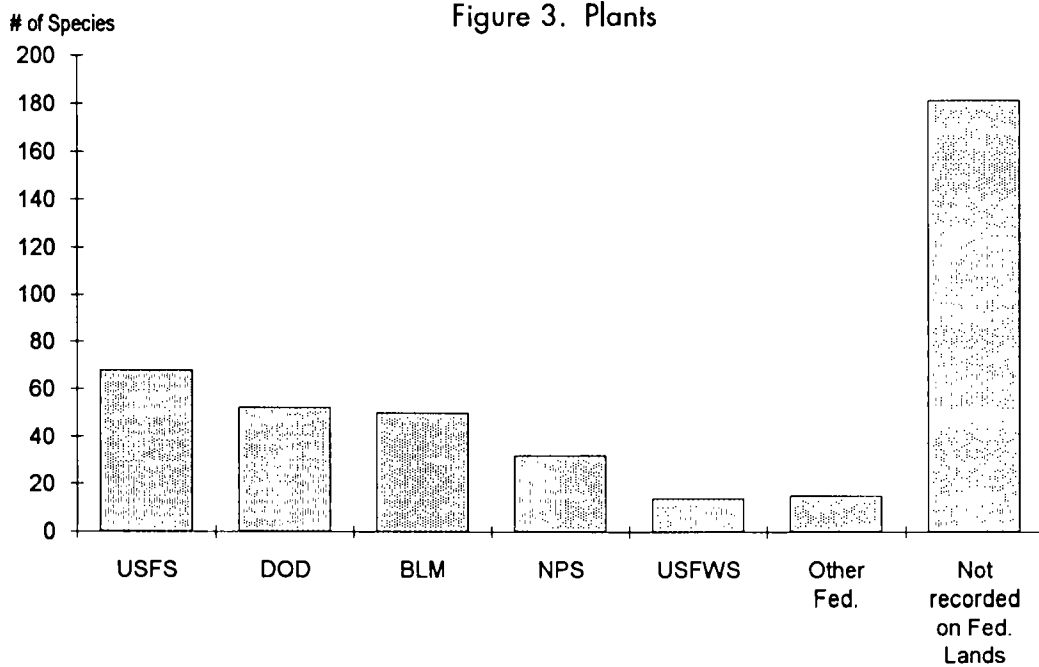


Figure 3. Plants



Listed Species Occurring by Jurisdiction on Federal Lands

Figure 4. Invertebrates

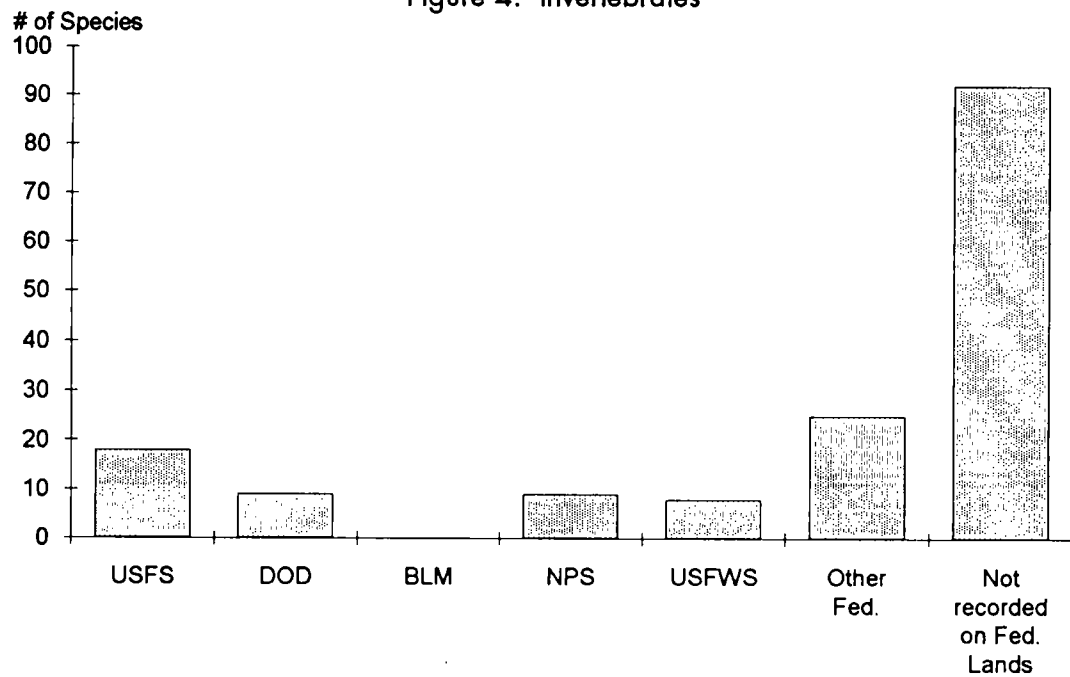
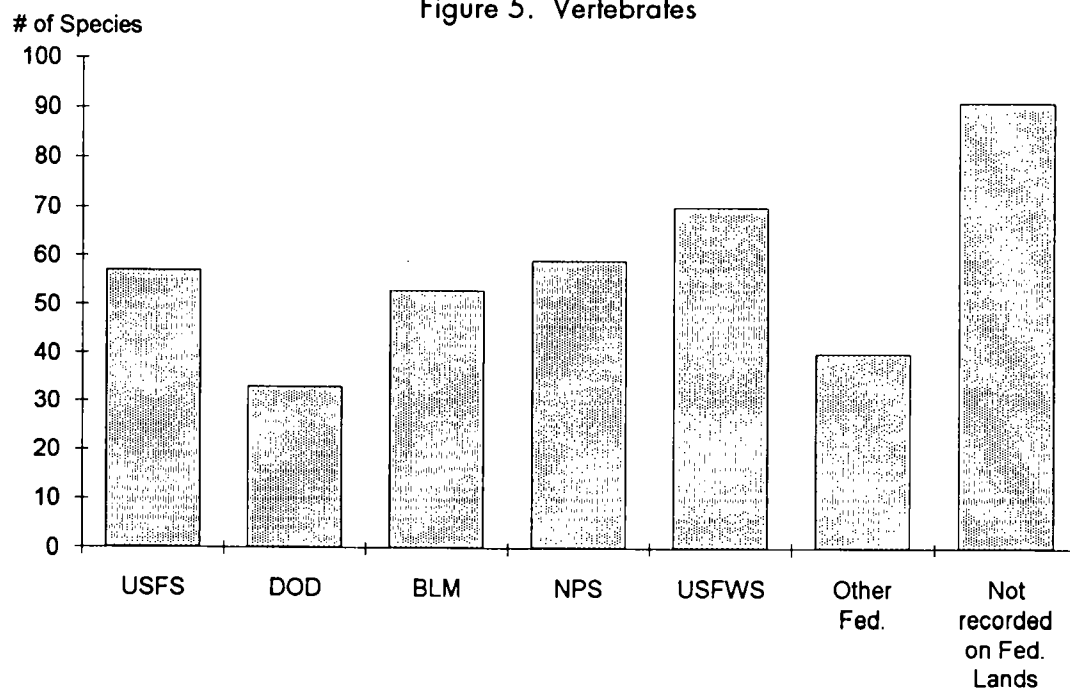


Figure 5. Vertebrates



Occurrences of Listed Species on Agency Lands

The opportunity for significant recovery actions on Federal land is reflected by the large proportion (over one-third) of the occurrences of federally listed species which are on agency lands (Figures 6 -9). These figures also indicate that this is a big job, made even bigger by the need to coordinate with protection actions on surrounding lands to accomplish ecologically significant ecosystem protection. If candidate species were included, many of which are just as imperiled as the listed species, the job would be shown to be many times greater.

The average number of occurrences per listed species varies markedly among plants, vertebrates and invertebrates. There is an average of 34 occurrences per species for all species combined (Figure 6), 17 occurrences per plant species (Figure 7), 67 occurrences per vertebrate species (Figure 9), and 13 occurrences per species for invertebrates (Figure 8). However, the diffuse distribution of some vertebrates heavily influences these figures. If the 12 vertebrates with the greatest number of occurrences are removed from the calculations (12,121 occurrences or 49% of the original total for all species), the vertebrate average drops to 20 and the overall average to 17.

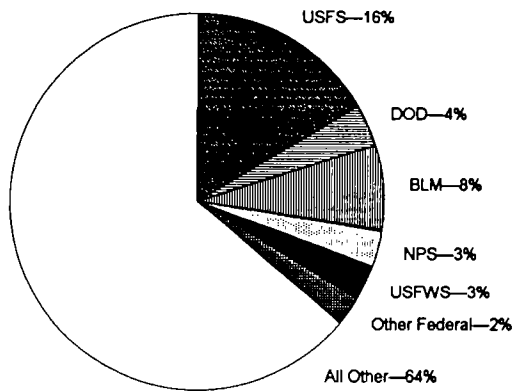
The reason for the diffuse occurrence pattern among many vertebrates, such as the bald eagle (*Haliaeetus leucocephalus*) and red-cockaded woodpecker (*Picoides borealis*), is that each occurrence or locality contains only a pair or sometimes a single individual, whereas occurrences for plants and most invertebrates tend to denote the presence of entire local populations (which may be large or small, of course). The diffuse pattern may also make these species more difficult and expensive to adequately conserve, although many other variables may be important. Species occupying aquatic habitats, for example, pose special difficulties regardless of taxonomic group, since they are vulnerable to impacts on entire watersheds.



