



# **Parks Canada and NatureServe: Working Together to Conserve Biodiversity Paper UC2268**

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## 0.0 Abstract

Parks Canada's mandate includes protecting ecological integrity (EI) now and for future generations. Conserving biodiversity including species at risk is a key component to protecting EI.

Parks Canada needs a standard biodiversity information system that includes a standardized data model and standardized spatial mapping capacity in order to protect EI.

Parks Canada is working with NatureServe's Biotics GIS system.

Parks Canada is using both the biological and technical standards that are embodied in the system for internal park management as well as the real capacity to work with other governmental departments, including provincial and territorial governments, NGOs, US jurisdictions, and other members of the biodiversity conservation community.

NatureServe is a non-profit conservation organization that coordinates an international network of natural heritage programs and conservation data centers operating in all 50 US states, 11 provinces and territories in Canada, as well as in Latin America and the Caribbean.

## 1.0 Conservation of Biodiversity

Biodiversity is referred to as life's plants and animals. It is commonly recognized that maintaining Biodiversity and turning the trend on its reduction is crucial to human kinds survival (Wilson, E.O, 2005).

The most imperilled part of Earth's biodiversity is referred to as rare species. Rare species are a function of various factors such as limited natural habitat or human induced reductions. The Government of Canada passed '*The Species at Risk Act*' in June of 2003 to help protect and recover rare species in Canada as part of a strategy to Canada's signing of the worlds Convention of Biodiversity in 1992.

### 1.1 Parks Canada and Ecological Integrity

Canada's national parks organization, the first in the world, traces its roots back to 1885 when 26 square kilometres (km<sup>2</sup>) around mineral hot springs near Banff Station, Alberta, were set aside for public use.

The Parks Canada Agency is headquartered in Gatineau, Quebec, with senior executive offices located in Calgary, Banff, Halifax and Québec City. Parks Canada employs 5500 employees across 39 operational field units, each providing on-site services to visitors in national parks, national marine conservation areas, and national historic sites, including historic canals.



Parks Canada currently protects 270 thousand km<sup>2</sup>, representing 28 of Canada's 39 natural regions. In addition, the potential exists to add a further 128 thousand km<sup>2</sup> to the system if new park and park expansion proposals currently being discussed with provincial and community partners come to fruition. The existing parks amount to roughly three percent of Canada's land mass, analogous to a geographic area equivalent to the size of all of the maritime provinces combined, plus the island of Newfoundland.

According to the *Canada National Parks Act*, the law governing national parks in Canada, "ecological integrity" means, with respect to a park, "...a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes."

In plain language, ecosystems have integrity when their native components are intact, including: abiotic components (the physical elements, e.g. water, rocks), biodiversity (the composition and abundance of species and communities in an ecosystem, e.g. tundra, rainforest and grasslands represent landscape diversity; black bears, brook trout and black spruce represent species diversity) and ecosystem processes (the engines that makes ecosystem work; e.g. fire, flooding, predation).

Parks Canada's objective is to allow people to enjoy national parks as special places without damaging their integrity. In other words, ecological integrity is our endpoint for park management; ecosystem management is the process used to get there.

The Parks Canada Agency (PCA) in trying to manage for ecological integrity is concerned with the status of all species living in its protected heritage areas. However, the Parks Canada Species at Risk Program pays particular attention to the recovery of species at risk found either exclusively or predominantly within national parks and other protected heritage areas.

Parks Canada staff collaborates with other federal, provincial and territorial agencies, as well as with universities and not-for-profit organisations and is an active member of many SAR recovery teams.

In terms of Biodiversity inventory, Parks Canada uses a stepwise approach (Figure 1) with earlier data collection steps involving more biodiversity elements (e.g. species and natural communities), examined in lesser detail, and later steps involving fewer biodiversity elements (e.g. all or a subset of species at risk), examined in greater detail (Eberhardt, 2005).

