

NatureServe is a leader in the field of biodiversity data management—the systems, software, and information technology tools needed to manage biodiversity data and to deliver useful products and services. For over 30 years, the hundreds of scientists of the NatureServe network of natural heritage programs have studied and documented imperiled plants, animals, and ecosystems, amassing more than 500,000 detailed locational records, representing the nation's leading source for information on threatened species and habitats.

Although widely used by government, conservation groups, and the private sector to inform conservation and environmental management, no comprehensive, direct Internet access to these data existed until now.

**NatureServe Web Services provides direct access to these data from your desktop by confederating the existing distributed network of biodiversity databases held by the natural heritage programs in each of the 50 states.**

## ■ THE GOAL: DISTRIBUTED WEB SERVICES ARCHITECTURE

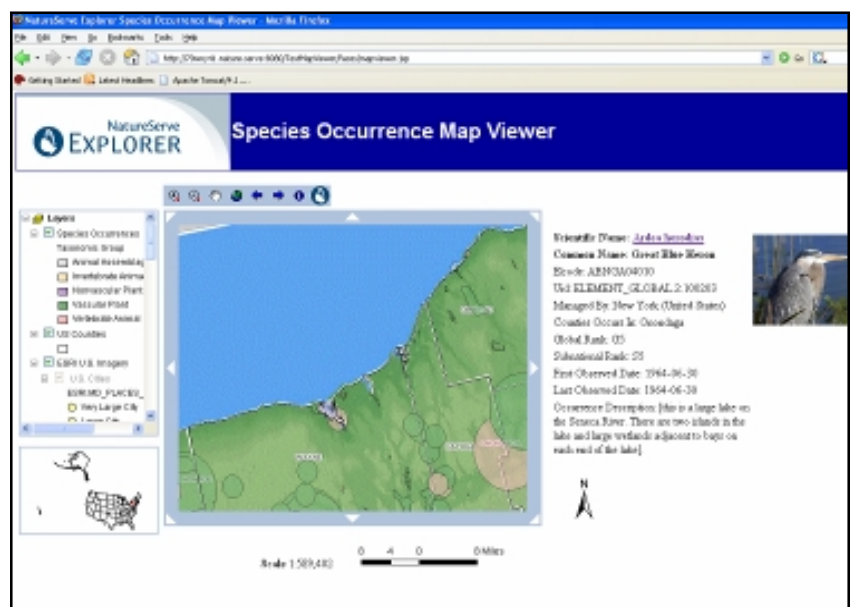
NatureServe is implementing web services for our central database node to improve access to our network's vast biodiversity data resources, using established XML-based web services protocols. This will provide unparalleled flexibility for online data access making it easier to explore, extract, and analyze our data in a way that makes sense for your needs and applications. You can dictate the format that you need through such mechanisms as XML transformation from our schema to another or even create customized GIS data layers.

Although in practice it will take some time for all network participants to become web services-enabled, the long-term vision is to employ this web services framework for all NatureServe network nodes. Through this architecture, each data provider would continue to host the data locally and respond directly to data requests from the central node or from other compatible third-party applications.

## ■ THE PRODUCT: MENU OF WEB SERVICES IN DEVELOPMENT

NatureServe is developing a menu of standard and GIS-based web services that will respond to application requests. Examples of the type of request-response services under development are listed below. For responses that include location information, detailed or generalized map features will be returned in a format that can be displayed and integrated into open GIS applications.

- Submit the name of a species and retrieve detailed information about that species, including its legal and conservation status.
- Submit the name of a species and retrieve all known population occurrence locations for that species in North America.
- Submit a boundary for your area of interest, and retrieve a yes/no response about whether there are any known occurrences for threatened and endangered species in that area.
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# Web Services: Delivering Biodiversity Data to your Desktop

- Submit a species name and a boundary for your area of interest, and retrieve all known population occurrence locations for that species within the provided area.
- Submit a boundary for your area of interest, along with an Endangered Species Act status or NatureServe conservation status, and retrieve a list of the species matching your criteria known to occur in the provided area.

## ■ THE TECHNOLOGY: MORE ABOUT WEB SERVICES

NatureServe Web Services are built on two complementary technologies. The first is a suite of web services delivering both standard and custom biodiversity XML documents, discovered using UDDI and accessed using SOAP or REST. The second is a set of robust GIS map services and feature services using the ESRI technology platform as its core. Both of these technologies have been combined so that they are platform and application independent to allow for the maximum user base possible. These two technologies form the data delivery portion of NatureServe Web Services.

Securing these two core technologies is a unique access control system that has been developed in collaboration with researchers at the University of Massachusetts-Boston. Most web service-based security approaches focus only on protecting XML documents, without addressing the unique problems that are presented by protecting GIS data integrated with other XML data. This robust security system is the key to reassuring data providers that their data will be protected and controlled.

These technologies integrate to form a peer-to-peer network where all of the data providers in the NatureServe network are serving their data using a common set of web and map services. Using web services, NatureServe network data providers will eventually be capable of responding directly to information requests with near real-time data.

## ■ THE DATA: OUR NETWORK AND BIODIVERSITY DATA MODEL

The NatureServe network is one of the most successful existing examples of a distributed network of biodiversity databases. The key to creating interoperability among the 60 local database nodes that comprise the NatureServe network in the United States and Canada is the common use of a rigorous set of biological inventory and data management standards and protocols, known collectively as *natural heritage methodology*. Natural heritage methodology is designed to support a decentralized database network that respects the principle of local custodianship of data.

This existing NatureServe biodiversity data model forms the basis for the standard set of XML schemas that is exposed through the Internet gateway. These standard schemas are a crucial component of a web services environment, because they allow all members of the NatureServe network to communicate among themselves in a standard way while also giving consumers of NatureServe data a common vocabulary.

## ■ BENEFITS FOR DATA USERS

- Access comprehensive data on the location and distribution of species populations and ecological communities from a single Internet source — “one-stop shopping.”
- Obtain near real-time access, reflecting the most recent biological inventories and taxonomic changes.
- Access data in formats needed for use and analysis in other applications, such as GIS data layers.
- Easily compare data developed across multiple states and provinces.

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### FOR MORE INFORMATION

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