



Inventory and Monitoring Program

Data Management Plan for the Southern Plains Inventory and Monitoring Network

Natural Resource Report NPS/NRPC/NRR—2008/067



ON THE COVER

Pecos National Historical Park. NPS Photo

Data Management Plan for the Southern Plains Inventory and Monitoring Network

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Change History

Version numbers will be incremented by a whole number (e.g., Version 1.3 to Version 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.6 to Version 1.7) when there are minor modifications that do not affect requirements or procedures included in the plan.

The following revisions have occurred to this plan since September 30, 2008

Version #	Date	Revised by	Changes	Justification

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List of Acrynomns

ALFL	Alibates Flint Quarries National Monument
ANCS+	Automated National Catalog System
BEOL	Bent's Old Fort National Historic Site
BOD	Board of Directors
CAVO	Capulin Volcano National Monument
CESU	Cooperative Ecosystems Studies Unit
CHIC	Chickasaw National Recreation Area
DGPS	Differential Global Positioning System
DMP	Data Management Plan
EHE	Estimated Horizontal Error
ESRI	Environmental Systems Research Institute
EXIF	Exchangeable Image File Format
FAB	Front End Builder
FGDC	Federal Geographic Data Committee
FOIA	Freedom of Information Act
GIS	Geographic Information System
GPS	Global Positioning System
I&M	Inventory and Monitoring (Program)
ITIS	Integrated Taxonomic Information System
JPEG	Joint Photographic Experts Group
NAD27	North American Datum 1927
NAD83	North American Datum 1983
NADCON	North American Datum Conversion
NMAS	National Map Accuracy Standards
NPS	National Park Service
NRDT	Natural Resources Database Template
PDA	Portable Digital Assistant
PDF	Adobe Portable Document Format
PDOP	Dilution of Precision
RPRS	Research Permit and Reporting System
SNR	Signal to Noise Ratio
SOP	Standard Operating Procedure
SOPN	Southern Plains Network
SQL	Structured Query Language
TC	Technical Committee
TIFF	Tagged Image Format
TSN	Taxonomic Serial Number
USGS	U.S. Geologic Survey
UTM	Universal Transverse Mercator
WAAS	Wide Area Augmentation System
WAN	Wide Area Network
XML	Extensible Markup Language

Executive Summary

The central mission of the National Park Service (NPS) Inventory and Monitoring (I&M) Program is to provide timely and usable scientific information about the status and trends of park resources to park managers. To meet this challenge a method for effective data management that can effectively produce, maintain, and distribute the products of scientific investigation conducted in our parks is required.

Good data management provides the means by which a thorough understanding of the value of scientific information about our natural resources can become a part of the National Park Service heritage. Data management refers to the framework by which data are acquired, maintained, and subsequently made available. Data management is not an end unto itself, but a means of maximizing and insuring the quality and utility of our natural resource information. A robust data management system is particularly important for long-term programs where the lifespan of a data set will span the careers of several scientists. Sound data management is vital to the success of any long-term research program.

The purpose of the Southern Plains Network's data management plan is to provide I&M and other park staff with a conceptual framework for a method of data management that will ensure the production and dissemination of timely and usable scientific information about the status and trends of park resources to park managers. Our strategy for achieving this goal is to ensure the quality, interpretability, security, longevity, and availability of our natural resource data. Our objectives include:

- Confidence in the security and availability of natural resource data and related information
- Easy access to information, and appropriate safeguards for sensitive information
- Awareness of the intended use and limitations of each data set
- Infrastructure and documentation that encourages data exploration
- Compatibility of data sets for exploration and analysis at larger scales and across disciplines
- Implementation of standards and procedures that facilitate information management, and that reinforce good habits among staff at all levels of project implementation, including project leaders, technicians, and volunteer data collectors
- A proper balance between the standards needed to ensure quality and usability, and the flexibility to meet specific needs and encourage innovation
- A team of natural resource professionals who view data not as a commodity but as the lifeblood of our work

This plan is to be used in conjunction with the *Data Management Guidelines for Inventory and Monitoring Networks* (NPS 2008b). These guidelines are referred to as the national-level data management plan (DMP), which describes national policy and overall principles used across all I&M networks. The structure of the Data Management Plan for the Southern Plains Network and much of the content is derived from the national DMP (NPS 2008). This plan provides details for how data management activities will be conducted within the Southern Plains Network (SOPN) Specifically, this plan describes how the network will: Support Inventory and Monitoring Program objectives

- Acquire and process data
- Assure data quality
- Document, analyze, summarize and disseminate data and information
- Maintain nationally developed data management systems
- Maintain, store and archive natural resources data and information

Acknowledgements

This document represents a culmination of effort across the Inventory and Monitoring Program and could not have been written without their inspiration and insight. The community of data managers in the I&M Program and parks within the 32 I&M Networks fosters a collaborative environment with the free sharing of information. Credit is due to all who have preceded SOPN in the completion of network data management plans, and for making these plans available to the rest of us.

Specifically, ten data management plans were used extensively in the development of this plan and associated standard operating procedures and I would like to send our appreciation to the authors of those plans: Doug Wilder (Central Alaska Network), Rob Daley (Greater Yellowstone Network), Whitney Granger (Gulf Coast Network), Geoff Sanders (National Capitol Region), John Boetsch, Bret Christoe, and Ronald Holmes (North Coast and Cascades Network), Sara M. Stevens and Gary Entsminger (Northeast Coastal and Barrier Network), Fred Dieffenbach (Northeast Temperate Network), Margaret Beer, Elizabeth Nance, Aneth Wight, Melissa Powell, Russ DenBleyker (Northern Colorado Plateau Network), Brent Frakes, David Pillmore, Dan Manier, Billy Schweiger, Mike Britten (Rocky Mountain Network), Rosamonde R. Cook and Pat Lineback (Sierra Nevada Network), and Dorothy Mortenson (Southwest Alaska Network).

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Chapter 1. Introduction

Since 1916, the mission of the U.S. National Park Service (NPS) has been “...to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (National Park Service Organic Act, 1918).

Chapter 4 of the 2006 NPS Management Policies states, “The National Park Service will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, process, systems, and values of the parks.”(NPS 2006). This policy, 90 years after the Organic Act, continues to stress that one of park managers’ core responsibilities is to preserve park resources, and their associated values, in their natural state for future generations. Through an implemented and maintained data management program, inventories of park- related natural resource data, and a long-term natural resource monitoring program, the Southern Plains Inventory and Monitoring Network (“SOPN” or “the Network”) can provide park managers with up-to-date scientific knowledge and tools to help them better understand and manage the parks’ ecosystems. The objective of this data management plan (DMP) is to provide a guideline that SOPN will follow in order to manage all aspects of ecological data maintained by the network.

1.1 The National Park Service Vital Signs Monitoring Program

The Inventory and Monitoring (I&M) Program represents a long-term commitment by the NPS to assess and document the status, health and trends of park resources. In 1998, the National Parks Omnibus Management Act established a framework for the I&M Program, which fully integrates natural resource monitoring and other scientific activities into the management processes of the National Park system.

The Inventory and Monitoring Program’s long-term goals (NPS 2008a) are to:

- Inventory the natural resources under National Park Service stewardship to determine their nature and status.
- Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments.
- Establish natural resource inventory and monitoring as a standard practice throughout the National Park system that transcends traditional program, activity, and funding boundaries.
- Integrate natural resource inventory and monitoring information into National Park Service planning, management, and decision making.
- Share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

To achieve the last two of these goals, a modern information management infrastructure must be developed. This infrastructure will include procedures to ensure that relevant natural resource data collected will be entered, validated, analyzed, reported, documented, cataloged, archived, and made available to others for management decision-making, research, and education.

