❖Standard 3: Use a consistent data management framework in accordance with internal and partner organization data standards.

[CONCEPTUALIZE]

Rationale

Establishing and using a consistent data management framework will enable more effective use of the assessment/vision, efficient updates over time, analyses within and across ecoregions, and implementation by partners and stakeholders.

Recommended Products

- Documentation of data types, sources, confidence levels, gaps, data sharing agreements, and use/limitations.
- A populated database that contains all of the required data fields in the Data Standards[1]. Data must be managed in consistent database structures (currently the Conservation Planning Tool [CPT] is the accepted standard for long-term data management and access).

INTRODUCTION

Data management is just as important as the data itself. If data is collected but not easily accessible, all the effort that went into collecting it will be lost. A good data management program recognizes that: 1) Information comes from a wide variety of sources, but it should be managed in one place within a consistent framework; 2) This information will be used for years, and it should be simple to revise and update 3) Information will be shared with others and used in other phases of conservation actions, and; 4) Staff turnover will occur. Appropriate documentation allows knowledge to be passed on.

The Nature Conservancy does not yet have a comprehensive data management strategy. However, the Conservancy has developed a number of tools, methodologies and, more recently, standards, to aid in the management of tabular and spatial ecoregional information. This section discusses data management strategies, data standards, and tools, such as Geographic Information Systems (GIS) and TNC's Ecoregional Data Management Tool.

Well-executed data management includes:

- A data management strategy
- Metadata/data standards
- The support of a data manager
- The use of tools such as GIS and EDMT.

Data management strategy

[1] Current Data Standards can be found at http://www.conserveonline.org/2004/09/g/ERA_Data_Standard_Version_1.0

Ecoregional assessment teams invest resources into data compilation to produce a set of products. This information can quickly become outdated, be misinterpreted because of lack of documentation, or even become lost. Conservation approach depends on reliable, credible and current information. Without a data management strategy for each ecoregional assessment, information can become isolated or rendered useless, and unable to provide the key indicators necessary to monitor the progress toward our biodiversity conservation goals.

We need to organize data systematically if we are to access, analyze, and share those data. At a minimum, a Data Collecting and Management Strategy should:

- List data needs and possible sources
- Define how standards and metadata will be used throughout the data collecting process
- Define data sharing agreements with data sources where applicable
- Gather all freely available and useful data
- Collect and manage data using adequate cartographic and mapping standards (projection systems, measurement units and datum systems)
- Perform a data reliability/confidence and accuracy assessment of collected data, developed data and products (e.g. viability assessments)
- Define data gaps and priorities for filling gaps.
- Define data that require regular updates (viability ranks, scope and severity of threats etc.)
- Perform analyses, document analyses and data modifications
- Prepare final reports, organize data for distribution and publication.
- Develop data distribution plan (including data licensing, data sharing agreements and MOU's)

Ecoregional Assessment Data Standards and Metadata

In large organizations, dozens of assessment teams are collecting and managing information in parallel. Data standards guide the process of collecting, managing and storing data to keep data organized and useful for assessment teams, partners and for further analyses,. Data standards identify the minimum contents of a dataset including conceptual attributes and values for tabular and spatial data layers. Metadata is the documentation that accompanies any dataset whether tabular or spatial. Metadata records information such as the source, reliability and scale of the data, the citation, the appropriate use and a contact person or agency. Metadata also documents the accuracy, projection and derivation of spatial data.

An organization-wide standard that defines the manner in which data are documented saves time and resources in developing data and preparing it for distribution. Several organizations have developed and implemented data standards (NPS, USGS, etc). The Nature Conservancy has developed its first iteration of data standards aimed at organizing spatial and tabular information pertaining to target selection, goal setting, target occurrences, viability, and portfolio assembly. Assessment teams are encouraged to use the current data standard to effectively manage conservation information in ecoregional assessments. (See Ecoregional Assessment Data Standard version 1.0)

Data management support

All ecoregional assessment teams need the support of a data manager who is able to collect information, perform complex analyses, produce quality maps, and administer all tabular and spatial information in an organized and efficient manner. The lead information manager/data manager would ideally be located in a field office and should be identified as early as possible to answer key information management questions and establish the data management structure for an ecoregion. This person should coordinate information management during the active planning and between editions of the plan. Organizations or field offices with limited staff capacity may need to contract with a state Heritage Program, Conservation Data Center, or even a partner to manage ecoregional information, but it will be important to establish clear data sharing agreements with these programs.