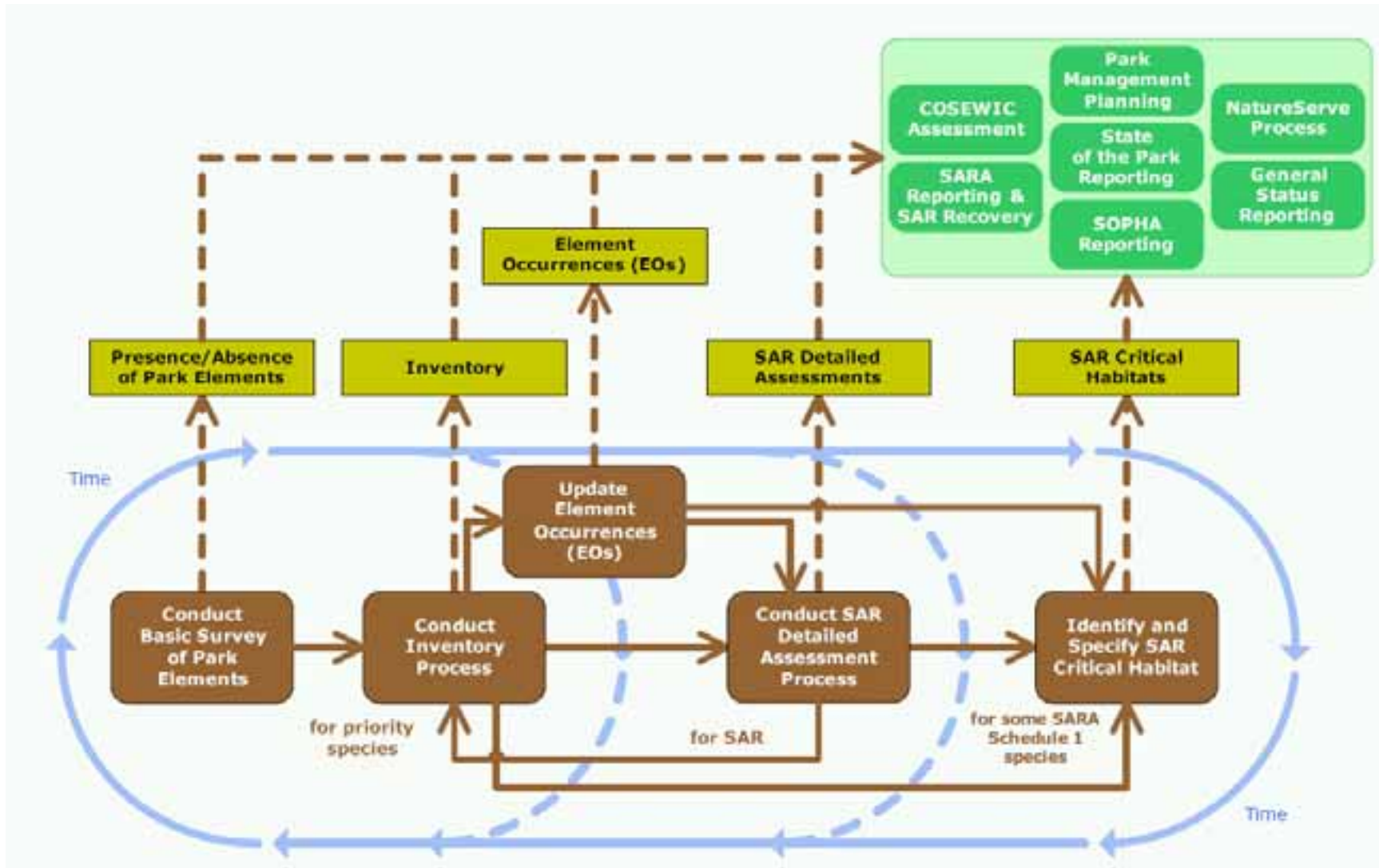
The data collection steps are as follows (see Figure 1):