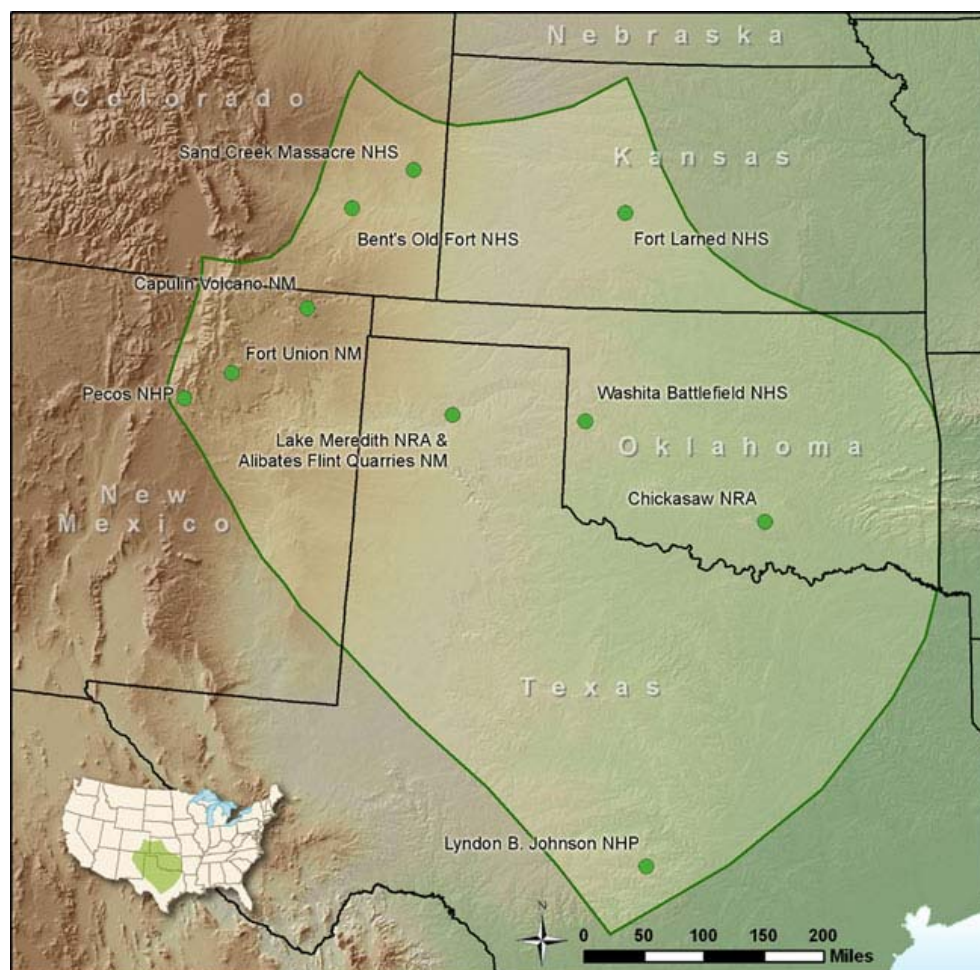


Figure 1-1. The Southern Plains Inventory and Monitoring Network

1.2 Southern Plains Network

The Southern Plains Network (SOPN) (Figure 1.1) consists of mostly mixed- and shortgrass prairie ecosystems. It is bordered on the east by tallgrass prairie and on the west by the forested ecosystems of the Rocky Mountains. SOPN parks vary in size from 326 acres (132 ha) to more than 46,000 acres (18,615 ha) (Table 1.1), and contain a wide range of biotic communities and abiotic conditions (Table 1.2).

Most of the SOPN parks were established primarily for cultural and recreational reasons. Therefore, only three parks (Bent's Old Fort NHS, Chickasaw NRA and Lake Meredith NRA) have full time natural resource staff. However, all network parks contain significant natural resources. Many of these resources are embedded within a framework focused on a human event or activity, and the enabling legislation for many of the parks refers to ecological systems (e.g., requiring that the scene for the period of significance at a historical park be maintained). SOPN parks are some of the only representatives of short- and mixed-grass prairie ecosystems in protected status (Perkins et al. 2008).. The parks occur in a landscape dominated by agriculture, and act as natural oases that are refugia for endemic, threatened, and endangered species, as well as common species. (Perkins et al. 2008).

Table 1-1. List of abbreviations, affiliations, and basic statistics for the 11 Southern Plains Inventory and Monitoring Network parks

Park name	Abbreviation	State	Region	Year est.	Acres (ha)	Base Funding (FY05)	FTE (FY04)	Visitation (FY04)
Alibates Flint Quarries NM	ALFL	TX	Intermountain	1965	1,371 (555)	\$0	0	1,794
Bent's Old Fort NHS	BEOL	CO	Intermountain	1960	799 (323)	\$1,052,000	19	31,487
Capulin Volcano NM	CAVO	NM	Intermountain	1916	793 (321)	\$651,000	10	58,705
Chickasaw NRA	CHIC	OK	Intermountain	1906	9,889 (4,002)	\$3,032,000	41	2,939,119
Fort Larned NHS	FOLS	KS	Midwest	1964	718 (291)	\$941,000	13	35,535
Fort Union NM	FOUN	NM	Intermountain	1956	721 (292)	\$773,000	13	13,572
Lake Meredith NRA	LAMR	TX	Intermountain	1990*	46,349 (18,757)	\$2,150,000	40	806,481
Lyndon B. Johnson NHP	LYJO	TX	Intermountain	1969	674 (273)	\$3,361,000	52	94,963
Pecos NHP	PECO	NM	Intermountain	1965	6,670 (2,699)	\$1,324,000	19	34,435
Sand Creek Massacre NHS	SAND	CO	Intermountain	2000	2,400 (971)	\$356,000	3	0
Washita Battlefield NHS	WABA	OK	Intermountain	1965	326 (132)	\$640,000	3	15,723
TOTAL					71,606 (29,878)	\$14,280,000	213	4,032,814

Table 1-2. Biophysical overview of the Southern Plains Network.

Park	Annual precip. (in.)	Avg. min./ max air temp (°F)	Elevation (ft)	Vegetation Province (Bailey 1994)
ALFL	20	43/71	2,800–3,320	Southwest Plateau and Plains Dry Steppe and Shrub
BEOL	12	37/69	3,980–4,020	Great Plains-Palouse Dry Steppe
CAVO	9	35/62	6,990–8,180	Great Plains-Palouse Dry Steppe
CHIC	38	49/72	780–1,160	Prairie Parkland (Subtropical)
FOLS	23	41/67	2,020–2,095	Great Plains Steppe
FOUN	17	31/64	6,685–6,835	Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow
LAMR	20	43/71	2,800–3,320	Southwest Plateau and Plains Dry Steppe and Shrub
LYJO	32	52/78	1,190–1,565	Southwest Plateau and Plains Dry Steppe and Shrub
PECO	17	32/63	6,695–7,575	Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow
SAND	13	35/66	3,940–4,085	Great Plains-Palouse Dry Steppe
WABA	25	44/71	1,920–2,000	Great Plains Steppe and Shrub

1.2.1 Network Staff

The SOPN is comprised of three permanent staff, the Network Coordinator, Data Manager and Biological Technician. The Network Coordinator and Biological Technician are located at Highlands University in Las Vegas, NM. The Data Manager is based at Lyndon B. Johnson NHP

(LYJO), Johnson City, Texas. The Board of Directors (BOD) and Technical Committee (TC) help provide guidance and support to the program.

1.2.2 Board of Directors

The network's oversight is provided by the BOD, which is comprised of three Superintendents from network parks that each serves a three-year term on a rotational basis, the chair of the Technical Committee who serves a two-year term, and the Network Coordinator and Intermountain Regional I&M Coordinator who are both permanent board members. In addition, there are two advisory, non-voting members from the Great Plains Cooperative Ecosystem Studies Unit (CESU) and the Gulf Coast CESU.

1.2.3 Technical Committee

The Network's Technical Committee (TC) is the primary functioning body with responsibility for general program planning and implementation. The technical committee is comprised of one natural resource, or appointed staff member from each of the 11 network parks. All are permanent members of the committee. The chair position rotates every two years.

1.3 Goals and Objectives

The goal of SOPN's data management program is to maintain, in perpetuity, the data and derived information from the network's resource inventory and monitoring program. The purpose of this document is to describe at a the objectives, policies, and guidelines that will ensure the highest standards for data acquired or managed by the network. These standards include:

- *Accuracy:* The quality of the data collected and managed by SOPN is paramount. Analyses performed to detect ecological trends or patterns require data with minimal error and bias. Inconsistent or poor-quality data can limit the detectability of subtle changes in ecosystem patterns and processes, lead to incorrect interpretations and conclusions, and could greatly compromise the credibility and success of the I&M Program. To ensure that the network produce and maintain data of the highest possible quality, procedures are established to identify and minimize errors at each stage of the data lifecycle.
- *Security:* Digital and hard-copy data must be maintained in environments that protect against loss, either due to electronic failure or to poor storage conditions. The network must have in place proper storage and backup procedures and disaster recovery plans. In addition, collaboration with the NPS Museum Management Program enlists the expertise of museum curators and archivists to ensure that related project materials such as field notes, data forms, specimens, photographs, and reports are properly cataloged, stored, and managed in archival conditions.
- *Longevity:* Countless data sets have become unusable over time either because the format is outdated, or because metadata is insufficient to determine the data's collection methods, scope and intent, quality assurance procedures, or format. While proper storage conditions, backups, and migration of data sets to current platforms and software standards are basic components of data longevity, comprehensive data documentation is

equally important. Networks must ensure that data sets are consistently documented, and in formats that conform to current federal standards.

- *Usability:* One of the most important responsibilities of the Inventory and Monitoring Program is to ensure that data collected, developed, or assembled by staff and cooperators are made available for decision-making, research, and education. Providing well-documented data in a timely manner to park managers is especially important to the success of the program. Networks must ensure that:
 - data can be easily found and obtained
 - data are subjected to full quality control before release
 - data are accompanied by complete metadata
 - sensitive data are identified and protected from unauthorized access and distribution.

1.4 Integration with the National Level Data Management Plan

A new methodology for creating network-level data management plans was created in 2007. This new method involved creating a national-level data management plan (DMP) that would contain key laws, guidance and policies that are relevant across the program. Network-level plans will provide general information and directions for data management activities required by the individual network. Specific aspects of data management will be addressed in a series of Standard Operating Procedures (SOPs) located in the appendices of this document. Many of the data management methods will be dependent on the individual projects. When possible, the network will try to utilize as many of the same SOPs and guidelines for each project in an attempt to keep methodologies consistent. It is the intention of this DMP to be easily adapted to all SOPN natural resource projects.

Chapter 2. Infrastructure and System Architecture

A modern data management infrastructure (e.g., hardware, software) represents the foundation upon which our network information system is built. Infrastructure refers to the system of computers and servers that are functionally or directly linked through computer networking services. Architecture refers to the applications, database systems, repositories, and software tools that make up the framework of an information management system. The SOPN relies on park, network, and national Information Technology (IT) personnel and resources to maintain a computer infrastructure and architecture. This includes but is not limited to hardware replacement, software updates and support, security updates, virus-protection, telecommunications networking, and server backups. As technology relating to computer hardware resources advances, and the Network's computer infrastructure evolves, modifications will be made to meet information management objectives. Communication and networking with park IT specialists is essential to ensuring adequate resources and service continuity for SOPN computer systems architectures.