Red-Cockaded Woodpecker

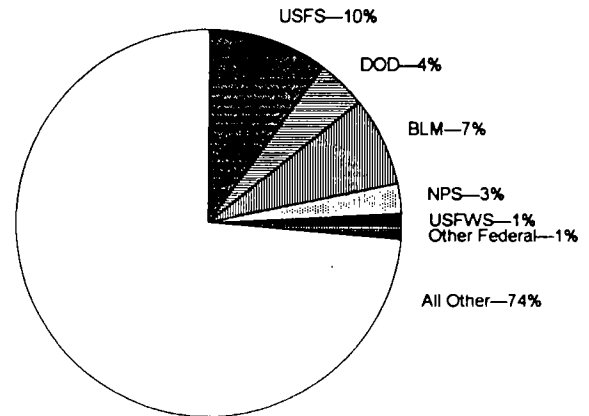
Occurrences of Listed Species by Land Ownership Category

Figure 6. All Species



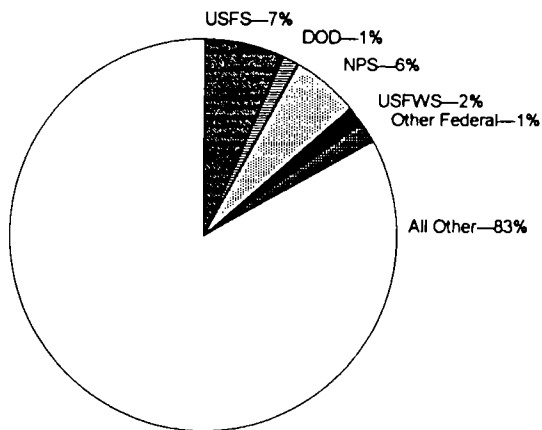
Total # of Species—728
Total # of Occurrences—24,573

Figure 7. Plants



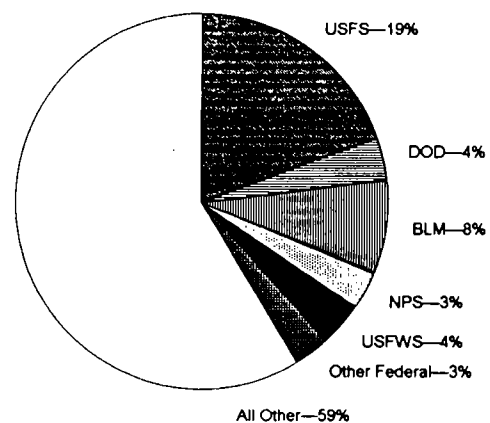
Total # of Species—344
Total # of Occurrences—5,769

Figure 8. Invertebrates



Total # of Species—130
Total # of Occurrences—1,690

Figure 9. Vertebrates



Total # of Species—254
Total # of Occurrences—17,114

Getting Ahead of the Extinction Curve

Establishing Conservation Priorities

Through the following examination of the status of selected animal groups, we are going beyond the Federal land aspects of endangered species management to identify commonalities in species' imperilment status, threats, and conservation needs.

The Natural Heritage Network has established a ranking system to reflect the biological imperilment status of each species on a state (S-rank), national (N-rank), and range-wide or global (G-rank) basis. Using information compiled by the various Natural Heritage Data Centers, each species is subjected to a formal ranking procedure that evaluates its abundance, distribution, and fragility, as well as the threats it faces. Each rank ranges from 1 to 5, representing a status of critically imperiled to demonstrably secure. Special ranks are assigned for extinct or extirpated (X) and historic (H), the latter meaning that there are no known current occurrences but we haven't given up hope and are still surveying for the species in the field. In general, species with a rank of G1–G3 are biologically qualified for listing as endangered or threatened, subject to additional questions about degrees of threat.

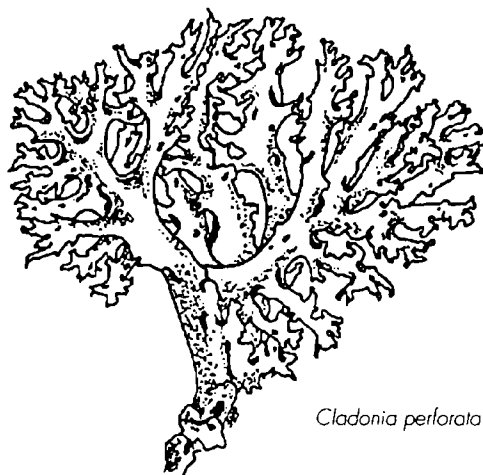
Species with G-ranks of 1 (G1), are critically imperiled throughout their range and typically have fewer than 6 occurrences in the world, or fewer than 1,000 individuals.

Species with G-ranks of 2 (G2), are imperiled throughout their range and typically have between 6 and 20 occurrences, or fewer than 3,000 individuals.

Species with G-ranks of 3 (G3), are vulnerable throughout their range and typically have fewer than 100 occurrences, or fewer than 10,000 individuals.

The global rank patterns among animal groups (Figures 10–12) highlight the degraded condition of many aquatic ecosystems in the U.S. By comparing the G-ranks of aquatic groups (amphibians, fishes, crayfishes, and unionid mussels) with those of the more terrestrial groups (mammals, birds, and reptiles), the disproportionate numbers of aquatic taxa in peril are striking. Over 760 aquatic species (44%) are ranked GX, GH, or G1–3 as compared to the 203 terrestrial species (13%) in the same categories. This is because aquatic systems are vulnerable to the effects of pollution, impoundment, water appropriation, and watershed abuse. Federal agencies have jurisdiction and a high degree of responsibility in this area.

A disparity exists between the percentage of federally listed species in each taxonomic group and the number of rare or declining taxa as determined by G-ranks (Figure 11). It is especially noticeable among the invertebrate groups (crayfishes and mussels), where listing has lagged well behind our consciousness of their imperilment. Not only have the species been hurt by this, but so have the aquatic ecosystems that constitute their habitat—ecosystems with many economic and social values which are diminished by the same forces which are destroying the organisms.