Job Descriptions summarize some of the major strengths, roles and responsibilities of data managers. The links below will take you to descriptions for the following TNC job titles:

Science Information Manager - (http://34568.portal.tnc.org/hr/compensation/files/6014.doc)
GIS Manager - (http://34568.portal.tnc.org/hr/compensation/files/6013.doc)

A one-size-fits all, standardized data management strategy will not be suitable for all assessments. However, data managers should be able to be cross-walk and integrate their data management framework with other data management systems through the use of data, mapping, and cartographic standards. Existing data management tools will enable data managers to administer information, but in special cases they will need to create, innovative solutions for data storage, analysis and distribution. Documenting this innovation is the key to providing learning opportunities. Documenting data gaps is also crucial to enabling efficient future assessment iterations and revisions through identifying the areas where more data are needed to create a more complete decision support tool.

Data management tools

The information collected in an ecoregional assessment, ranges from tabular and spatial data of conservation targets (species, communities and ecological systems) and their attributes, to names of participants and experts consulted in the process. Below is a brief description of the primary tools used for spatial and tabular data management. .

A **Geographic Information System** (GIS). Provides one of the most comprehensive, standardized and flexible data management tools. Widely available, with ongoing support and innovations, GIS will provide a user with the basic data management and analysis tools to work with all spatial data, in both vector and raster formats. A GIS will also manage associated tabular information (the attributes) of spatial data and enable the user to update this information. Finally, the GIS provides a platform for map creation for communication products. There are many GIS software products with different approaches, costs, learning curves, sophistication, and each has its individual strengths and weaknesses. This toolbox provides a review of GIS software and their potential applications.

ESRI

This software developer company has developed dozens of specific tools for a variety of applications for the past 25 years. ESRI provides the standard GIS packages used at TNC due to its ease of use, reliability and scalability. Data development, analysis and storage are the more common applications of the ESRI tools. There are a variety of tools and applications:

- *ArcView 3.x*: A simple, robust and programmable application that enables users to use data layers, connect them to databases, perform simple analyses and create good quality maps. Biodiversity analysis extensions for ArcView have been developed by a variety of authors:
- *Patch Analyst*: Provides fragmentation analysis of a continuous landscape by measuring connectivity, edge metrics and other statistics of land cover maps.
- *X Tools:* Provides basic geoprocessing tools, projection tools, atttribute tools and more.
- *ArcGIS*: A more comprehensive tool set is included in this version of the ESRI GIS. There are three versions of this application: ArcGIS, ArcCatalog and ArcINFO. Each offers extra tools that enable additional operability in analyses, databases, complex data models and metadata management. ArcGIS provides such a comprehensive GIS, that it is now becoming the standard recommendation for GIS, analysis and spatial data management.

In addition to the standard tools that are included in the two packages mentioned above, there are additional, optional tools:

- *Spatial Analyst*: Enables raster data analyses, grid reclassification and more.
- *Image Analysis*: Provides basic image processing tools such as georegistration, unsupervised classification tools, among others.
- In addition, there are other tools such as *Network Analyst, Tracking Analyst*.. See the Resources section for more information.

Also, ESRI offers a yearly training event for conservation applications that is accessible for non-profit organizations for discounted or free access. Read up on the Society for Conservation GIS sponsored by ESRI at http://scgis.org/.

IDRISI

Standard data management and analysis can be developed in ESRI products, but Clark Lab's IDRISI provides a comprehensive analytical toolset that enables research with applications in priority setting, multi-criteria evaluation and more. One of the priority setting tools developed by the Arizona Chapter of the Conservancy used IDRISI's toolset (see link to Arizona example of priority setting).

Remote Sensing

Most data is obtained from existing datasets or collected at the field using GPS units. However, in situations when little data exists or data is obsolete, remotely sensed data can be used to assess the current coverage of land cover types in a specific area. Remotely sensed data can include satellite imagery at a variety of scales and from a variety of sources, and aerial photography. Sayre et al (2000) details applications of remotely sensed data for biodiversity applications. Advanced tools to interpret and process remotely sensed data can be found in the ERDAS Imagine software packages.