2.1 SOPN Program Architecture

An important element of an information management program is a reliable, secure network of computers and servers. Our digital infrastructure has three main components: a network-based local area network (LAN), a regional wide-area network (WAN), and servers maintained at the national level (Figure 2-1). Each of these components hosts different parts of our natural resource information system. Network workstations will either connect directly to this network from inside the regional WAN, or via virtual private network (VPN) connections for offices not located within NPS buildings.

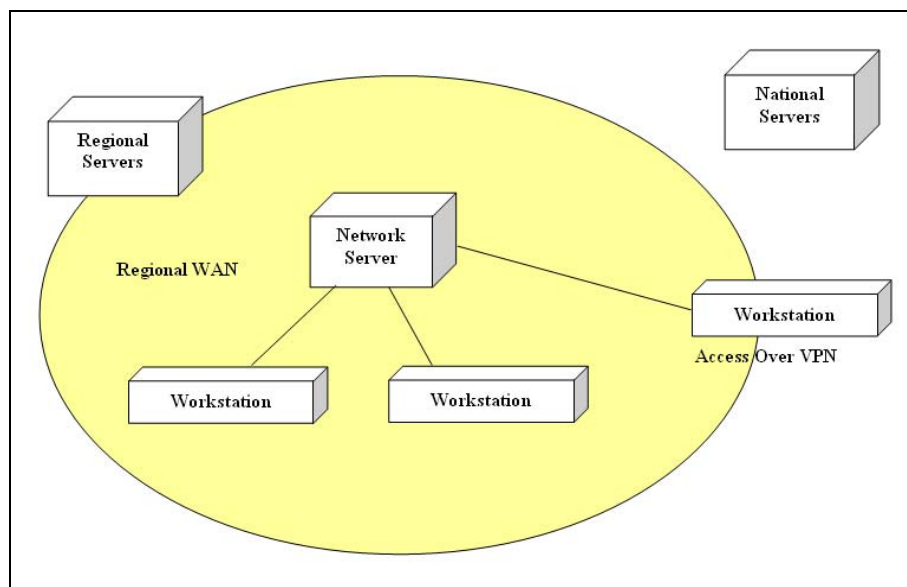


Figure 2-1. Main Components of the SOPN Infrastructure

IT duties for Network programs such as I&M are provided primarily by the network data manager and in some cases, the IT staff at LYJO. These include hosting and managing Network

electronic files being created, managed, and disseminated by Network staff and cooperators. The SOPN LAN will be housed with the data manager at LYJO and is the primary repository for I&M electronic files with access available to I&M staff. Files will be managed within a standardized electronic directory structure organized by project (see Appendix A- Central Files Directory Structure for details) . Security will be achieved through electronic file and directory permissions with administration rights controlled by IT personnel and a limited number of trained program staff.

2.2 National System Architecture

The national I&M program provides several repositories for hosting SOPN information products and applications for summarizing park data at a national level. The applications are available online (with the exception of ANCS+ and NPSTORET) and allow users to access basic natural resource information for SOPN parks. Specific descriptions of each of these applications can be found in Section 2.4.2.3 of the NDMP.

- NatureBib – master database for natural resource bibliographic references
- NPSpecies – master database for species occurrence records and evidence (voucher specimens, references, observations or data sets) at each park
- NPS Data Store – master database of metadata for Geographic Information System (GIS) and natural resource data sets and a repository for that data
- NPS Focus Digital Library and Research Station – a decentralized digital imagery and data management system, implemented through a central public Internet portal sponsored by the NPS Office of the Chief Information Officer. Includes to the NPS Data Clearinghouse.
- NPS Data Clearinghouse – the central repository for NPS GIS data available to the public. Implemented through the NPS Focus gateway.
- NPS Automated National Catalog System (ANCS+) – the official curatorial cataloging system of the NPS.
- Biodiversity Data Store – an Internet-based repository of documents, GIS and other data sets that contain information of plant and animal species that contribute to knowledge of the biodiversity in national parks
- NPSTORET (also known as NPS Water Quality Database Templates) – a NPS database designed to facilitate park-level standardized reporting for STORET, an Internet-based interagency water quality database developed and supported by the Environmental Protection Agency (EPA) to house local, state, and federal water quality data collected in support of managing the nation’s water resources under the Clean Water Act.

2.3 Network Security

Local and wide area networks currently conform to Department of Interior (DOI) security guidelines. All sensitive electronic files should be placed in protected folders with limited read and write access. Electronic file and directory permissions administration will be partially

decentralized with file and folder administrative rights controlled by limited Network staff including the data manager and, in some cases, the LYJO IT specialist. Deployment of a Microsoft utility will enable the management and restoration of New Technology File System (NTFS) file and folder permissions on network servers. Staff needing read or write access to the SOPN directory structure will be enabled through Microsoft Active Directory and NTFS permissions.

There are very rare circumstances where encryption of sensitive electronic files and/or folders may be necessary. As an example, files on removable media or portable devices may rarely need additional protection from unauthorized access or use. An encryption policy and procedures for staff who must implement electronic file encryption or other security measures is currently under development.

2.4 SOPN I&M Web Sites

The SOPN I&M main web site provides to the public, general information about the Network and its parks, and the I&M Program, including information on inventories, monitoring, data management, and reports and publications as directed by WASO's general webpage templates. The website will also be used to distribute products such as results of I&M vital signs monitoring (e.g., executive briefs, progress reports, trend reports, etc.) and the SOPN Data Management Plan. An Intranet portal is also in place, where park and network staff can share information and data that are not ready or is inappropriate for public posting. Structure and content of the SOPN I&M web sites comply with National Park Service standards listed in Section 2.5.4 of the national DMP (NPS 2008b).

2.5 Collaboration Technologies

A small group of network park staff, the Collaborative Technologies Work Group, evaluated current collaborative technologies and developed recommendations aimed at improving remote collaboration between groups and/or individuals at physically separate locations. Effective and efficient communications are essential and staffs must consider using both emerging and existing technologies as a means to improve communications. The SOPN I&M Program is an good example of a program requiring collaboration between employees at four national parks spread across a large geographic area making face-to-face meetings difficult.

Section 2.4.4 of the National DMP (NPS 2008b) provides information regarding the collaboration technologies that can be utilized by the I&M Networks. Based on recommendations from the collaboration technologies workgroup, SOPN will consider adopting Microsoft SharePoint Services.

2.6 Geographic Information Systems

SOPN Park staff will receive network support for ESRI (Environmental Systems Research Institute) software packages ArcView and ArcGIS. This support includes documentation, archiving, and providing geographic information system (GIS) data and products to various cooperators and others by request. The NPS Intermountain Regional GIS office may also provide support when needed. The National DMP suggests using NPS Theme Manager to provide GIS layers to staff with limited skills(NPS 2008b). SOPN will consider this option for deploying GIS data. Standards regarding GIS data can be found in Appendix D – GIS Specifications.

2.7 Database Applications Development

Section 2.4.6 of the National DMP calls for desktop versions of network databases to be developed in the latest Microsoft Access format unless otherwise specified in the project study plan (NPS 2008b). Desktop databases produced under contract will also use Microsoft Access unless otherwise specified in advance. At this time, SOPN does not anticipate the need to move to an enterprise relational database management system such as Microsoft SQL Server. However, SOPN will revisit this position every year and switch over should the need arise. Further details regarding database applications can be found in Chapter 5 of this plan.

2.8 Word Processing

All reports and other textual documents will be finalized in editable electronic format in the latest available version of Microsoft Word or Adobe Acrobat, unless otherwise specified in the project study plan. Distribution copies will be converted to the latest version of Adobe Acrobat.

2.9 Digital Data Formats

Section 2.5.1 of the National DMP provides guidance and standards for digital data formats (NPS 2008b). This includes databases, tabular data, spatial data and image data. SOPN will adopt the standards listed in the following sections. Additionally, all digital file names will follow specifications found in Appendix C – Digital Document File Naming Conventions.

2.9.1 Databases

Well thought-out database design standards are necessary to promote compatibility among data sets encourage sound database design, and facilitate interpretability of data sets. SOPN has adopted the Natural Resources Database Template (NRDT) as the standard for database design and recommends this method be used as much as possible. A description of the NRDT and a working database is presented in Chapter 5 – Database Design. Additional information can be found at (<http://science.nature.nps.gov/im/apps/template/index.cfm>). Specific guidance regarding databases can be found in Appendix B – Database Specifications.

2.9.2 Tabular data

Tabular data can be stored in any number of applications (i.e. word processing, spreadsheets, databases and tables) and formats (e.g. dat, txt, xml, dbf, xls, csv). The SOPN standard format for tabular data is Microsoft Excel (.xls) or tab-delaminated text files (.txt). The Network will strongly encourage documentation of attribute and table information (see metadata development in subsequent chapters). Specific guidance regarding tabular data can be found in Appendix B – Database Specifications.

2.9.3 Spatial data

The coordinate system standard the National Park Service is *Universal Transverse Mercator with North American Datum 1983* (UTM NAD83) (NPS 2008b). Efforts will be made to migrate existing spatial data this data projection and it will be used for any new spatial data development.