Cladonia perforata

Figure 10. Status of Selected North American Animal Groups

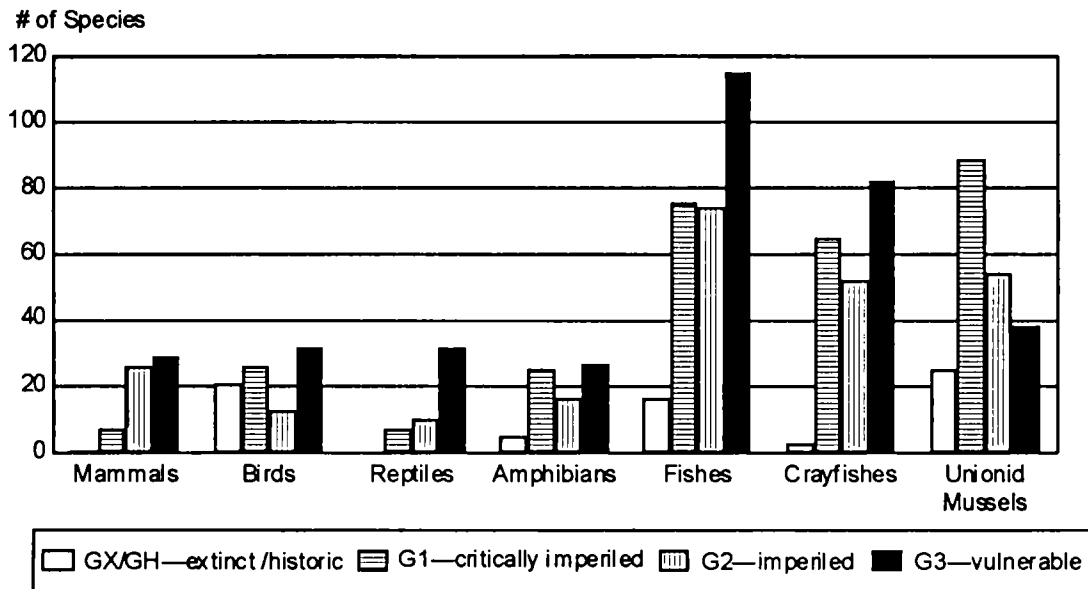


Figure 11. Aquatic Ecosystems: Pre-listing management priorities

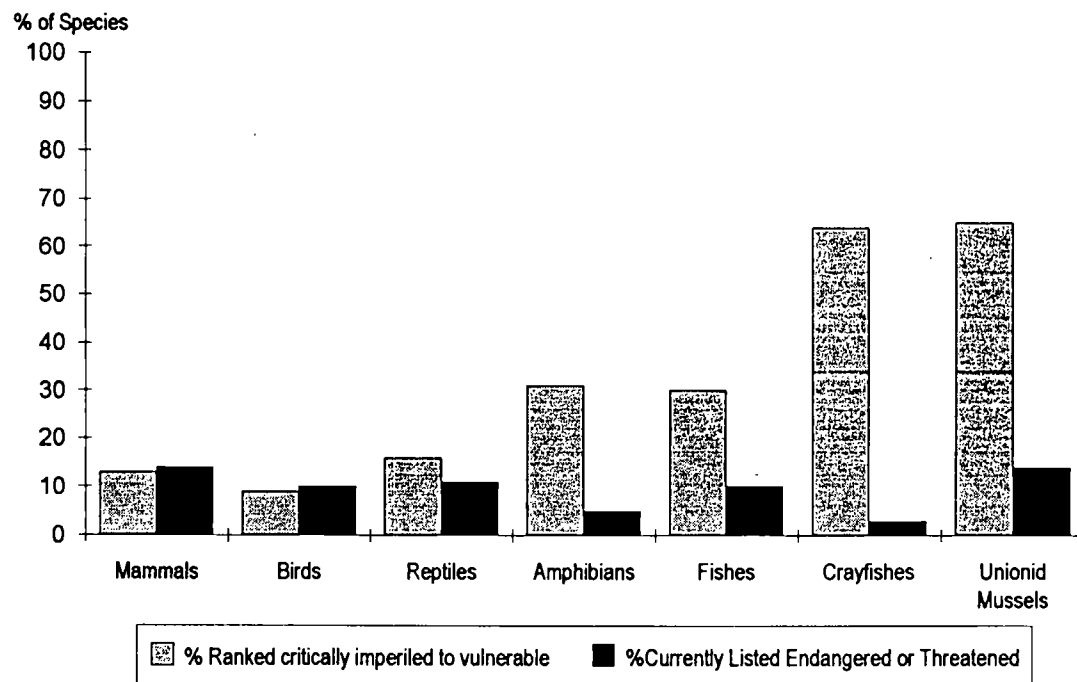


Figure 12. Status of U.S. Animal Species
Natural Heritage Network Central Databases
The Nature Conservancy 3/93

No. of Species Ranked (U.S.)											
	GX	GH	G1	G2	G3	G4	G5	G?	Misc.	Total	
Mammals*	1	0	7	26	28	89	280	22	0	453	
Birds*	18	3	26	13	32	83	617	33	0	825	
Reptiles*	0	0	7	10	32	47	208	7	0	311	
Amphibians*	3	2	25	17	27	42	114	2	0	232	
Freshwater Fishes*	17	0	76	74	115	135	403	71	2	893	
Vertebrate Total*	39	5	141	140	234	396	1622	135	2	2714	
Butterflies	1	2	6	9	42	93	319	302	15	789	
Crayfish*	1	2	65	52	82	55	52	3	2	314	
Unionid Mollusks*	11	14	89	54	38	37	37	19	1	300	
Other Invert.	20	178	485	404	193	540	901	3032	135	5888	
Invertebrate Total	33	196	645	519	355	725	1309	3356	153	7291	
Total Full Species	72	201	786	659	589	1121	2931	3491	155	10005	

An (*) indicates that all full species in that group have ranks and the total (far right column)

* is the number of full species in the U.S.

*Includes certain estuarine fishes.

Management Options for Candidates and other Rare Species

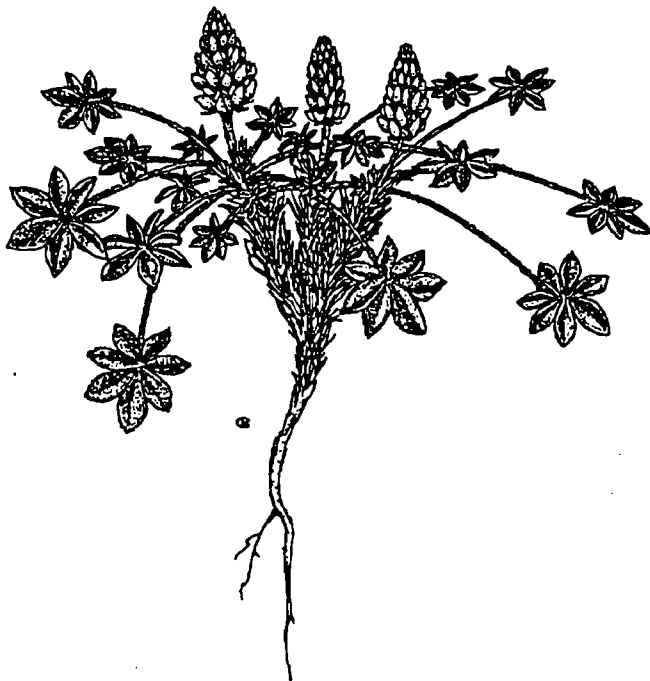
Of approximately 2,400 plant species ranked G1 and G2, one third have never been formally considered for federal listing; the same is true for half of the 5,000 native U.S. plant species ranked G1 through G3. With appropriate planning and management, many of these rarities can be conserved with no need for formal listing, greatly reducing the likelihood of future legal and economic conflicts.

A good example of a land-managing agency taking action to stay ahead of the listing curve is the USDA Forest Service's Sensitive Species Program. Each Regional Forester has the authority to designate taxa as "sensitive" and directs the National Forests in his or her region to evaluate projects to ensure that Forest Service actions do not contribute to the loss of viability for these species. The Sensitive Species Program manages a large number of species not currently listed under the Endangered Species Act (Figure 13).

Sensitive species are typically identified in consultation with the State Natural Heritage Data Centers. On a national level, information on threatened, endangered and sensitive species occurring on Forest Service lands is derived from a shared database maintained under a cooperative agreement between The Nature Conservancy and the USDA Forest Service. Habitat conservation assessments are prepared for sensitive taxa and the Forest Service works with the Fish and Wildlife Service's Pre-listing Recovery Program to plan conservation strategies.

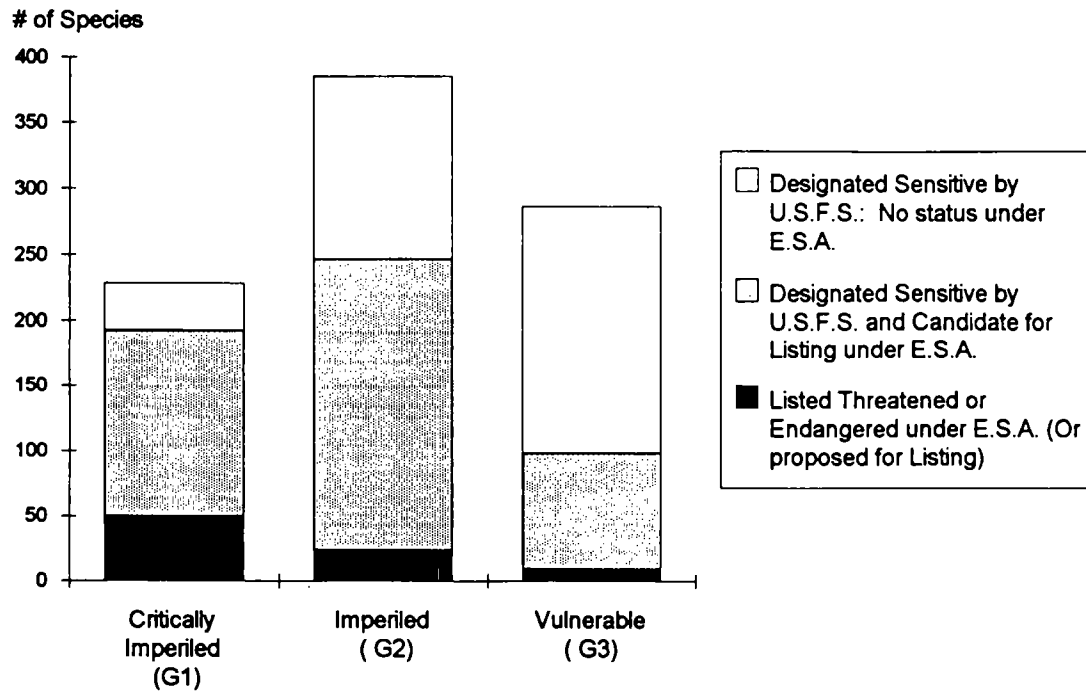
Over 70% of the Forest Service's sensitive species are plants, many of which are rare partly because they depend on a restricted habitat. Lassics lupine (*Lupinus constancei*) for example, is ranked G1 because it has very few occurrences and is endemic to a small area. It occurs only on serpentine substrates in the Lassics mountains area, on one Ranger District of the Six Rivers National Forest in northern California. Although not listed, Lassics lupine has been designated

Sensitive by the Forest Service's Pacific Southwest Region. The Forest recently closed a road and is designating a special botanical area to conserve the habitat of this and several other sensitive species found on Lassics serpentine.



lassics lupine, *lupinus constancei*

Figure 13. Globally Rare and Imperiled Plant Taxa
Managed for Conservation on US. Forest Service Lands