1. Conduct a Basic Survey of Park Biodiversity Elements
2. Conduct an Inventory and Update Element Occurrences (NatureServe Element Occurrences)
3. Conduct a Species at Risk (SAR) Detailed Assessment (NatureServe Park Ranking Process)





Figure 1 - PCA Inventory Sequence:





## **1.2 NatureServe and Conservation**

NatureServe is a non-profit conservation organization that provides the scientific information and tools needed to help guide effective conservation action. The organization carries on a legacy of conservation work that began when The Nature Conservancy helped to establish the first state natural heritage program in 1974. Over the next two decades The Nature Conservancy and a collection of public and private partners built a network of natural heritage programs in the United States to collect and manage data about the status and distribution of species and ecosystems of conservation concern.

As this network expanded to include Canada and Latin America, natural heritage programs and their Canadian counterparts (called conservation data centres) became the recognized source for the most complete and detailed information on rare and endangered species and threatened ecosystems, relied upon by government agencies, corporations, and the conservation community alike. Today the NatureServe network includes 74 independent natural heritage programs and conservation data centres throughout the Western Hemisphere, with some 800 dedicated scientists and a collective annual budget of more than \$45 million.

NatureServe, the membership organization for this network, was established in 1994. In 2001 The Nature Conservancy, which since the 1970's had provided scientific and technical support to the network, transferred this role to NatureServe, along with professional staff, databases, and responsibility for the scientific standards and procedures under which the network operates.

The cornerstone concept of the network is that the member programs employ a uniform set of tools and methods – currently embodied in the *Biotics* software – so as to enable a body of compatible data to be built for the purpose of informing conservation work. The level of detail in this data enables meaningful work by conservationists at a local scale, and the standards employed across the network allow for the aggregation of data at the regional, national, and international scales.

## **1.3 PCA and NS working together**

### **1.3.1 Scientific Standards**

Parks Canada needs a standard system and methodology in order to manage biodiversity information within PCA lands and waters as well as greater ecosystems, including that for species at risk (SAR), within Parks Canada. It also needs to share this information with other members of the biodiversity conservation community, including provincial/territorial governments, NGOs, and US jurisdictions. As well implementation of the Species at Risk Act (SARA) and the national *Accord for the Protection of Species at Risk* both require Parks Canada to work with other governmental departments, including provincial and territorial governments,



NGOs, US jurisdictions, and other members of the biodiversity conservation community. Using a common information system and data standard will greatly enhance this effort.

After examining several possibilities including internal development, Parks Canada chose Biotics 4, the NatureServe biodiversity data management system, as the best way to standardise biodiversity tools and science for data gathering, sharing and access (Oliver, 2004). Historically Parks Canada has managed biodiversity at a very coarse scale nationally and at a fine scale usually project based at the Park level. The relationship and system with NatureServe has allowed Parks Canada to manage all types and scales of biodiversity data at a national level yet are accessible and useful at a Park level. By choosing to adopt the NatureServe system Parks Canada has chosen to help the NatureServe network and benefit from the 32 years in data management experience. Biotics 4 offers all the elements for a standardized system to collect systematic and incidental survey data for almost all species. It was recognized early that Parks Canada would not use Biotics 4 to collect all types of observations (particularly the non-rare species and plot data) and would need to work with NatureServe to develop a module for that purpose. In 2003, Parks Canada and NatureServe signed an MOU enabling joint efforts in biodiversity conservation, and in 2005 signed a joint data sharing agreement to enable Parks Canada to use Biotics 4 and become part of the NatureServe network.

### 1.3.2 Technical Standards

*Biotics 4*, the current software version, was released in 2002. It offers a suite of industry standard relational database (*Oracle*) and GIS (ESRI's *ArcView*) tools, as well as custom utilities for administration and data manipulation, and tools for facilitating the exchange of data according to the operating procedures of the NatureServe Network (figure 3). It is designed for use in a networked environment. Parks Canada uses Citrix Technology in order to share the application across its network including sites with very slow bandwidth.