Currently, Network and park staff use many different raster and vector data formats for storing and managing spatial data. Vector data formats commonly include ESRI ArcInfo coverages,

shapefiles, and personal geodatabases. Raster data formats commonly include MRSID, TIFF, GEOTIFF, and Grid structures. Since ESRI software products have historically demonstrated excellent backward compatibility with older data structures, there is no requirement for SOPN to migrate data formats to more modern data structures and all the above listed formats will be accepted. Specific guidance regarding spatial data can be found in Appendix D - GIS specifications and Appendix E – GPS Specifications.

Section 2.5.1 of the National DMP discusses the file geodatabase format that recently became available with the release of ArcGIS 9.2(NPS 2008). This data structure does carry numerous advantages such as scalability, ability to handle large datasets and compatibility across operating systems. However, at this time SOPN does not have a large GIS collection and park staff has limited GIS skills. At this time the network will continue to maintain data in shapefile format, but this position will be reconsidered annually.

2.9.4 Image data

Photographic information has become not only an important component of resource management but also a consumer of considerable amounts of electronic storage. Photographic information in the forms of digital images, scanned photographs, and satellite imagery has become a primary concern of both IT and data management staff for two reasons. First, IT staff are looking for simple and easy ways to store the large number of digital images that field personnel collect. Second, data management staff are concerned information may be lost with this large influx of digital imagery and want to encourage personnel to document what they obtain. SOPN has adopted ThumbsPlus from Cerious Software, Inc. for image management due to it's ease of use and because image metadata is stored in a Microsoft Access database. This will facilitate exporting image data to other applications. Specific guidance regarding image data can be found in Appendix I - Digital Photograph Management Guidelines.

2.10 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for infrastructure and architecture for SOPN.

- Appendix B – Database Specifications
- Appendix C – Digital Document File Naming Conventions
- Appendix D – GIS Specifications
- Appendix E – GPS Specifications
- Appendix M – Web Page Development and Maintenance

Chapter 3. Data Management Process and Workflow

There are two main types of projects handled by natural resources and SOPN staff:

1. Short-term projects - These include single year projects, individual park research projects, inventories, or pilot work done in preparation for long-term monitoring or research.
2. Long-term projects – These include Network vital-signs monitoring projects central to the I&M program and multi-year research projects and monitoring performed by other park programs, agencies and cooperators. Long-term projects often require a higher level of documentation, peer review, and program support.

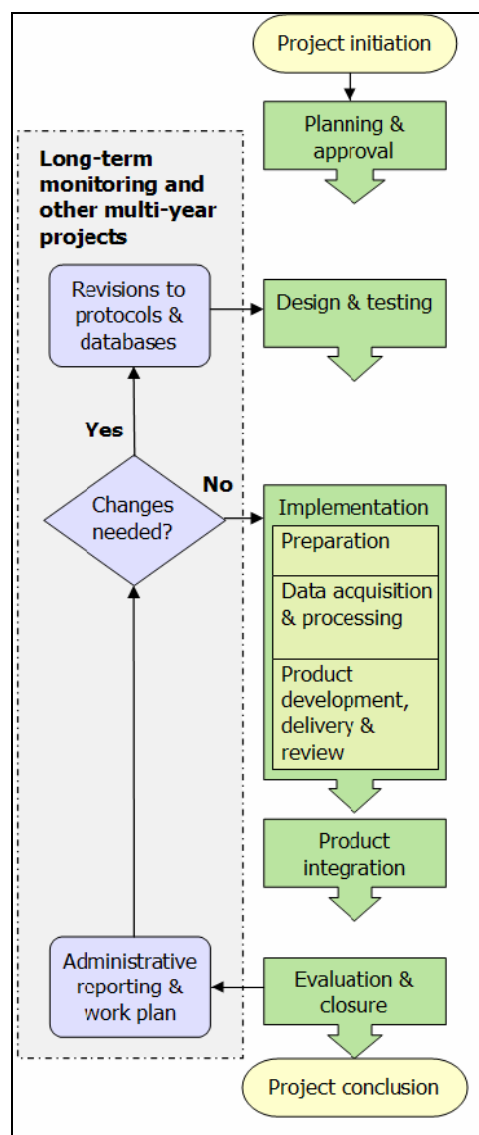


Figure 3-1. Primary Project Stages

Both short-term and long-term projects share many work flow characteristics, and both generate data products that must be managed and made available. However, long-term projects have an increased need to adhere to and maintain standards and will require the ability to comparing data over an extended period of time (decades for long term monitoring).

3.1 Project Management Stages

Projects conducted by SOPN can be divided into a series into five primary stages (Figure 3.1):

1. **Planning and Approval.** At this stage many of the preliminary decisions are made regarding areas such as project scope and objectives. Funding sources, permits and compliance are also addressed at this time. Primary responsibility rests with project leaders and the network coordinator. Although there are no specific data management activities during this phase, to anticipate data management needs the data manager will need to remain informed.
2. **Design and Testing.** Details regarding how data will be acquired, processed, documented, analyzed, reported are developed during this stage. Collaboration between the project leader and the data manager is critical in order to assure data quality and integrity. Key data

management details such as developing documentation of project databases (relational diagrams, data dictionaries, business rules, and front-end programming, etc.) and formal metadata are worked out during this stage. A joint effort is required to develop and document the project methods, data design, data dictionary, and the database itself.

3. **Implementation.** Data are acquired, processed, error-checked and further documented, and products are developed during this stage. The project leader oversees all aspects of this stage, with the data management staff functioning primarily as facilitators to support database applications, GIS, GPS, data verification, summarization, and analysis. Project staff members work to develop and finalize the deliverables that were identified in the project planning documents (i.e., protocol, study plan, contracts, agreements or permits).
4. **Product Integration and Distribution.** Data are merged from the working database to master databases. Administrative records should be delivered to appropriate park and Network staff as specified. All project deliverables should be distributed according to specifications, which should be stipulated in all protocols, contracts, agreements, and permits. Products that do not meet program requirements should be returned for revision.
5. **Evaluation and Closure.** Project records are updated in the tracking database to reflect the status of the project. After products are catalogued and made available, program administrators, project leaders, and data managers should work together to assess how well the project met its objectives, and to determine what might be done to improve various aspects of the methodology, implementation, and formats of the resulting information.

3.2 Data Lifecycle

Project data take different forms and are maintained in different places as they are acquired, processed, documented and archived. These phases can be modeled as a sequence of events and tasks which involve interaction. Specifics regarding the data lifecycle can be found in the national DMP (NPS 2008b). Key highlights of this cycle include:

- Archiving all raw data in their native format.
- Using working databases as the focal point of all modification, processing, and documentation of data collected for a given time period.
- Archiving and posting or integrating data with national archives after all quality assurance, documentation and certification are complete.
- Uploading data for long-term monitoring projects into master databases
- Using certified data sets to develop reports and other data products (maps, checklists, etc.). These products are also archived and posted to appropriate national applications and repositories.
- Documenting all subsequent changes to certified data sets in an edit log, which is distributed with the data.

3.3 Standard Operating Procedures

Specific guidance on how the SOPN will manage projects can be found in the following document.

- Appendix J – Project Data Life Cycle Guidance.

Chapter 4. SOPN Roles and Responsibilities

Data management is about people and organizations as much as it is about information technology, database theory, and applications. For large park resources programs, such as the SOPN Inventory and Monitoring program to work effectively, everyone within the program, and all those in collaboration with it, must have stewardship responsibilities for the production, analysis, management, and/or end use of data produced by the program. In order to meet new data management goals and standards developed by the National Park Service and its constituents, program staff must understand how data and information flow (discussed in Chapter 3) and what their roles and responsibilities are in this process. A role is a function or position (e.g., Data Manager). A responsibility is a duty or obligation (e.g., review data records). Table 4.1 summarizes general types of data stewardship activities and the roles typically associated with them. Further details can be found in Section 4.4 of the national DMP (NPS 2008b).

Table 4-1. Categories of data stewardship involving Southern Plains Network personnel

Stewardship Activity	Description of Activities	Principal Roles
Production	Creating data or information from any original or derived source. This includes recording locations, images, measurements, and observations in the field, digitizing source maps, keying in data from a hardcopy source, converting existing data sources, image processing, and preparing and delivering informative products, such as summary tables, maps, charts, and reports.	Project Crew Leader, Project Crew Member, Data/GIS Specialist or Technician
Analysis	Using data to predict, qualify, and quantify ecosystem elements, structure, and function as part of the effort to understand these components, address monitoring objectives, and inform park and ecosystem management.	Ecologists, Resource Specialists
Management	Preparing and executing policies, procedures, and activities that keep data and information resources organized, available, useful, compliant, and safe.	Project Leader, Data Manager, GIS Manager, IT Specialist, Database Manager, National-level Data and Information Managers
End Use	Obtaining and applying available information to develop knowledge that contributes to understanding and managing park resources.	Project Leader, Park Managers and Superintendents, Others

Data management and stewardship is the responsibility of all participants in SOPN I&M activities and requires true collaboration among many people with a broad range of tasks and

responsibilities. Good habits and attitudes are as important as standards and procedures. Although primary responsibility resides with the data manager, project leaders, and GIS specialist who make up the core data management team, all SOPN staff and cooperators are responsible for ensuring data stewardship is practiced throughout the life of a monitoring project. Table 4.2 summarizes the roles and responsibilities of SOPN staff and cooperators with respect to data stewardship. It should be noted that a single person may take on more than one role in a given project. For instance, the SOPN data manager will also take on the role of GIS specialist for projects conducted within SOPN.

Table 4-2. Roles of SOPN network staff and cooperators working on monitoring projects.