The Nature Conservancy developed the **Conservation Planning Tool** (CPT) to manage the common types of tabular data collected during the Ecoregional Assessment Process. CPT is a relational database developed for Microsoft Access. It is the Conservancy's primary tool for tabular data management and was designed to standardize data storage. It will catalogue data related to portfolio sites, targets, ownership/administration, threats, strategies, stratification units, participants and experts, and general ecoregion description data. This tool helps organize and archive data, identify data gaps, standardized data for larger scale roll-ups and analyses and ready data for import/export for other purposes such as GIS and Conservation Area Planning. The Conservancy recently released version 1.5 with user recommended modifications and additional capacity for marine and freshwater data. For a useful description of one teams experience with CPT see *Populating the CPT: the Southeast Division's Experience* in the Resources section of this document.

OPPORTUNITIES FOR INNOVATION

Under development

CASE STUDIES

- EDMT GIS Tools. The Ecoregional Data Management Team (EDMT) was asked to design a suite of products that would 1) meet the need of Northwest chapters for efficient data assembly and management and readily accessible products of ecoregional assessments (ERA), and 2) design and test a system for addressing these needs TNC-wide. A data model and custom GIS software have been completed and are useful for ERA data rollup, development of ecoregional status measures, development of custom products relevant to external partners, and support for analyses at the scale of ecoregional portfolio sites, multi-ecoregions, and larger (e.g., global habitats). While the tools developed are still being tested and therefore not publicly available, a comprehensive summary of the development and use of these tools can be accessed here. For more information contact Steve Farone (sfarone@tnc.org).

TOOLS

CPT version 1.5 is available from Marjorie Bennett (mbennett@tnc.org) or Kurt Eckerstrom (keckerstrom@tnc.org). View a summary of the new version here.

Ecoregional Assessment Data Standard, Version 1.0- is a standard that outlines the minimum required data attributes that must be compiled during an ecoregional assessment. The standard provides "dictionaries" of data attributes necessary for all stages of the EA process and definitions of these attributes.

GIS Tutorial Dataset provides data and a tutorial to teach basic GIS functions useful to conservation planning. This tutorial can be found at http://gis.tnc.org/knowledge/training/CSDintroAV.php

An example of a Metadata report for the Southern Rocky Mountains Ecoregion Boundary can be viewed at http://gis.tnc.org/community/projects/FWI/metadata/srock_ecoreg.htm

RESOURCES

Websites

ArcView tools are available at the GIS.TNC.ORG website. See http://gis.tnc.org/systems/sw_links.php?display=sw_esri

The authoritative source for extensions for ArcView can be found at http://arcscripts.esri.com/

You can find more descriptions on extensions for ArcView at http://support.esri.com/index.cfm?fa=software.filteredGateway&PID=25 and for ArcGIS at http://support.esri.com/index.cfm?fa=software.extentions&PID=43

To obtain ESRI GIS products for Conservancy offices, please contact Susan Miller (smiller@tnc.org) or Demian Ryebock (dryebock@tnc.org) at the Conservation Systems Office.

Find out more about remotely sensed data interpretation using ERDAS at http://www.gis.leica-geosystems.com/Products/Imagine/

A more comprehensive list of GIS, analysis and Remote Sensing software can be found at http://www.geoplan.ufl.edu/software.html

More information on IDRISI and research applications is available at www.clarklabs.org

Publications

BCIS has developed an eight volume framework for data management and sharing available at www.biodiversity.org

Biodiversity Conservation Information System. 2000. Framework for Information Sharing: Principles . Busby, J.R. (Series Editor).

Executive Overview

- Volume 1: Principles
- Volume 2: Procedures Manual
- Volume 3: Custodianship
- Volume 4: Data Access
- Volume 5: Metadata
- Volume 6: Standards & Quality Assurance
- Volume 7: Core Datasets
- Volume 8: Tools & Technologies

Groves, C. (2003). Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. Washington, The Nature Conservancy. Island Press.

Minor, Brit (2005). Populating the CPT: the Southeast Division's Experience. Southern Resource Office, The Nature Conservancy.

Reichl, O. (1998). An Information Management Plan for the Thousand Islands Ecosystem. St. Lawrence Islands National Park, Mallorytown, Ontario.

Sayre, R., E. Roca, et al. (2000). Nature in Focus: Rapid Ecological Assessment, Island Press.