## **1.4 How does it work**

The Conservation Data Centres process Parks Canada observational data into Biotics 4 (Figure 2 number 6) and, periodically on a scheduled basis, forward the information to the central NatureServe database for further processing and coordination. The central NatureServe database will then send updated information back to the provincial/territorial CDC and also to the Parks Canada Biotics 4 database in National Office. The updated information will be available to field units and service centres primarily through the Parks Canada installation (figure 2) (Eberhardt, 2005).





## 2.0 The future

### 2.0.1 Parks Canada

Parks Canada will continue to develop the partnership with NatureServe. Currently Parks Canada needs a standardized system to collect all types of biodiversity observations (Figure 2 number 2). Biotics 4 although capable, was not designed as a general observation system (Biotics focuses on rare species). Parks Canada currently has a few data models for collecting observations based on internal working groups.

The first step in developing an observation system for Parks Canada is to develop an observation data model. To realize this Parks Canada is currently participating on NatureServe's Element Observation data model working group. The goal of the working group is to provide a more holistic conservation based observation data model. Once this data model is in place it will allow Parks to manage their observations in a standardized model, which will allow easier exchange with Conservation Data Centres.

### 2.0.1 NatureServe

NatureServe establishes goals for each fiscal year. One of the goals this fiscal year is to move the development of Biotics 5 forward and the priority will focus on the observation data system that will be built on the NS observation data model.

Over the course of the network's history the data system and associated information management methods have evolved and become finely tuned to the needs of conservation scientists and practitioners. The current version of the system contains standardized databases that are used to manage information about taxonomic names, characterization of species and higher taxa, ecosystem and community type classifications, conservation ranks of species and communities, species population occurrences, and detailed spatial distributions for species of concern.

#### 2.0.1.1 The Vision for Biotics 5

Many technical trends and advances are available now and it is time to develop a new version of the *Biotics* system that takes full advantage of these advances. NatureServe has identified key design goals for the next generation of its data management system. The new version must:



- **Be standards based.** It will embody a full implementation of current global standards for data content and technology.
- **Be interoperable.** The various subject-area application modules (taxonomy, population occurrences, etc.) must interoperate in logically cohesive ways, and there must also be interoperability between *Biotics 5* installations. The system will use web services in large measure to accomplish this.
- **Be accessible.** *Biotics 5* is to be 100% web-based. It will provide support for disconnected usage for certain applications.
- **Be multi-lingual.** It must provide the user with the choice of an interface in English, French, or Spanish.
- **Operate in near “real-time”.** The system will provide a single solution for data collection, data management, and data publishing. Exchange of data among users will be possible upon demand.
- **Be extensible.** The system will be able to accommodate new application modules and new core functions with relative ease. Specifications for creating new functions will be made available to appropriate developers.
- **Have an upgrade path.** It must provide for a “hosted” mode of use (i.e., it must be operable by a host agency, for use by other agencies), and thereby streamline the process of updating the technology. It must leverage the community’s pool of investment dollars.
- **Be affordable.** Through the “hosted” deployment scenario, it will minimize startup and ongoing management costs for the user; the need to acquire and manage expensive local systems will be reduced.

NatureServe is considering designing Biotics 5 to take full advantage of ArcGIS Servers functionality. ArcGIS Server would enable the NatureServe Networks data for the Canadian Conservation Data Centers and United States Heritage Programs to be hosted as a live GIS based web application that is centrally located. This would enable users across the network with different access levels, skills and technologies to input and access the information that is needed for appropriate conservation planning and management while minimizing cost for each program or data center. Using the ArcGIS Server framework would allow for simplified customization and integration into other systems that may be used across the network. By using these technologies provided by ESRI the current process of data exchanges, data access distribution and capacity would be dramatically improved over the current technologies being implemented in various forms throughout the NatureServe Network.

### 2.0.2 Parks Canada and NatureServe

Parks Canada and NatureServe will continue to work together to develop scientific standards and data to help the conservation of biodiversity through contracts, working groups, training and staff exchanges.