Role	Data Stewardship Responsibilities
Project crew member	Collect, record, verify data; perform data entry; organize field forms, photos, other related materials
Project crew leader	Supervise crew, communicate regularly with data manager and project leader
Network data manager /GIS specialist	Ensure program data are organized, useful, compliant, safe, and available. Oversee GPS data collection, manage spatial data, prepare maps, perform spatial analyses
IT specialist	Apply database and programming skills to network projects, maintain information systems to support data management
Project leader	Direct operations, including data management requirements, for network projects
Resource specialist	Evaluate validity and utility of project data; document, analyze, publish data and associated information products
Quantitative ecologist	Determine project objectives and sample design; perform and document data analysis and synthesis; prepare reports
Network coordinator	Coordinate and oversee all network activities
Park or regional curator	Ensure project results (documents, specimens, photographs, etc.) are cataloged and stored in NPS or other repositories
I&M data manager (national level)	Provide service-wide database support and services; provide data management coordination among networks
End users (managers, scientists, interpreters, public)	Inform and direct the scope of science information needs; interpret information and use to direct or support decisions

4.1 Standard Operating Procedures

A Roles and Responsibilities section is to appear in all SOP's created by SOPN to insure that everyone involved in a project clearly understand the tasks assigned to them in all projects.

Chapter 5. Database Design

The network data manager and project leaders will collaborate on design of field data sheets, database structure, and database application for each monitoring project. Databases will be standardized where possible following the I&M recommended guidelines for database structure and naming conventions developed in the Natural Resource Database Template (NRDT) and the Recommended Naming Standards. SOPN will also develop standardized lookup tables for data elements shared across many monitoring projects. SOPN currently uses Microsoft Access for all project databases. Designing modular databases instead of a central database will allow for greater flexibility to accommodate each project's needs and sufficient standardization can ensure the ability to aggregate and summarize data across multiple projects. At this time, SOPN is not planning on moving to a client-server relational database management system such as Microsoft SQL Server. However, all databases will be designed to allow upscaling to a client-server relational database system should the need occur. The following provides general guidance for all databases used by the SOPN. Specific details regarding database design can be found in Appendix B – Database Specifications.

5.1 Natural Resources Database Template

The National Park Service Inventory and Monitoring (I&M) Program's Natural Resource Database Template (NRDT) is a set of Microsoft Access relational database tables that parks and networks can use to develop applications for capturing natural resource inventory and monitoring data. The NRDT:

- Provides both a data interchange standard and a standard MS Access database core that allows flexibility in application design.
- Serves as a starting point for application development that can be extended as necessary to accommodate any inventory or monitoring field sampling protocol.
- Standardizes location and observation data to facilitate the integration of data sets.
- Acts as a design platform for developing database applications in MS Access allowing users to enter, edit, display, summarize, and generate reports for inventory or monitoring data sets.
- Integrates with other I&M data management systems and data standards including the NR-GIS Metadata Database, GIS tools and data, the NPS GIS Committee Data Layers Standard and the NPS Metadata Profile.

5.1.1 Front End Builder

The Front-end Application Builder (FAB) is a Microsoft Access file that is intended to be used by developers of NRDT applications to create a front-end (user-interface) to an NRDT v.3.2 back-end (database). The FAB comes with many built-in features that allows developers to quickly add functionality to network databases. These features include:

- table linking utility
- data backup
- compaction
- lookup table management
- main menu

- standardized data entry forms for core NRDT v.3.2 tables
- standardized data "gateway" form for retrieving records

5.2 Data Modeling

Communication is a vital part of developing a suitable database design for individual projects. One mechanism for this communication is collaborative development of data models by the network's data manager and project leaders. Data models combine diagrams with associated descriptions and the I&M Program utilizes three types.

- Conceptual Data Models are constructed to graphically portray processes specifically related to the implementation phase of a project – especially those involving acquisition, processing, and QA/QC (see below) of data. They are software-independent, free of details and focus on capturing enough information needed to accurately depict project data design.
- Logical Data Models are an abstract representation of database entities, their relationships and key attributes.
- Physical data model depicts the structure of the actual database, with all of its data tables, field definitions, and relationships. Although the logical and physical models might appear similar, the physical model provides enough detail to construct the physical database.

Databases created by SOPN will have associated data models created as part of the design and documentation process. Further details regarding data modeling can be found in Section 5.5 of the national DMP (NPS 2008b).

5.3 Quality Assurance/Quality Control

The success of any natural resources program is dependent on the quality of the data it collects, manages, and disseminates. The concepts of quality assurance (QA) and quality control (QC) are defined in Chapter 7 and discussed with respect to each phase of a project's lifecycle. Relational Database Management Systems (RDMS) can be designed to incorporate and automate many QA/QC procedures associated with data collection and processing. All databases designed by the SOPN will include features to insure data integrity. (See Appendix B – Database Specifications for details).

5.4 Database Documentation

5.4.1 Basic Requirements

Relational databases will be documented according to the standards outlined above. Complete documentation will also include a narrative overview with a description of the business rules employed, entity relationship diagrams, and documented programming code. Relational databases will also utilize internal documentation such as table and field descriptions and will include a table to track modifications.

MS Access databases should be documented with the built-in Database Documenter tool, and documentation should include all objects. This will produce a pre-formatted report containing complete specifications of properties, relationship types and attributes, table indexes, and user and group permissions on every object in the database. This information, combined with the

programming code would enable any developer to recreate the structure and function of the database.

The NPS Metadata Profile currently does not support all of this information., It will be stored independently and concurrently with the formal metadata in each database directory.

Some metadata can now be extracted automatically from an MS Access database. The NPS Database Metadata Extractor MS Access add-in, Version 1.0 for MS Access 2000-2003, automatically harvests entity (table) and attribute (field) metadata, including value ranges (domains) from MS Access databases. It further allows the user to edit and review the harvested metadata, make batch edits, and export the metadata to a FGDC-compliant XML file. Exported XML can be used in the Metadata Tools & Editor either by opening it to start a new metadata record or by updating a template to fill in section 5 of an existing record. Further details regarding FGDC-compliant metadata can be found in Appendix G – Metadata Specifications.

Project databases developed for the I&M Program will include a mandatory table, *tbl_Db_Meta*, which will contain a description of the purpose of the database, and a link to metadata records in the NPS Data Store.

5.4.2 Revisions

Every alteration in a project database that occurs after data collection and entry have begun should be documented. A table of revision history can be included within the database itself or maintained as a separate log. For I&M project databases, the table *tbl_DB_Revisions* is mandatory. This table includes contact person; date, reason, and description of the revision; and a link to *tbl_Db_Meta*.

5.5 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for databases creation by and for SOPN.

- Appendix B – Database Specifications
- Appendix G – Metadata Specifications

Chapter 6. Data Acquisition, Processing and Reporting

Data managed and utilized by the network will originate from three types of sources: within the network, other NPS data collection efforts, and outside the NPS.

- Network Data –data produced from projects that are initiated (funded) by the SOPN I&M Program or projects that involve the I&M Program.
- NPS Data –data produced by the NPS that does not involve the I&M Program.
- External Data –data produced by agencies or institutions other than the National Park Service.

6.1 Programmatic Data

Project crew leaders and members are primarily responsible for the collection, entry, and verification of data acquired from the field. Each monitoring project protocol will detail procedures for these data acquisition steps based on guidelines outlined in this plan. As data are collected and entered into a database, quality control procedures will be used to increase accuracy and limit transcription mistakes. A verification procedure will be used to check for and correct any transcription mistakes. NPS data acquired from parks, regional offices and national programs will undergo limited processing. Legacy data from parks will be evaluated and prioritized for digitizing or converting to modern formats. External data necessary for each project will be identified during project planning and protocol development and will be acquired if documentation is complete. In some cases, the network will access data that are maintained and archived by other programs (e.g. climate data).

6.1.1 Data Collection

A variety of tools are available to SOPN for data collection and include items such as field forms, computers, GPS units, etc. A general discussion of these tools are covered in detail in Section 6.4.1 of the national DMP (NPS 2008b).

6.1.2 Data Processing

Each project will have a database and field forms developed prior to the collection of any data in the field. SOPN program databases will be developed in conjunction with project protocols and will be based on the I&M Natural Resources Database Template (Chapter 5) and will include built-in procedures for QA/QC (Chapters 5 and 7). Ideally, data processing should proceed as follows, and as soon as possible after data are collected.

- Field crews enter all data into an approved project database, under the supervision of the project leader.
- Field crews periodically forward project data files to the project leader and/or data manager (refer to individual protocols for specific requirements).
- All data undergo QA/QC procedures (see Chapter 5 and 7 for more specifics on data verification and validation).
- The data manager maintains the master copy of the database and updates it with certified data files received from the project leader.
- National databases are updated as per the procedures outlined in Chapter 10.

Spatial data

Details regarding methods for spatial data collection and processing can be found in the Appendix D – GIS Specifications and the Appendix E –GPS Specifications..

Photographs

Photos taken as part of a project’s data collection protocol constitute data and need to be organized, documented and preserved in conjunction with all other project data. The processing, documentation, and storage of photographs, including digital photos are detailed in the Appendix I – Digital Photograph Management Guidelines.

Remote Sensing Data

The processing of remotely-sensed data is often project specific. Therefore, project plans, protocols, and SOPs should document these procedures. Some steps will be common to all data sets, including:

- Images are geometrically registered using nearest-neighbor resampling methods and co-registered to UTM NAD83. Registration accuracy is assessed.
- Images are radiometrically corrected and converted to exo-atmospheric reflectance.
- Atmospheric corrections are made, if applicable.
- All iterations (raw, intermediate corrections and final) are maintained until project completion when raw and final products are archived.