Case Studies

Mid-Atlantic Serpentine Barren

Description

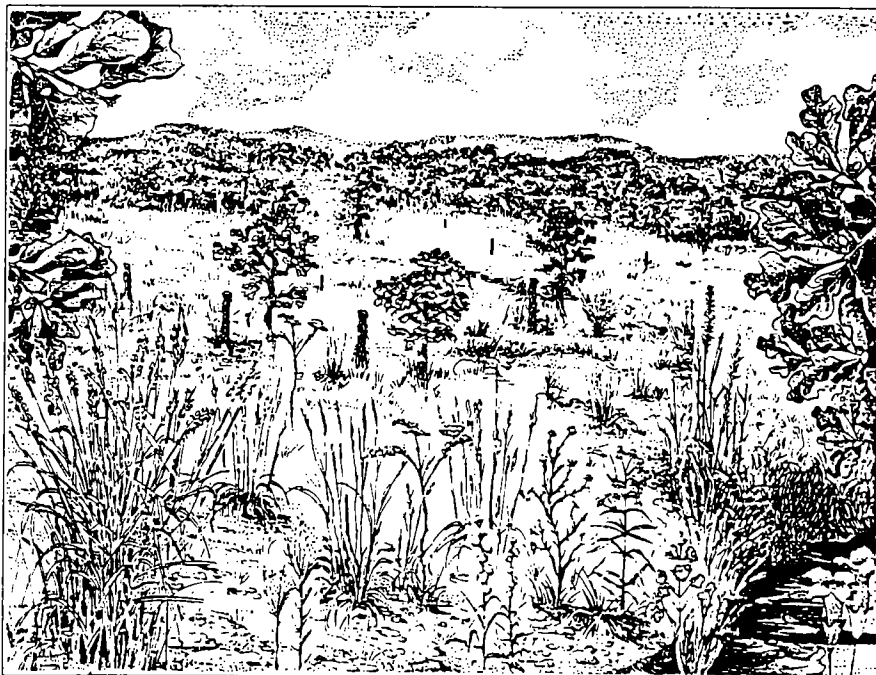
The serpentine barren is a grassland or savanna that grows on a nutrient-poor soil called serpentine. Early settlers and farmers referred to these essentially treeless areas as "The Barrens" because their attempts to cultivate them met with little success. Serpentine soil and the bedrock it is derived from are highly unusual because they contain very low amounts of nutrients and high amounts of heavy metals. The bare rock and thin soils also foster very high summertime temperatures in the soil. Only plants that can tolerate these severe conditions persist in serpentine barrens, so the resulting vegetation is an unusual combination of scattered stunted trees, grasses, and herbs, many of which are rare. The term "serpentine" refers to the greenish color of the bedrock, which somewhat resembles the color and pattern of a snake's skin.

From the air, serpentine barrens resemble islands. Their boundaries are abrupt and obvious because the vegetation reflects a profound difference in the underlying bedrock. They usually have many rock outcrops, and their soils are notably thinner than those adjacent. Common grasses of serpentine barrens include little bluestem and prairie dropseed, and the few trees that do grow there are generally a mixture of pines and oaks. Other species commonly found on Mid-Atlantic serpentine barrens include whorled milkweed, green milkweed, creeping phlox, and slender knotweed.

Habitat and ecology

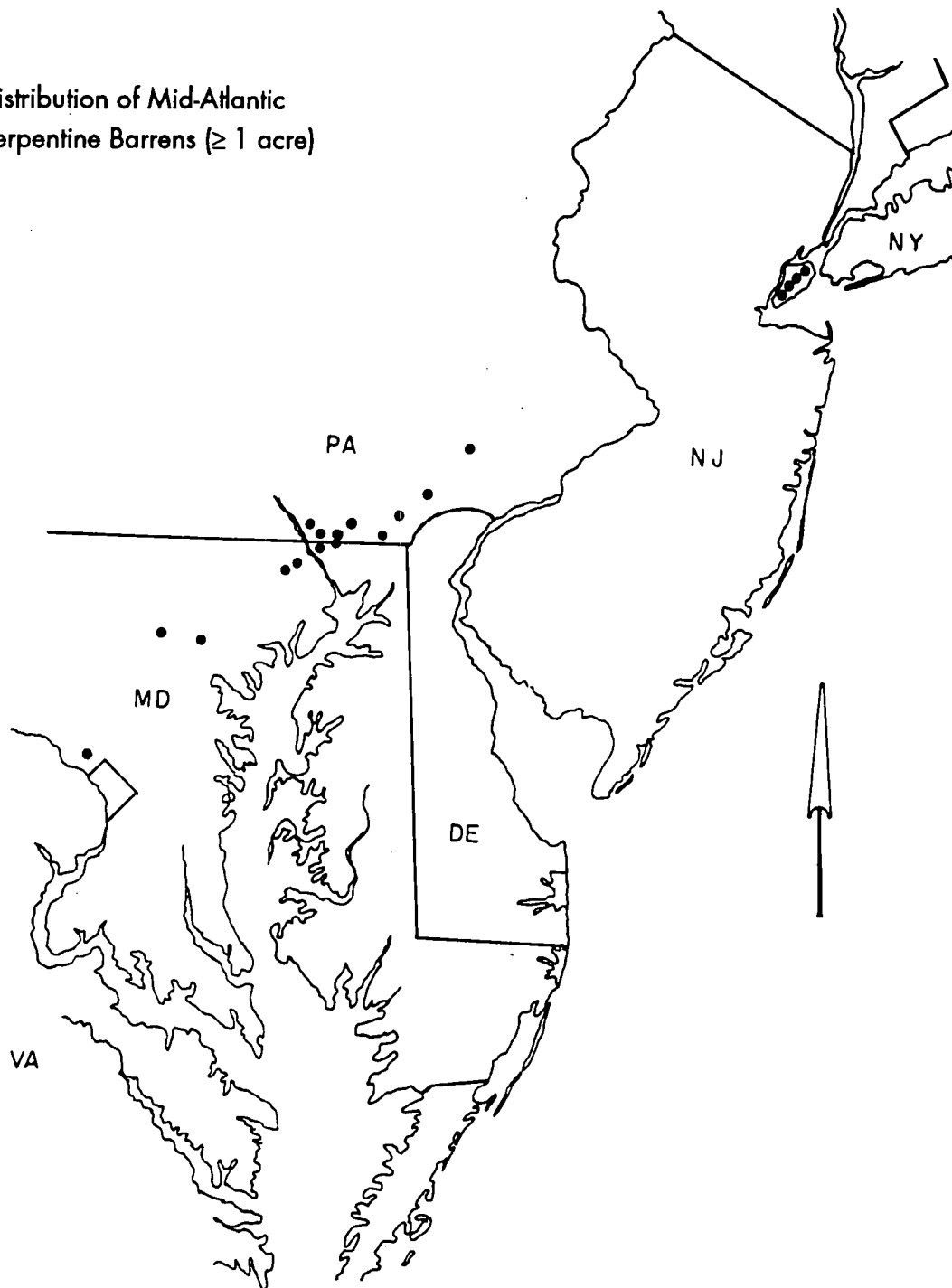
The harsh growing conditions effectively exclude many plant species from growing in serpentine barrens, though occasional hardy trees from the surrounding land can become established.

These invading trees provide shade and small cool areas within the barrens, paving the way for other plants, less tolerant of the harsh conditions, to invade. Serpentine barrens would become overrun with plants from the surrounding landscape were it not for periodic



Serpentine grasslands after a prescribed burn, a diverse mosaic of prairie grasses and flowering herbs

Distribution of Mid-Atlantic
Serpentine Barrens (≥ 1 acre)



State by state summary (Table 1)

New York—Four sites ranging from two to ten acres exist on Staten Island. Three are in municipal ownership, and all have been significantly degraded. The tree species commonly associated with this community are no longer present. No rare species currently exist on these sites, nor is there evidence that they ever occurred historically.

Pennsylvania—Eight sites greater than two acres in size remain. Nearly a dozen sites in the western suburbs of Philadelphia have been fragmented, degraded, or destroyed by incompatible land use. One of the major sites is currently being eroded by a stone quarry, and another is imminently threatened by construction. Three sites are currently in partial or total public ownership (county or state park, or land trust). Eastern serpentine aster, *Aster depauperatus*, a federal candidate for listing (C2), occurs on all of the sites and two other candidate plants are found on one site.

Maryland—Seven sites of at least one acre exist. Two are in public ownership; the largest is primarily owned and managed by the state. One site is threatened by a stone quarry. Five of these sites contain rare species. One site contains the federally endangered sandplain gerardia, *Agalinis acuta*.

Delaware—One historical site has been destroyed and no other examples of serpentine barrens remain in the state.