Parks Canada wants to help NatureServe become a stronger organization. As NatureServe becomes stronger it will directly benefit Parks Canada and conservation in general.



The two organizations will be working very closely to develop an Element Observation system built on the NatureServe Element Observation data model in the next year. This will greatly increase the ability for these two organizations to work together and have the best available data for conservation needs. This new observation system will be the first module in Biotics 5 and will be based on webservices and rely heavily on ESRI for its GIS capacity.



Figure 2 - PCA – NS Dataflow:

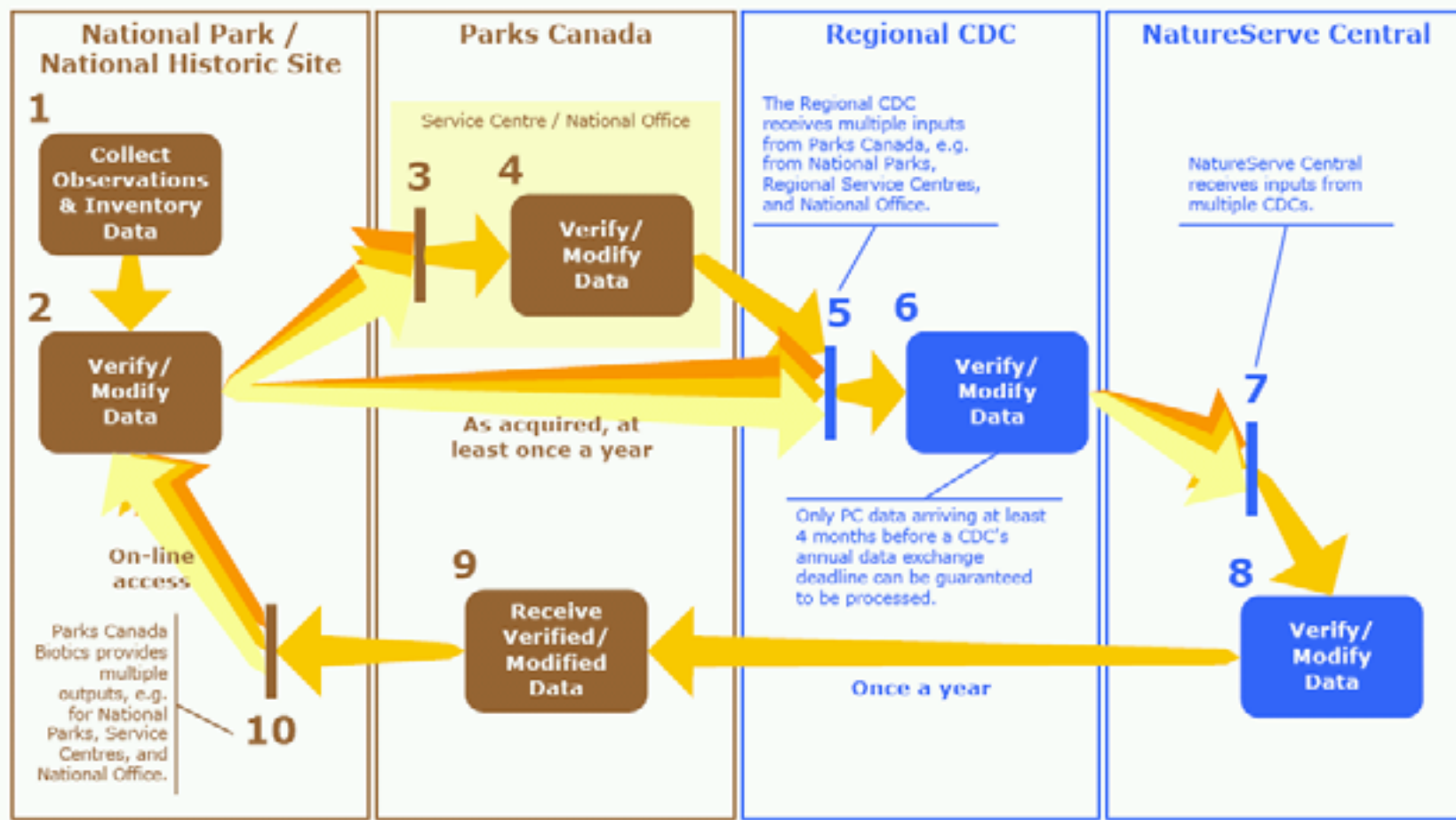







Figure 3 - Biotics 4 :