Vouchers

The acquisition and processing of biological specimen vouchers will be guided by the policies outlined in Appendix L – Voucher Specimen Collection Management Guidelines.

6.2 Non-programmatic Data

A number of data sets used to manage the natural resources of SOPN parks is collected by entities outside of the Network (universities, state and federal agencies, and NPS programs). These data collection efforts are referred to *as data discovery or data mining*. Data collected and products produced by such efforts provide a great deal of information about park natural resources and are therefore relevant to many of its programs. Information collected during the data discovery process should be maintained either electronically or in hard copy format depending on how it was collected, and should be documented as fully as possible (Chapter 8). Data should be disseminated to the appropriate repository as summarized in Table 6.1 and discussed in Chapter 10.

Data discovery is an integral part of project development, but efforts should not be limited solely to project development needs. This should be an ongoing process requiring regular data searches and visits to Network parks to ensure that Network parks maintain as much material relevant to managing their natural resources as possible. Encouraging data sharing among parks will assist in this process and may alleviate the need for regular searches of park records.

Details regarding types and sources of data discovery and mining can be found in Section 6.5 of the national DMP (NPS 2008b). Future data mining efforts within SOPN should adhere to the guidelines and protocols that will be outlined in Data Mining and Discovery SOP (under development as of September 2008).

Table 6-1. Summary of possible data sources for different types of information and repositories where they are maintained

Type of Data	Possible Source	Repository
Bibliographic / Literature	• Online literature databases (e.g., First Search or Biosis) • Library catalogs (e.g., academic or research institutions) • Park archives through ANCS+	• NatureBib • Reference cabinets for hard copy materials • Digital archive for electronic materials
Geographic Data	• Regional centralized GIS data • Federal and state geographic data clearinghouses • Local, state, and federal government offices • Regional and park GIS specialists	• NPS Data Store • Digital archive
Biologic / Natural Resource Data	• Voucher collections (museums, parks, universities) • Network parks	• NPSpecies • Digital archive

6.2.1 Data Collection

The acquisition of data from non-programmatic sources should follow program specifications as outlined by a project protocol or SOPs. Procedures should be standardized as much as possible, include:

- Contacting data stewards and informing them of program needs.
- Establishing Memoranda of Understanding (MOUs) if needed.
- Developing a contingency plan in case the data source is no longer available.
- Determining whether data can be consistently exported/imported and establishing a schedule.
- Determining how the data will be stored and integrated into the program.
- Determining how errors will be addressed.
- Determining if documentation is adequate and if not, completing where necessary.
- Identifying any interest in the exchange of program data and information with the outside program.

Agency or organizational stewards of these data often have the expertise to conduct proper quality control procedures and the capability to function as a repository and clearinghouse for validated data. In some cases, portions of external databases may be incorporated into SOPN databases and thereby made more accessible to staff.

6.2.2 Data Processing

Much of the data identified during the discovery process are likely to be the legacy type. As time and resources permit, SOPN will convert legacy data to file formats compatible with current software standards. Hardcopy references and other materials containing legacy data can be scanned and saved as .pdf files and stored in a program's digital library (Chapter 11). All legacy data sets should be reviewed and cataloged as follows:

- Enter all biodiversity data into NPSpecies (this is especially important for park-based biological inventories).

- Enter all natural resource reports and publications related to SOPN parks into NatureBib. Hard copies should be stored in the appropriate park collections and electronic copies archived in the proper directory on the Network file servers (Chapter 11)
- All GIS data should be stored in the proper projection (UTM NAD83) and accompanied by FGDC-compliant metadata (Chapter 8).

6.3 Analysis and Reporting

Obtaining meaningful results from data summary and analysis is essential to providing useful information for natural resource managers and scientists. It is therefore incumbent on data managers and data stewards to provide valid data in formats that support scheduled and ad hoc display, query, analysis, summary, and reporting. Routine and scheduled data summary, analysis and reporting requirements and procedures should be identified in project protocols. SOPN will follow the guidelines for analysis and reporting set forth in Section 6.6 of the National DMP (NPS 2008b).

6.4 Changes to Procedures

It is recognized that over time, changes may need to be made to established procedures. Should this need come, SOPN will follow the guidance set forth in Section 6.7 of the National DMP (NPS 2008b). Any changes that occur as a result of a change in a project's protocol should be documented in the formal documentation developed for the database (Chapter 5).

6.5 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for the acquisition, processing and reporting of data collected by SOPN.

- Appendix D – GIS Specifications
- Appendix E – GPS Specifications
- Appendix F – Library Management Strategy
- Appendix H – Guidelines for Maintaining and Updating NPSpecies
- Appendix L – Voucher Specimen Collection Management Guidelines
- Data Mining and Discovery SOP (under development as of September 2008)

Chapter 7. Quality Assurance and Quality Control

The success of the I&M Program will ultimately depend on the quality of the data that are collected, processed, and disseminated. To ensure data of the highest quality, procedures have been established to identify and minimize errors at each project stage associated with the data life cycle. Quality assurance and quality control protocols and execution are the responsibility of all project participants joint responsibilities, the results of which are documented to notify end users of the level of data quality. Quality assurance, data summary, and data analysis are the responsibility of the project leaders; however, the data manager will provide tools to project leads to facilitate these activities.

Although some quality control procedures depend upon the nature of a specific project, some general concepts apply to all network projects. To ensure that all SOPN vital signs monitoring projects produce and maintain data of the highest quality, a common set of procedures has been developed to identify and minimize both the frequency and significance of error at all stages in the data life cycle. Examples of quality assurance practices include:

- Field crew training
- Standardized field data forms with descriptive data dictionaries
- Use of handheld computers and data loggers with built-in controls
- Equipment maintenance and calibration
- Procedures for handling data in the field
- Database features to minimize transcription errors, including range limits, pick lists, etc.

Verification and validation, including automated error-checking database routines and quality assurance methods should be in place at the inception of any project and continue through all project stages to final archiving of the data set.

7.1 General Standards and Guidelines

To ensure that SOPN produces and maintains data of the highest possible quality, a series of methods have been established to identify and minimize errors at each project stage associated with the data life cycle. These methods are detailed in Chapter 7 of the national DMP (NPS 2008b). QA/QC procedures specific to any project should be specified in a project's protocols and SOPs.

7.2 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for the QA/QC procedures for data collected by SOPN.

- Appendix B – Database Specifications
- Appendix K – Quality Assurance/Quality Control Guidance

Chapter 8. Data Documentation

Documentation is essential to the longevity and value of project data. Anyone using these data in the future will need to know as much as possible about what, where, how, when, why, and by whom the data were collected, along with appropriate uses, including restrictions on sensitive information, and any known limitations. A good data management system cannot simply attend to the tables, fields, and values that comprise a data set. It also must provide a process for developing, preserving, and integrating the research context that makes data interpretable and useful. For SOPN, this will involve the development of formal metadata— a detailed, structured set of information about the content, quality, condition, and other characteristics of project data. The development of formal metadata that follow Federal Geographic Data Committee (FGDC) and NPS standards for content and format will enable the cataloging of project data sets within intranet and internet systems, thereby making them available to a broad range of potential users.

Metadata for all SOPN monitoring projects will be parsed into two nested levels of detail, each targeted to a specific audience. The first level consists of *minimally compliant metadata*, which presents an overview of the product crafted to quickly convey the essentials needed to understand the context of the data. The second level is *fully compliant metadata*, which provides all components of supporting information such that the data may be confidently manipulated, analyzed and synthesized. Further details can be found in Section 8.3.1 of the national DMP 8.3.1 (NPS 2008b) and in Appendix G – Metadata Specifications.

8.1 Metadata Creation Tools

There is a series of tools available to facilitate metadata collection. SOPN will use the following tools for Descriptions of these tools can be found in Chapter 8 of the national DMP (NPS 2008b). The SOPN data manager will provide training and support in the use of these tools to project leaders and will aid in metadata development where practical. Upon completion, metadata will be posted with project data so that they are available and searchable along with their constituent data sets and reports via the SOPN Internet web site and the NPS Data Store.

8.2 Metadata Process and Work flow

Data used or documented by SOPN can be grouped into three broad categories based on data origin: SOPN project data; other NPS data; and data from external (non-NPS) sources. The level and extent to which metadata and work flow process can be completed varies depending on these data categories

- SOPN Project data – These are projects undertaken by SOPN and metadata considerations begin at the onset of the project. Complete and compliant metadata are required for each project.
- Other NPS data – This category includes natural resource-related data sets typically obtained during the data mining process at parks. Ongoing resource management projects in network parks are the source of many valuable natural resource-related data sets. While many of the data sets from these projects have associated documentation or knowledgeable project leaders who are still at the parks, well-structured and compliant metadata are frequently not created or maintained.. While the desirable level of

documentation may not be possible, all available data and supporting documentation are assembled and reviewed.

- External Data - Other agencies and organizations gather data that are relevant to SOPN or park projects. If SOPN obtains these data sets it also makes an effort to obtain all available metadata. As with legacy data, gaps may exist in non-programmatic data documentation.

8.3 Making Information Available

Metadata created using ArcCatalog and NPS Metadata Tools and Editor will be submitted to the NPS Data Store. A link to data posted NPS Data Store will also be posted on the SOPN website. Metadata records may be withheld from public posting, or may be abridged, if their content is classified as sensitive and their release could potentially jeopardize a protected resource (see Chapter 9, Data Dissemination).