Table 1. Serpentine Barren Sites

<u>Owner</u>	<u>Sites</u>	<u>Quality</u>
State		
State	Goat Hill, PA (Shared w/MD)	Excellent
State/Private	Soldiers Delight, MD	Excellent/good
Other		
Municipal	Seaview, NY	Good/fair
Municipal	Heyerdahl Hill, NY	Fair
Unknown	Grymes Hill Serpentine, NY	Fair
Municipal	Wagner High School Meadow, NY	Fair
County	Nottingham Park, PA	Excellent
Private	New Texas, PA	Excellent
Private	Unionville, PA	Good/fair
Private	Rock Springs, PA	Good
Private/Municipal	Chrome Barrens, PA	Good
Private	Fern Hill, PA	Fair
Private	Sugartown, PA	Fair
Private	Pilot Serpentine Barren, MD	Good
Municipal	Robert E. Lee, MD	Good?
Private	Haborim Dror Camp Moshava, MD	Good?
Private	Goat Hill, MD (shared w' PA)	Fair
Private	Bald Hill, MD	Fair
Private	Big Pines Serpentine Barren, MD	Unknown

Management needs

Direct impacts by land development activities must be reduced. The long-term viability of serpentine barrens depends on a program of prescribed burning to sustain a mosaic of successional stages and to restore grassland and woodland vegetation to areas within or on the margins of barrens that have been encroached upon by fire-intolerant trees. Exotic species that are not controlled through prescribed burns must be eliminated through other means, wherever possible.

Benefits of the Endangered Species Act

The serpentine barrens offer an excellent opportunity to protect a diversity of rare species through habitat management. The sandplain gerardia, *Agalinis acuta*, is federally listed as endangered and is found only at one Maryland serpentine barren site and fewer than ten non-serpentine sites in the northeast. One candidate (C2) species, eastern serpentine aster, *Aster depauperatus*, is found exclusively on serpentine barrens. Purple spurge, *Euphorbia purpurea*, and a leafhopper species so new to science that it lacks a species name, *Limottetix* sp. 1 are candidate (C2) species that are also found on serpentine barrens. Other even more imperilled species found on serpentine barrens have no official status under federal listing process. Examples included Torrey's mountainmint, *Pycnanthemum torrei*, which has a Natural Heritage rank of G2, and a critically imperilled species of moss, *Bryum reedii*, which has a Natural Heritage rank of G1. This moss is believed to occur at five or fewer places on earth.

In addition to federally listed species, serpentine barrens harbor species that are listed as endangered or threatened under state authority. For example, the Soldiers Delight serpentine barren in Maryland harbors 18 state listed endangered and 4 state listed threatened plant and animal species. In fact, 3 species which occurred at the Soldiers Delight site historically are now extirpated from Maryland altogether. Two of these species are believed to be extirpated from Maryland because the majority of grassland ecosystems (including serpentine barrens) have disappeared from the state.

Although the Mid-Atlantic serpentine barren is an extremely rare ecosystem that harbors many rare species, it is not currently afforded protection under the current endangered species act. Loss of habitat such as this is the overwhelming cause of the decline for many species. Preserving entire ecosystems such as the serpentine barrens would not only afford protection to federally listed species, but would also prevent other species from declining to the point where they must be listed.



Sandplain Gerardia, *Agalinis acuta*, Federally listed as Endangered

Seabeach Amaranth (G2)

(*Amaranthus pumilus*)

Federal Status: Proposed for listing as a Threatened Species, Federal Register, May 26, 1992

Description

The seabeach amaranth is a low-growing, leafy herbaceous plant currently known from about 40 less-developed beach areas in the Carolinas and on Long Island, New York. Confined to open sand along the ocean shore, this relative of the cultivated amaranths forms rounded, branched clumps a foot or more in diameter. Its fleshy, bright pink or red stems bear inconspicuous flowers and fruits.



Habitat and ecology

With its deep green leaves, seabeach amaranth stands out in the open vegetation of coastal beaches and overwash flats, growing beyond the daily high-tide mark in areas affected by hurricanes and other major storms. Seeds of the this amaranth can survive many years buried in the sand, then germinate when brought near the surface by severe storms.

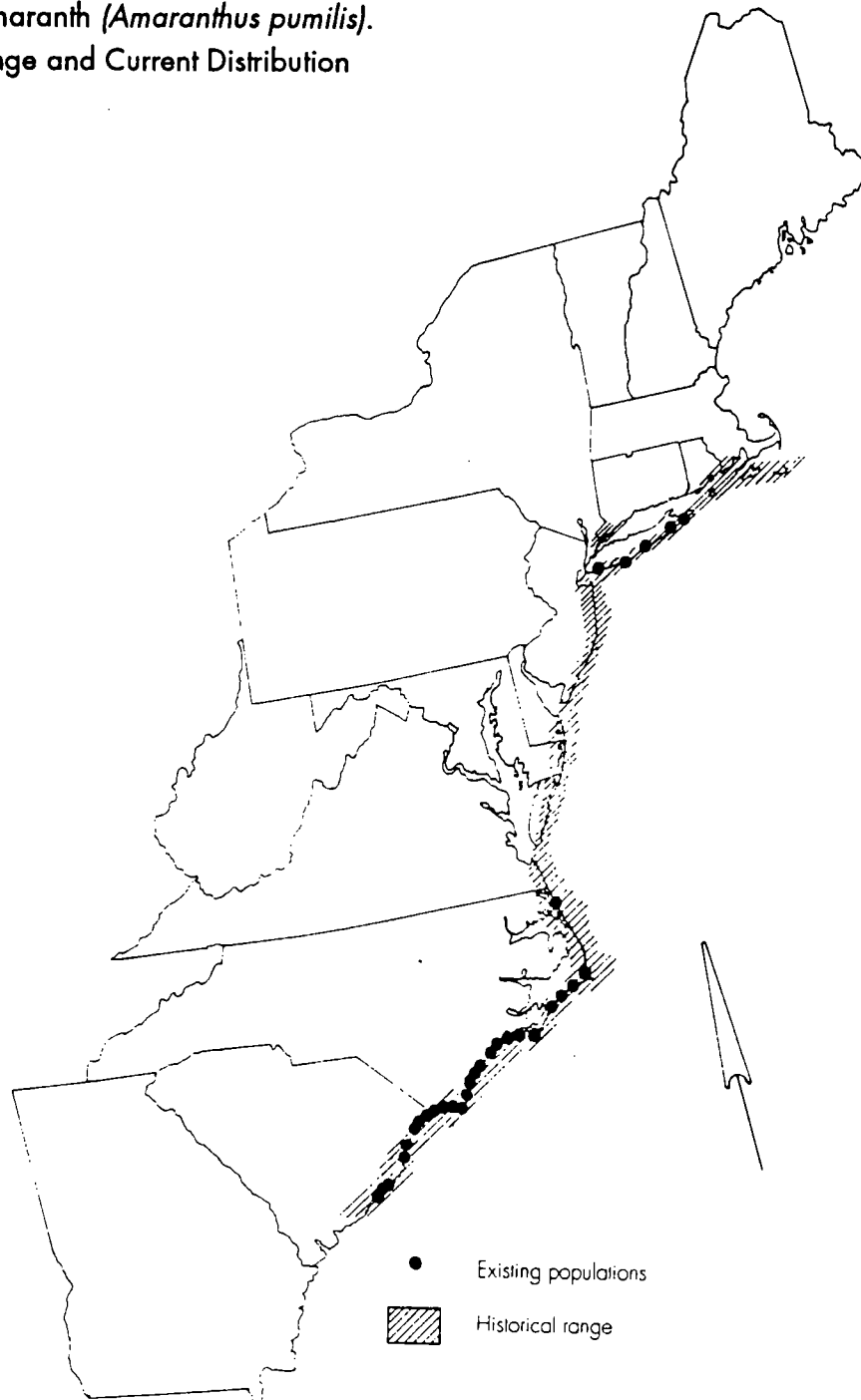
The ecosystem in which seabeach amaranth occurs is also essential to numerous other plant and animal species of the ocean shore. Two federally listed birds, the piping plover and the least tern, regularly nest in these back-dune sandflats throughout the range of the amaranth. In the Carolinas, the federally listed loggerhead sea turtle also uses amaranth beaches for nesting. Management of back-beach areas for these rare birds and turtles also helps amaranth plants by restricting or prohibiting foot and vehicular traffic through the nesting areas during the plants' growing season.

Historical range and current distribution

Seabeach amaranth formerly ranged along beaches of the Atlantic Coast irregularly from Kiawah Island, South Carolina, north to Nantucket, Massachusetts. Old museum specimens show it once inhabited many of the very places which have become major East Coast beach resorts, such as Coney Island and Atlantic City. The species no longer occurs in about half of the places it was once found (see map), and seems to be gone altogether from Massachusetts, Rhode Island, New Jersey, Delaware, Maryland, and Virginia.

North Carolina is this species' present stronghold, with about two dozen populations. In South Carolina, seabeach amaranth is currently known from about a dozen populations, and in New York State it has about five populations on Long Island.

Seabeach Amaranth (*Amaranthus pumilis*).
Historical Range and Current Distribution



Reasons for decline

Intolerant of competition, seabeach amaranth plants are not found in dense vegetation. Instead, this is a 'survivalist' species, adapted to the sunlight, saltwater, and drifting sand of the ocean beach, a habitat in which few other plant species can grow.

Seawalls, jetties, breakwaters, and other structures have often been constructed in developed areas to protect roads and buildings near the water. The beaches in these places usually lack the sparsely vegetated back-beach habitat preferred by the seabeach amaranth. Other beach-stabilization techniques such as sand fences and beach-grass plantings are also generally detrimental to this plant.