### Tracker – tabular data management



- Form based interface for finding and managing data
- Easy navigation between related data  
Work with multiple records across data types at one time
- Saved lists and related functionality simplify data organization
- Supports extensibility with dynamic tab interface
- Editing tools such as spell check and rich text support
- Tool for ad-hoc queries

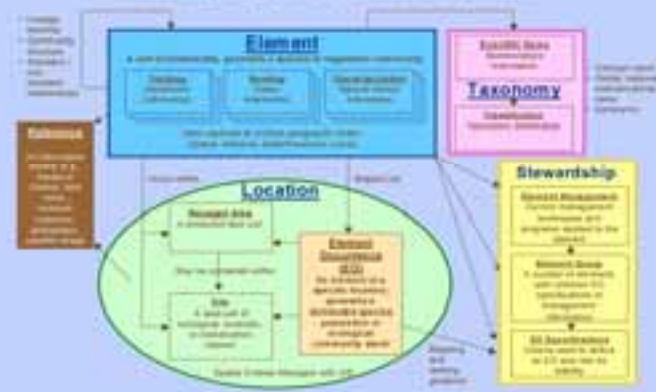
### Exchanger – data exchange tools



- Standard XML exchange format allows data to be shared between database nodes
- Implements rules to aid taxonomic reconciliation
- Flexible interface supports field-by-field comparison of incoming records

## Biotics 4 Logical Model

Reflecting 25 years of practical experience




The diagram illustrates the logical model with four main components:
 

- Element** (blue box): A unit of biodiversity, occurrence, or distribution, representing a specific taxonomic entity.
- Location** (green oval): A geographical area, including a specific site or a range of sites.
- Stewardship** (yellow box): A record of management actions, including monitoring, protection, and restoration.
- Taxonomy** (pink box): A classification system, including taxonomic hierarchy and nomenclature.


 Relationships are shown between these components, such as 'Element' being associated with 'Location' and 'Stewardship', and 'Taxonomy' providing the classification for 'Element'.

### Mapper – spatial data management



- Creating Occurrence Representations
- Calculating Spatial Attributes
- File Management and Navigation
- Advanced Spatial Editing Tools


### Administrator



- Manage user access and security  
Security for group/users down to the field level
- Extensibility  
Customize local optional data with dynamic lists
- Configure domain tables and system options

### Biotics 4: Technological Components

- Database: Oracle
- OS: Windows
- User Interface: Microsoft
- Data Exchange Format: XML
- Reporting Tool: Crystal Reports





### **3. 0 References:**

Eberhardt, Ewen and Oliver, David, 2005: Guide to Biodiversity Element Inventory and SAR Detailed Assessment. Internal PCA Report

Oliver, David and Eberhardt, Ewen, 2004: A Review of Biodiversity in Parks Canada. Internal PCA Report.

Wilson, E.O et al, 2005, INSIGHTS: Human Activities Cause of Current Extinction Crisis, letter to members of the U.S. Senate Environment and Public Works Subcommittee on Fisheries, Wildlife and Water.

### **4. 0 Links:**

Parks Canada:

<http://www.pc.gc.ca/>

Parks Canada Biotics Web Explorer (non sensitive data):

<http://www.pc.gc.ca/apps/bos/>

NatureServe:

<http://www.natureserve.org/>

NatureServe Explorer:

<http://www.natureserve.org/explorer/>

NatureServe Biotics :

<http://www.natureserve.org/prodServices/biotics.jsp>