8.4 Updating Metadata Records

For SOPN projects, the project lead is required to keep the data manager and GIS specialist informed of any data or format changes so that associated metadata can be verified and updated.

8.5 Vital Signs Metadata

Long-term monitoring projects present a different set of metadata questions and requirements that may extend beyond the scope of the project tracking database, established FGDC standards, or a descriptive document for a tabular data. Essential documentation such as algorithms, output files, or spatial analyses may reside in different systems and formats, and could potentially be overlooked when distributing or applying the data. Depending on the project, documentation may need to include details on data models or algorithms used, procedures for data synthesis, and associated input and output files. Data use and data request histories, and secondary research or publications resulting from long-term monitoring projects, may also need to be tracked.

As the protocols are developed, vital signs documentation will be tested and will evolve to combine metadata needs and ease of use.

8.6 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for the documentation of data collected by SOPN.

- Appendix G – Metadata Specifications

Chapter 9. Ownership and Sharing

SOPN data and information products are considered property of the NPS. However the Freedom of Information Act (FOIA) establishes access by any person to federal agency records that are not protected from disclosure by an exemption. The SOPN will comply with all FOIA strictures regarding sensitive data. If the NPS determines that disclosure of information would be harmful, information may be withheld concerning the nature and specific location of the following:

- Endangered, threatened, rare or commercially valuable National Park System Resources (species and habitats)
- Mineral or paleontological objects
- Objects of cultural patrimony
- Significant caves

Specific laws and guidance for determining whether data should be protected can be found in Chapter 9 of the national DMP (NPS 2008b).

9.1 Determining Data Sensitivity

Each project leader, as the primary data steward, will determine data sensitivity in light of federal law, and will stipulate the conditions for release of the data in the project protocol and metadata. Network staff will classify sensitive data on a case-by-case or project-by-project, basis. The project leader will work closely with investigators for each project to ensure that potentially sensitive park resources are identified, and that information about these resources is tracked throughout the project.

Network staff are responsible for identifying all potentially sensitive resources to principal investigator(s) working on a project. Investigators, whether network employees or partners, will develop procedures to flag all potentially sensitive resources in any products that come from the project, including documents, maps, databases, and metadata. When submitting any products or results, investigators should specifically identify all records and other references that contain data pertaining to potentially sensitive resources. Additionally, investigators should not release any information in a public forum before consulting with Network staff to ensure that the information is not classified as sensitive or protected.

Natural Resource information that is sensitive or protected requires the following steps:

- Identification of potentially sensitive resources.
- Compilation of all records relating to those resources.
- Determination of what data must not be released to the public.
- Management and archival of those records to avoid their unintentional release.

9.2 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance regarding the ownership and sharing of data collected by SOPN.

- Appendix N – Approving Information for Distribution

Chapter 10. Dissemination

All monitoring information products will be vetted for sensitive data prior to making them available to the general public. Classification of sensitive I&M data will be a shared responsibility that includes network staff, park resource management staff, park superintendents, and investigators working on individual projects. Park management has ultimate responsibility for deciding which information is sensitive and should not be released to the public. The network has ultimate responsibility for ensuring that sensitive data is not released to the public.

10.1 Dissemination and Access

Dissemination of monitoring and information products from SOPN will follow these guidelines:

- data will be easily located and acquired
- only data subjected to full quality control and quality assurance measures will be released
- data will be accompanied by complete metadata
- sensitive data will be identified and protected from unauthorized access

Information products will be made available primarily through websites and clearinghouses which will allow users to search for and download reports, summarized data, maps and metadata and other associated information. Distribution means will include (but may not be limited to) the methods listed in Table 10-1. Specific details regarding data dissemination can be found in Section 10 of the national DMP (NPS 2008b).

Table 10-1. Southern Plains Network Data Access Locations

Item	Repository
Reports (public) - digital	SOPN LAN servers, SOPN public website, NPS Data Store, NPS Focus, NatureBib
- hard copy	SOPN I&M library
- bibliographic	NatureBib
Network-generated digital datasets and data products (public, non-sensitive) • Certified data and data products (including photographs) • Metadata	SOPN LAN servers, NPS Data Store, Biodiversity Data Store, NPSpecies, EPA STORET
Network-generated digital datasets and data products (NPS staff, sensitive) • Raw, validated data • Analytical products • Metadata • Reports • Digital photos • Digital presentations, etc.	SOPN LAN servers
Project products • Specimen vouchers • Photographic film	Park Museums or other curation facilities, according to project SOP's

10.2 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for the dissemination of data collected by SOPN.

- Appendix A – Central Files Directory Structure
- Appendix C – Digital Document File Naming Conventions
- Appendix M – Web Page Development and Maintenance
- Appendix N – Approving Information for Distribution

Chapter 11. Records Management and Object Curation

Data maintenance, storage, and archiving procedures will ensure that data, information, and physical objects are:

- Kept up-to-date with regards to content and format such that the data are easily accessed and their heritage and quality is understood
- Physically secure against environmental hazards, catastrophe, and human malice

Technological obsolescence is a significant cause of information loss, and data can quickly become inaccessible to users if they are stored in out-of-date software programs or on outmoded media. Effective maintenance of digital files depends on the proper management of a continuously changing infrastructure of hardware, software, file formats, and storage media. As software and hardware evolve, data sets must be consistently migrated to new platforms, or they must be saved in formats that are independent of specific platforms or software (e.g., ASCII delimited files). Data maintenance schedules will be developed to ensure that data are migrated and kept up-to-date.

11.1 Archiving and Storage

Digital and analog information products will be stored, archived and maintained in a variety of repositories (Table 11-1). Digital products resulting from monitoring projects will be archived on the SOPN file server and national file and data servers and protected from catastrophic loss by regular, automated backups to external media. Analog products will be archived to NPS standards by individual park facilities or approved non-NPS institutions. At the termination of a project or at regular milestones, an archival package will be prepared and delivered to the desired location.

Table 11-1. Repositories for SOPN information products.

Repository	Information Products
SOPN Project Directories	Working database, metadata, protocols, SOPs, reports, administrative records, digital photos
SOPN Project Databases	Certified data sets, comprehensive data for multi-year products
Park collections and /or National Archives	Administrative records, voucher specimens, raw data forms, hard copy reports
Specialized museum facilities (e.g. Botanical Research Institute of Texas)	Voucher specimens
NPSpecies	Compiled information about species occurrences, abundance, residency, and nativity
NatureBib	Natural resource documents, I&M reports
NPSTORET	Water quality data
NPS Data Store	Metadata and non-sensitive digital data sets

11.2 Records Management

11.2.1 Electronic File Naming Guidelines and Standards

All electronic files will be named according to guidelines and standards outlined in Digital Document File Naming Conventions SOP. These will apply to all SOPN electronic files created or maintained by staff or cooperators.

11.2.2 Directory Structure

Electronic files will be managed within a hierarchical set of file directory structures. The Central Files Directory Structure SOP provides an example of a very detailed layout of the directory structure for the SOPN I&M program which includes folders for administrative files, data, publications, and reports. All Network programs will shift toward a file directory structure like this one. The SOPN LAN will be the primary repository for all network I&M electronic files.

11.3 Backup, Recovery, and Storage

Both electronic and hardcopy files should be consolidated and packaged for archival when a project is complete or when milestones are reached. Project leaders are responsible for packaging electronic files and data and for preparing materials for the curator. Project protocols should designate who will be responsible for product archiving, integration, backup, and distribution.

11.4 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for the archival and storage of data collected by SOPN.

- Appendix A – Central Files Directory Structure
- Appendix C – Digital Document File Naming Conventions
- Appendix L – Voucher Specimen Collection Management Guidelines
- Appendix M – Web Page Development and Maintenance

Chapter 12. Project Tracking and Documentation

12.1 Tracking

SOPN will develop and implement a process for tracking I&M projects, including project status, data, and the products of analysis. This process will support program coordination and annual reporting, and improve accountability for Network natural resource inventory and monitoring efforts. All projects will be tracked using a database located on the SOPN file server. This will serve as the primary organizational tool for cataloguing and searching information for ongoing and completed network project. This database will be used to:

- Maintain a list of projects, both ongoing and completed
- Provide a method of tracking product deliverables
- Manage project codes used to tie information to other NPS tracking systems (e.g., RPRS, PMIS, PEPC, RAMS)

12.2 Documentation

Projects will be documented by creating project-specific protocol narratives and SOPs. These documents must always accompany the distribution of monitoring data. The network's project tracking database will track the project narrative and SOPs by version number and should be updated whenever any narrative or SOP document is modified. The protocol narrative and SOPs will not be distributed without a log of changes from the project tracking database. Long-term monitoring projects may require additional documentation for items such as algorithms, output files, and analytical products which may reside in different systems and formats. Data use and data request histories, and information on secondary research or publications resulting from long-term monitoring projects, should also be maintained.

All projects electronic files should be stored in a well organized project directory structure that is clearly understood by all network staff. Network digital directory structures should be organized at the project level, such that most or all digital files associated with a project are filed under a common root directory. Project file names will adhere to the naming conventions established by the Network. Physical objects acquired as part of a project will be stored according to the Network's specification for records management and object curation.

12.3 Standard Operating Procedures

The following Standard Operating Procedures detail specific guidance for tracking and documenting SOPN projects.