Even in less developed areas, recreational use of Atlantic Coast beaches is often intense. Seabeach amaranth usually grows in the back-beach area, nearly at the dune line, while people congregate more often in the portions of the beach nearer the water. Therefore, amaranth conservation and recreational beach use need not be incompatible. Simple roping of amaranth habitat prevents unintentional trampling of the plants during their growing season. At other times, the moderate disturbance created by the occasional hiker or beach-buggy driver does no harm to the dormant seeds of the amaranth.

Land ownership and management

With its small, irregularly distributed populations, seabeach amaranth occurs on various federal, state, county, city, and private lands (see table). Of the species' twelve most important stands, eight include numerous parcels of private land, five include state or local-government lands, and only two (on Cape Hatteras National Seashore) involve federal lands. Several lower-quality stands occur on various other federal lands managed by the National Park Service, the U.S. Fish and Wildlife Service, and the Department of Defense's Camp Lejeune Marine Base.

The increased interest in recent years in applying an ecosystem approach to planning and management of Atlantic Coast beach areas should minimize future loss of seabeach amaranth habitat and prevent further decline of this plant and the other species found with it in these coastal habitats. Full recovery of these species will require interest and participation by numerous private beachfront landowners as well as federal, state, and local governments.

Land Ownership of Seabeach Amaranth Occurrences

<u>Landowner</u>	<u>State and Area</u>	<u>Quality</u>
Federal Lands		
Cape Hatteras National Seashore (NPS)	Cape Hatteras, NC	Excellent
Cape Hatteras National Seashore (NPS)	Ocracoke, NC	Excellent
Cape Lookout National Seashore (NPS)	Portsmouth, NC	Fair
Cape Lookout National Seashore (NPS)	Core Banks, NC	Fair
Cape Lookout National Seashore (NPS)	Shackleford Banks, NC	Fair
Gateway National Rec. Area (NPS), City	Rockaway Beach, NY	Fair
Fire Island National Seashore (NPS), State, County, Private	Fire Island, NY	Poor
Mackay Island National Wildlife Refuge (USFWS)	Cumtuck Banks, NC	Poor
Cape Romain National Wildlife Refuge (USFWS)	Cape Island, SC	Poor
Cape Romain National Wildlife Refuge (USFWS)	West Cape, SC	Poor
Cape Romain National Wildlife Refuge (USFWS)	Lighthouse Island, SC	Poor
Camp Lejeune Marine Base (DoD)	Onslow Beach, NC	Fair
State Lands		
State	Hammocks Beach, NC	Excellent
State, Private	Bogue Banks, NC	Excellent
State, Private?	Westhampton Island, NY	Good
State, Town	Jones Beach, NY	Good
State, Private	Huntington & Litchford Beaches, SC	Good
State	Masonboro Island, NC	Fair
State, Private	Myrtle Beach, SC	Fair
State	Bird Shoals, NC	Poor
State, Private	Cape Fear, NC	Poor
Other Lands		
Private	Holden Beach, NC	Excellent
Private	Ocean Isle Beach, NC	Excellent
Private	Topsail Beach, NC	Good
Private	Wrightsville Beach, NC	Good
Private	Pawleys Island, SC	Good
Private?	Southampton Beach, NY	Fair
Private	Hutaff's Beach, NC	Fair
Private	Figure-8 Island, NC	Fair
Private	Long Beach, NC	Fair
Private	Sunset Beach, NC	Fair
Private	Bird Island, NC/SC	Fair
Private	Kure Island, NC	Poor
Private	Waities Island, SC	Poor
Private	Debidue Island, SC	Poor
Private?	North Island, SC	Poor
Private?	Raccoon Key, SC	Poor
Private	Lea Island, NC	Unknown

The Karner blue butterfly

Lycaeides melissa samuelis

Federal Status: Listed Endangered by the U.S. Fish and Wildlife Service on December 22, 1992.

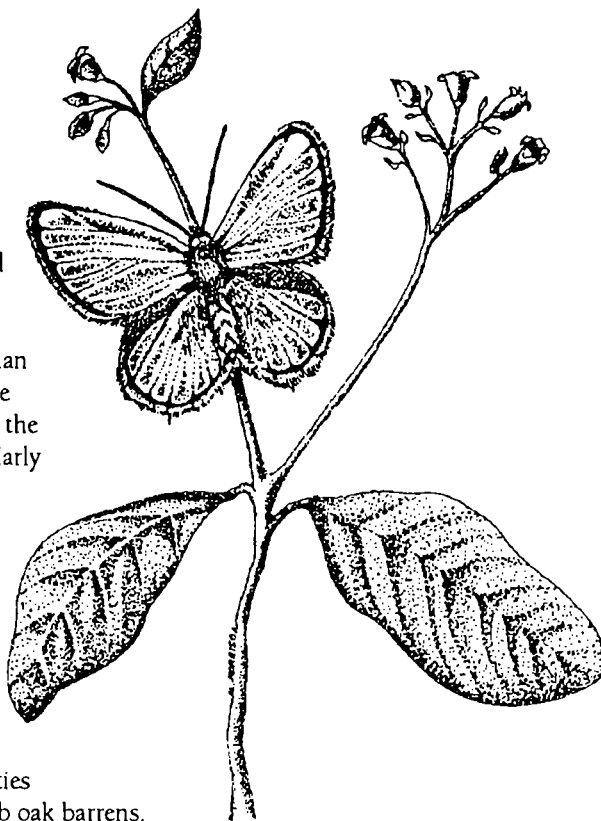
Description

The Karner blue was first distinguished in 1944 by Vladimir Nabokov: famous novelist and butterfly enthusiast. This gossamer-winged butterfly is smaller than a silver dollar. The male has silvery blue wings fringed with a black border, and the female has grayish brown wings irregularly fringed with orange spots.

Habitat and ecology

The Karner blue requires grassy or prairie like openings with wild lupine and nectar sources such as dogbane, New Jersey tea, and butterfly weed. In the East these openings occur in sandplain communities usually within very dry pitch pine/scrub oak barrens.

In the Midwest, the butterfly also requires very dry sandy areas including oak savanna, jack pine areas, and dune communities. The Karner blue always occurs with other rare butterflies and has two annual generations of adults, one in late spring, the other in summer. The ecology of this species is closely linked to fire. Historically, natural wildfires helped to maintain the habitat for the Karner blue as well as other rare butterflies and plants. Development and alteration of historic fire patterns are known causes of the decline of the Karner blue.



Historic range and current distribution

The distribution of the Karner blue butterfly generally follows the northern limits of the wild lupine which is the only food source for the butterfly while it is a caterpillar. It once had major populations in all states in the Great Lakes region as well as southern Ontario and eastward to New Hampshire and Massachusetts. However, it has been observed by those studying the butterfly that over the past 100 years, numbers of the Karner blue have diminished range-wide by 99 percent or more. This butterfly is now restricted to remnant populations in Minnesota, Wisconsin, Michigan, Indiana, New York, New Hampshire, and Illinois. It is completely extirpated from Massachusetts, Pennsylvania, Ontario and Ohio, and its long term prospects in New Hampshire, Illinois and Minnesota are poor due to small numbers and fragmented habitat.

Reasons for decline

Habitat destruction and fragmentation due to development, and declining frequency of wildfires that once created natural openings in the canopy for the wild lupine and understory nectar sources.

State by state summary

At the majority of places it is currently found this butterfly is threatened with extirpation. This is because *sites with fewer than 1,000 adults per year have been found not to be viable*; this concept is essential for understanding the concern for this species' survival.

All of the major populations of this butterfly have been inventoried and are monitored by the state Natural Heritage Programs. The following population estimates are based on the second, or summer, annual generations.

Minnesota—The presence of two historical records of the Karner blue in Minnesota prompted additional surveys that turned up essentially one extant population with more than 100 individuals on a state wildlife management area.

Wisconsin—While it is believed that at one time there were many large populations, 1990-1992 Status Surveys found many of the populations are now widely scattered and small, 70% had 50 or fewer adults observed. Two thirds of the sites where the butterfly is currently extant are owned by the Wisconsin Department of Natural Resources, the U.S. Fish and Wildlife Service, or the Department of Defense.

Michigan—There were over two dozen historical locations, but now only 6 counties still support the butterfly. Most all of the remaining populations are small. The largest population in Michigan was only estimated at 3,000 individuals in 1989. This population occurs in a State Game Area. There is also a population on National Forest land.

Illinois—In 1992 several individuals were discovered on state land. Previously, the Karner blue had not been recorded in Illinois since two specimens were found around the turn of the century.

Indiana—Occurs in two counties in Indiana. The largest population was estimated to have 4,500 adults in 1992 and occurs on National Park Service land. Two very small sites with more than a dozen individuals total are managed by The Nature Conservancy and the local County Parks Department.

New York—Although there are numerous small populations in New York, for reporting purposes they can be combined into two regional populations. One is in the Albany Pine Bush, where the butterfly was first discovered by Nabokov, and the other is located north of the Albany Pine Bush and currently consists of several fragmented sites the largest of which occurs at an airport. This population persists with numbers estimated around 14,000. Populations in the Albany Pine Bush are estimated to have dropped from 80,000 individuals in 1979, to around 1,000 in 1987, to 100-200 in 1990. The majority of extant sites are municipally or privately owned, but other land owners include a State Park, The Nature Conservancy, and Saratoga County.

New Hampshire—Two very small remnant populations exist within the Concord Pine Barrens. While the total populations were estimated at 2,000-3,000 individuals in 1983, there are now believed to be far fewer than 500 individuals. The larger of the two populations occurs on less than a three acre plot of privately owned land.

Benefits of the Endangered Species Act

Protection of habitat for this species will conserve many other rare and declining species as well. In New England and New York pine barrens are considered to be one of the rarest community types and similarly in the Midwest the oak savanna ecosystem has declined dramatically. These communities often contain other federal candidate species as well as a number of state listed species.

The funding available to date through the U.S. Fish and Wildlife Service for the status surveys and research has leveraged many times that amount of funding and support for state Heritage Programs, The Nature Conservancy, and others for inventory, management, monitoring, research and protection activities.

Natural Heritage Program & Conservation Data Center Network

Natural Heritage Programs (NHPs) and Conservation Data Centers (CDCs) are continually updated, computer-assisted inventories of the biological and ecological features and biodiversity preservation of the country or region in which they are located. These data centers are designed to assist in conservation planning, natural resource management, environmental impact assessment and planning for sustainable development.

The Network: Where are The NHPs and CDCs

There are now 85 data centers operating in the western hemisphere including all 50 U.S. states (most are called Natural Heritage Programs), several U.S. Bioserves and National Parks, Puerto Rico, three Canadian provinces, and 13 countries in Latin America (CDCs) and the Caribbean. Regional centers provide administrative and technical support to the individual programs.

Each data center is established within a local institution, most frequently as part of a government agency responsible for natural resource management and protection. While individual centers are under local control and are staffed by local scientists and conservationists, they also operate within a network.

Methodology: How the NHPs and CDCs Work

Most data centers use the Biological and Conservation Data System as the basis for operation, a system developed and refined by The Nature Conservancy since 1974. The information is managed in more than 30 interrelated computer files, supported by extensive map and manual files, and a library. A trained staff of biologists, natural resource specialists and data managers interprets the data for use in local conservation and development planning, natural resource management and environmental impact assessment.

Information assembled and managed by data centers focuses on: ecosystems and species, their biology, habitats, locations, conservation status and management needs; managed areas such as National Parks, Forest Reserves, and watersheds; and on data sources.

Each center compiles information from existing sources such as scientific literature, knowledgeable people, and museum collections. The local staff also directs and conducts field inventories of species and natural communities of special concern, or may be contracted for biological assessments of specific sites. Each study and report benefits from earlier work in the same area and, through the network, related information gathered at other times and places multiplies the local effort. Central databases are supported through cooperative agreements with academic and scientific institutions.

The Nature Conservancy's Role

The Nature Conservancy is involved in the establishment and operation of the CDCs by providing technical, scientific and administrative support and training. The Conservancy also makes available the computer technology, data inventory and management methodology, and procedure manuals used by CDCs and Natural Heritage Programs. The methodology constantly undergoes improvements as part of the partnership between the data centers and The Nature Conservancy. These continual advancements ensure that the entire network remains responsive to the needs of the conservation and development communities.

All told, there are over 400 biologists and computer technicians dedicated to the combined effort, with several hundred others working part-time on biological inventories and research. The Nature Conservancy is the administrative center of this network, promoting communications and the exchange of data, solutions and expertise throughout the network.

Applications: How NHPS and CDCs Are Used

Conservation Planning: The data center's integrated biological and land-use information is used to identify critical areas in need of protection, and to establish conservation priorities on a regional, national and global basis.

Development Planning: To help facilitate design and implementation of ecologically sound development projects, data centers provide biological and ecological information to multilateral development banks, bilateral development agencies, corporations both multi-national and local, as well as in-country governmental agencies.

Park and Protected Area Management: Wise stewardship of natural areas requires detailed knowledge of sensitive and endangered biological features. Information maintained by Heritage Programs and CDCs on parks, forest reserves, and wild areas, and the management requirements of their biological elements, is used to improve management practices.

Research and education: Results from each center's inventory work guides new basic applied scientific research. The biological databases represent an important resource for long-term environmental monitoring.

The U.S. Network of Natural Heritage Data Centers

ALABAMA NATURAL HERITAGE SECTION

Dept of Conservation & Natural Resources
Folsom Administration Bldg - Div. of Lands
64 N. Union St., Room 421 Montgomery, AL 36130
205-242-3484 FAX: 205/242-0999

ALASKA NATURAL HERITAGE PROGRAM

707 A Street, Suite 208 Anchorage, AK 99501
907/279-4549 FAX: 907/258-9139

ARIZONA HERITAGE DATA MANAGEMENT SYSTEM

Habitat Branch, Arizona Game & Fish Dept.
2221 W. Greenway Rd., Phoenix, AZ 85023
501/789-3612 FAX: 602/324-9154

ARKANSAS NATURAL HERITAGE COMMISSION

Suite 1500, Tower Building
323 Center St. Little Rock, AR 72201
501/324-9150 FAX: 501/324-9154

CALIFORNIA NATURAL HERITAGE DIVISION

The Resources Agency-Dept of Fish & Game
1416 9th St, 12th Flr, Sacramento, CA 95814
916/322-2493 FAX: 916/324-0475

COLORADO NATURAL HERITAGE PROGRAM

c/o University of Colorado Museum
Hunter 115, Campus Box 315 Boulder, CO 80309-0315
303/492-4719 FAX: 303/492-5105

CONNECTICUT NATURAL DIVERSITY DATABASE

Natural Res.Ctr, Dept of Environmental Protection
State Office Bldg, Rm 553, 165 Capitol Ave
Hartford, CT 06106
203/566-3540 FAX: 203/566-7932

DELAWARE NATURAL HERITAGE PROGRAM

Parks & Recreation, 89 Kings Highway Dover, DE 19903
302/739-5285 FAX: 302/739-3817

FLORIDA NATURAL AREAS INVENTORY

1018 Thomasville Rd., Suite 200-C
Tallahassee, FL 32303
904/224-8207; 224-0626 FAX: 904/681-9364

GEORGIA FRESHWATER WETLANDS & HERITAGE INVENTORY

Game and Fish Div., Georgia Dept of Natural Resources
2117 U.S. Highway 278 S.E. Social Circle, GA 30279
706/557-2514 FAX: 706/557-2770

HAWAII HERITAGE PROGRAM

1116 Smith St, #201 Honolulu, HI 96817
808/537-4508 FAX: 808/545-2019

IDAHO NATURAL HERITAGE PROGRAM

Dept of Fish & Game, 600 S. Walnut St, Box 25
Boise, ID 83707
208/334-3402 FAX: 208/334-2114

ILLINOIS NATURAL HERITAGE DIVISION

Dept of Conservation 524 S. 2nd St
Springfield, IL 62706
217/785-8774 FAX: 217/785-8277

INDIANA HERITAGE PROGRAM

Div. of Nature Preserves, Dept Nat. Resources;
402 W. Washington St; Rm W267
Indianapolis, IN 46204
317/232-4052 FAX: 317/232-8036

IOWA NATURAL AREAS INVENTORY

Bureau of Preserves & Ecol. Services
Dept of Nat. Resources, Wallace State Office Bldg
Des Moines, IA 50319
515/281-8524 FAX: 515/281-8895

KANSAS NATURAL HERITAGE INVENTORY

Kansas Biological Survey
2041 Constant Ave Lawrence, KS 66047-2906
913/864-3453 FAX: 913/864-7789

KENTUCKY HERITAGE PROGRAM

KY Nature Preserves Commission
407 Broadway Frankfort, KY 40601 502/564-2886

LOUISIANA NATURAL HERITAGE PROGRAM

Dept of Wildlife & Fisheries
PO Box 98000 Baton Rouge, LA 70898-9000
504/765-2821 FAX: 504/765-2607

MAINE NATURAL HERITAGE PROGRAM

Office of Community Development
State House Sta.130, 219 Capitol Ave. Augusta, ME 04333
207/624-6800 FAX: 207/624-6810

MARYLAND NATURAL HERITAGE PROGRAM

Dept of Nat. Resources E-1, Tawes Bldg
Annapolis, MD 21401
410/974-2870 FAX: 410/974-5592

MASSACHUSETTS NATURAL HERITAGE & ENDANGERED SPECIES PROG

Div of Fisheries & Wildlife
100 Cambridge St. Boston, MA 02202
617/727-9194 FAX: 617/727-7288

MICHIGAN NATURAL FEATURES INVENTORY

Mason Building, 5th floor
Box 30028 Lansing, MI 48909
517/373-1552 FAX: 517/373-6705

MINNESOTA NATURAL HERITAGE PROGRAM

Dept of Natural Resources
500 Lafayette Rd., Box 7
St. Paul, MN 55155
612/296-3344 FAX: 612/297-4961

MISSISSIPPI NATURAL HERITAGE PROGRAM

Museum of Natural Science
111 N. Jefferson St
Jackson, MS 39201-2897
601/354-7303 FAX: 601/354-7227

MISSOURI NATURAL HERITAGE INVENTORY

Missouri Dept of Conservation
PO Box 180 Jefferson City, MO 65102
314/751-4115 FAX: 314/893-6079

MONTANA NATURAL HERITAGE PROGRAM

State Library Bldg 1515 E. 6th Ave
Helena, MT 59620
406/444-3009 FAX: 406/444-5612

NEBRASKA NATURAL HERITAGE PROGRAM

Game & Parks Commission, 2200 N. 33rd St
PO Box 30370, Lincoln, NE 68503
402/471-5421 FAX: 402/471-5528

NEVADA NATURAL HERITAGE PROGRAM

Dept of Conserv. & Natural Resources
c/o Div. of State Parks
123 W. Nye Carson City, NV 89710
702/687-4245 FAX: 702/885-0868

NEW HAMPSHIRE NATURAL HERITAGE INVENTORY

Dept of Resources & Economic Development
172 Pembroke St, PO Box 856
Concord, NH 03301
603/271-3623 FAX: 603/271-2629

NEW JERSEY NATURAL HERITAGE PROGRAM

Office of Natural Lands Management
501 E. State St, CN404 Trenton, NJ 08625
609/984-1339 FAX: 609/984-1427

NEW MEXICO NATURAL HERITAGE PROGRAM

University of New Mexico, Suite 100
2500 Yale Blvd, SE, Albuquerque, NM 87131-1091
505/277-1991 FAX: 505/277-7587

NEW YORK NATURAL HERITAGE PROGRAM

Dept of Environmental Conservation
700 Troy-Schenectady Rd Latham, NY 12110-2400
518/783-3932 FAX: 518/783-3916

NORTH CAROLINA NATURAL HERITAGE

Dept of Env., Health & Nat. Res. - Div. of Parks & Rec.
Box 27687 Raleigh, NC 27611
919/733-7701 FAX: 919/733-2622

NORTH DAKOTA NATURAL HERITAGE INVENTORY

N.D. Parks & Tourism Dept
604 E. Boulevard Ave. Bismarck, ND 58505
701/224-4892 FAX: 701/224-4878

OHIO NATURAL HERITAGE PROGRAM

Div of Nat. Areas & Preserves, Dept of Natural Resources
Fountain Sq, Bldg F, Columbus, OH 43224
614/265-6453 FAX: 614/262-6546

OKLAHOMA NATURAL HERITAGE INVENTORY

OK Biological Survey
2001 Priestly Ave, Bldg 605 Norman, OK 73019-0543
405/325-1985 FAX: 405/325-7702

OREGON NATURAL HERITAGE PROGRAM

Oregon Field Office 1205 NW 25th Avenue
Portland, OR 97210
503/229-5078 FAX: 503/228-3153

PENNSYLVANIA NAT. DIVERSITY INVENTORY

PNDI-EAST—The Nature Conservancy
34 Airport Dr., Middletown, PA 17057
717/948-3962 FAX: 717/948-3957

PNDI-WEST—W. Pennsylvania Conservancy

Natural Areas Program, 316 Fourth Ave.
Pittsburgh, PA 15222
412/288-2777 FAX: 412/281-1792

PENNSYLVANIA BUREAU OF FORESTRY

Forest Advisory Services
Dept of Environmental Resources
PO Box 8552, Harrisburg, PA 17105-8552
717/783-0388

RHODE ISLAND HERITAGE PROGRAM

Dept of Environmental Mgmt.
Div. of Planning & Development
83 Park St, Providence, RI 02903
401/277-2776 FAX: 401/277-2591

SOUTH CAROLINA HERITAGE TRUST

S.C. Wildl. & Marine Resources Dept
PO Box 167 Columbia, SC 29202
803/734-3893 FAX: 803/734-4086 (CALL 1st)

SOUTH DAKOTA NATURAL HERITAGE

S.D. Dept of Game, Fish & Parks
Wildlife Division 523 E. Capitol Ave.
Pierre, SD 57501-3182
605/773-4227 FAX: 605/773-6245

ECOLOGICAL SERVICES DIVISION

Tennessee Dept of Conservation
Life and Casualty Tower
401 Church St. Nashville, TN 37243-0447
615/532-0431 FAX: 615/532-0120



Swamp pink

TEXAS PARKS & WILDLIFE DEPT
Endangered Resources Branch
3000 IH-35 S., Ste. 100, Austin, TX 78704
512/448-4311 FAX: 512/440-8887

UTAH NATURAL HERITAGE PROGRAM
1636 West North Temple, Ste. 316
Salt Lake City, UT 84116-3193
801/538-7201 FAX: 801/538-7315

VERMONT NATURAL HERITAGE PROGRAM
Agency of Natural Resources, Center Bldg
103 S. Main St. Waterbury, VT 05671-0501
802/244-7331 FAX: 802/244-1102

VIRGINIA DIVISION OF NATURAL HERITAGE
Dept of Conservation & Recreation
1500 E. Main St, Suite 312
Richmond, VA 23219
804/786-7951 FAX: 804/371-2674

WASHINGTON NATURAL HERITAGE PROGRAM
Dept. of Natural Resources
1111 Washington St. SE
Olympia, WA 98504-7047
206/902-1650 FAX: 206/902-1787

WEST VIRGINIA NATURAL HERITAGE PROGRAM
Dept of Natural Resources, Ward Rd.
PO Box 67 Elkins, WV 26241
304/637-0245 FAX: 304/637-0250

WISCONSIN NATURAL HERITAGE PROGRAM
Endang. Resources/4 Dept of Natural Resources
101 S. Webster St, Box 7921
Madison, WI 53707
608/266-0924 FAX: 608/267-3579

WYOMING NATURAL DIVERSITY DATABASE
3165 Univ. Station, Laramie, WY 82071
307/766-3441 FAX: 307/766-2271

Regional Heritage Data Centers

NAVAJO NATURAL HERITAGE PROGRAM
Navajo Fish & Wildlife
PO Box 1480, Window Rock, AZ 86515-1480
602/871-6472 FAX: 602/871-6177/7040

TVA REGIONAL HERITAGE
River Basin Operations, Wildlife & Natural Heritage
Norris, TN 37828
615/494-9800 FAX: 615/632-1612

National Park Data Centers

NATIONAL PARK SERVICE
c/o Trish Patterson
75 Spring St., SW Atlanta, GA 30303
404/331-4916

BLUE RIDGE PARKWAY
700 Northwestern Plaza
Asheville, NC 28801 704/259-0760

EVERGLADES RESEARCH CENTER
EVERGLADES NATIONAL PARK
c/o Biology Department
P.O. Box 249118 Univ. of Miami
Coral Gables, FL 33124
305/284-3013 FAX: 305/284-3039

GREAT SMOKY MTNS. NATIONAL PARK
ATTN: Janet Rock
107 Park Headquarters Rd.
Gatlinburg, TN 37738 615/436-1250

GULF ISLANDS NATIONAL SEASHORE
1801 Gulf Breeze Parkway
Gulf Breeze, FL 32561 904/934-2605

MAMMOTH CAVE NATIONAL PARK
Div. of Sci. & Resource Mgmt.
Mammoth Cave Natl Park
Mammoth Cave, KY 42259 502/758-2238

YELLOWSTONE CONSERVATION DATA CENTER
c/o Stu Coleman, Yellowstone Natl Park
P.O. Box 168 Yellowstone, WY 82190
307/344-2150

National Forest Data Centers

NATIONAL FOREST IN FLORIDA
Dept of Agriculture 227 N. Bronough St, Ste. 4016
Tallahassee, FL 32301
904/681-7329 FAX: 904/681-7144

NATIONAL FOREST IN NORTH CAROLINA
P.O. Box 2750 Asheville, NC 28802
704/257-4810

OUACHITA NATIONAL FOREST
P.O. Box 1270 Hot Springs, AR 71902
501/321-5323

S. FLORIDA/CARIBBEAN NAT'L
PARKS DATA CENTERS
PO Box 279, Homestead, FL 33030
305/242-7800

BIG CYPRESS NATIONAL PRESERVE
S.R.Box 110 Ochopee, FL 33943

BISCAYNE NATIONAL PRESERVE
PO Box 1369 Homestead, FL 33030

THE NATURE CONSERVANCY
SCIENCE DIVISION
1815 N. Lynn St Arlington, VA 22209
703/841-5300 FAX: 703/525-8024

Regional Support Centers—US

Eastern Heritage Task Force (EHTF)
The Nature Conservancy 201 Devonshire St, 5th floor
Boston, MA 02110
617/542-1908 FAX: 617/482-5866

Southern Heritage Task Force (SHTF)
The Nature Conservancy
101 Conner Dr., Suite 302
PO Box 2267 Chapel Hill, NC 27515-2267
919/967-5493 FAX: 919/967-1575

Midwest Heritage Task Force (MHTF)
The Nature Conservancy 1313 Fifth St, SE
Minneapolis, MN 55414
612/331-0700 FAX: 612/331-0770

Western Heritage Task Force (WHTF)
The Nature Conservancy 2060 Broadway, Suite 230
Boulder, CO 80302
303/441-0355 FAX: 303/449-4328