- Appendix A – Central Files Directory Structure
- Appendix J – Project Data Life Cycle Guidance
- Project Tracking SOP (under development as of September 2008)

Chapter 13. Implementation

The data management plans for each of the 32 I&M Networks are the first comprehensive documents of their kind in the NPS and contain practices that may be new to NPS staff and cooperators. However, almost every requirement stems from federal law and policies, Executive Orders, Director's Orders, or national I&M Program guidance. The DMP helps put these requirements into context, and provides operational and functional guidance for achieving them.

The main body of the national DMP (NPS 2008b) broadly addresses relevant subjects, but directs most of the details into individual appendices that comprise the network-level data management plan that serves as stand-alone document for ease of locating and retrieving specific information of greatest value to most users. The network-level plan will be revisited in three years or by October 1, 2011, and then every five years afterward. Plan appendices, including SOPs, detailed guidelines, reference manuals, policy statements, etc., will likely require more frequent updates to account for changes and revisions.

Implementation will require education and training in order to familiarize network and park staff and cooperators with the tools, procedures, and guidelines outlined in the plan. These efforts will begin in 2008 and be led by SOPN data management staff. Goals for the first 3 years include the following:

- Training all staff of targeted programs and their cooperators to understand the fundamentals of data and information management, including:
 - File management
 - Documentation
 - Quality assurance and quality control
 - Electronic storage
 - Archive storage
- Improving data management practices by implementing:
 - Accepted database design standards
 - Thorough testing of databases, data collection methods, and their integration prior to field work
 - Quality assurance and control procedures at every stage of project development
- Development of common SOPs and guidance documents for multiple protocols
- Insure that detailed specifications for data management that is consistent with the national and SOPN DMPs are included in every vital signs monitoring protocol
- Development of procedures and outlets for communication within and among Network parks and with the public

Beyond the first three years, goals should include the development and assessment of:

- Procedures to facilitate the summarization and reporting of monitoring data
- Framework and gateway for integration of monitoring data with other agencies or networks

- Methods for improving file management (e.g., a content management system), database administration and security (e.g., migration to SQL-Server), integration into the network of off-site users, and other needs identified in the DMP

Implementation and improvement of the data management system will be an ongoing process. The practices and procedures identified in this plan will continue to be encouraged broadly within the Network, and in time, have the above widely accepted and adopted by all SOPN park programs.

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Appendix A. Central Files Directory Structure

Update Frequency

As needed; Minimum Annually

Adapted From

Directory Structure - Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

A.1 Introduction

The Southern Plains Network has developed a defined directory structure in order to allow for an organized and efficient method for storing digital files. The directory map consists of two separate components. One is procedural, which defines rules of organization that will help determine how the directory structure will evolve through time. The other is structural, which formalizes the structure of the root folders.

A.2 Procedural Rules

Procedural rules define a thought process. Unlike structural rules, they do not outright define the directory structure, but instead provide a framework for allowing the structure to evolve through time. Any changes to the directory structure should conform to the following rules:

- Provides a consistent and logically organized structure that complements the Network's day-to-day operations
- Minimizes confusion about where information is located
- Allow for efficient, comprehensive, regular and secure means of backing up information
- Accommodate various security settings for different types of users
- Be hierarchical and minimize the ambiguity of where information should go. Ideally, the organization should be logical enough that one could navigate through the entire structure without ever requiring a map
- Separate in-progress/draft/unofficial/in-progress files from final/official information
- Be broad enough to clearly accommodate all types of information handled by the Network staff
- Be simple without sacrificing functionality
- Minimize the number of sub-folder levels. Ideally there should never be more than 8-10 subfolders within any primary directory.

- Newly created sub-folders should be organized by themes (e.g., hydrology, soil, etc.), rather than format (e.g., documents, GIS)

Information should never be arbitrarily divided in a way that increases the possibility of corruption or loss (e.g., metadata should never be separated from the data). When possible and appropriate, the structure should conform to other NPS and national directory structure standards. In keeping with these procedures, the following rules will apply to any folder expansions:

- Fiscal Years are represented by FY0x. Fiscal years begin October 1. Example: FY04.
- Subdirectories named “old” indicate older drafts of documents that are being temporarily archived. These folders are to be removed following final publication and archiving.
- Folder names should never have spaces or special characters (e.g., %&*).
- Primary folders, or those that are close to the root directory and unlikely to change in name or location are in UPPERCASE
- Two words are separated by an underscore (e.g., FIRST_SECOND).
- Secondary folders, or those that are many levels below the primary or are not accepted as a stable element of the SOPN directory structure are to follow Proper Case naming convention (e.g., FirstSecondThird)
- Absolutely no modification to the primary or secondary levels of the directory structure is to occur without approval by the Network Data Manager
- Sensitive information that must be managed by the Network will be placed in a /SENSITIVE/ sub-folder.
- In cases where a folder or file is inappropriately located, staff should notify the Network Data Manager

A.3 Structural Rules

The M drive is the primary Network drive and contains all of the information related to administration, monitoring, projects, tools and web development (Figure A-1). Currently this drive is a shared drive in the Network Data Manager’s computer. Only SOPN personnel have access to this drive. All computers using this drive must map to it as the M drive. At some point in the future, the contents of this drive will be migrated to a central file server. Mapping to the drive is possible by browsing to **\\NPS\Inpsopn10465\SOPN_Central_Files**

The following sections provide a brief description of the main subfolders.

A.3.1 Admin Folder

The administrative folder contains all administrative information handled by the SOPN, particularly by the network coordinator. This folder is fully accessible to all SOPN staff as read-only. The Network Coordinator and the Data Manager will have read-write access.

A.3.2 Dataman Folder

The data management folder houses all information regarding the data management operation in regards to data management planning. All network staff will have read-write to this folder

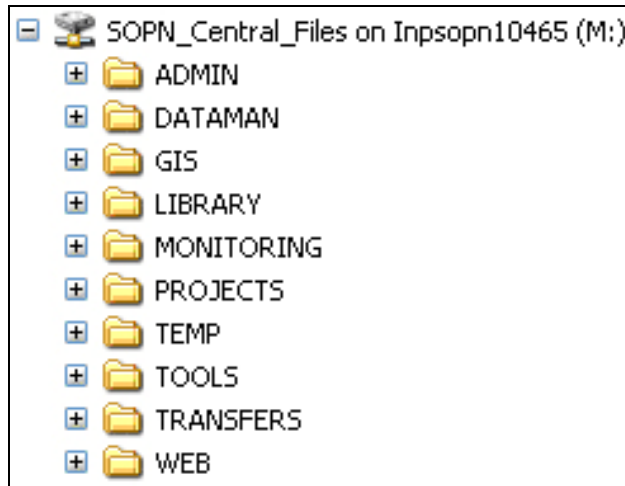


Figure A-1. Root Folders of the SOPN Central Files Directory

A.3.3 GIS Folder

The GIS folder houses all of the Network's base geographical information. This includes tabular datasets and native geospatial data (e.g., shapefiles and geodatabases) and the associated metadata. All Network staff have read-only access to this folder. The Data Manager has full administrative privileges. The organization of the sub-folders is found in the forthcoming GIS Management Strategy.

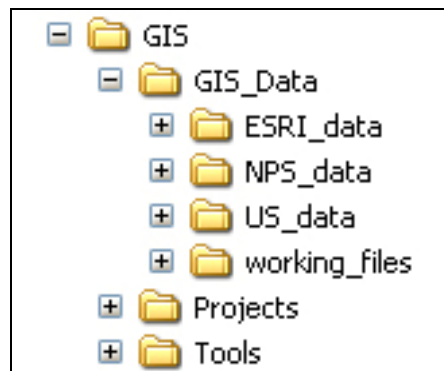


Figure A-2. GIS Sub-Folder

A.3.4 Library Folder

The principal function of library folder is to house all digital documents. This includes reference documents, completed park and network-specific reports, photographic images and completed maps and posters. The library is split into three subfolders.

The **\DOCUMENTS** folder contains digital versions of reports. All files in this directory should be in .pdf format. This directory will be further subdivided into 4 folders:

- The **\GeneralRefs** contains those documents and presentations which are intended strictly as reference material for the SOPN. No formal QA/QC will be applied to these

documents – it is entirely up to the staff member posting this information to ensure that it is to an appropriate quality level.

- **\Index** contains the SOPN search index. This is an Adobe Acrobat file that enables one to search the entire library for a keyword or phrase. This is the tool that should be used when attempting to find a document in the most efficient manor.
- The **\MasterRefs** folder contains all of the Park- or Network-specific documents that are part of the Library Operation and have been through the QA/QC process. These will be copies of documents already uploaded to NatureBib but maintained here for Network staff convenience.
- **\RefsToAdd** folder contains documents that are to be formally submitted to the Library Operation.
- The **\Manuals** contains digital copies of software and hardware instruction manuals. This folder is available to all network staff as read-only.

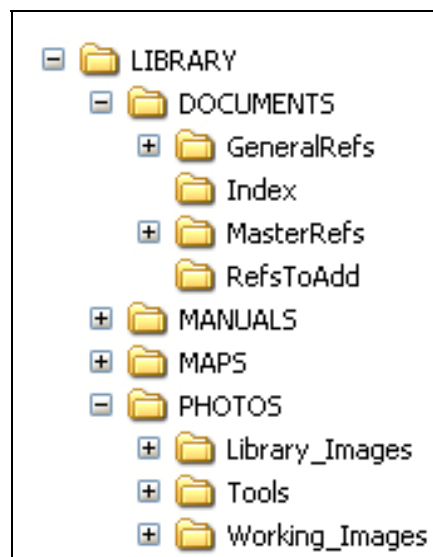


Figure A-3. Library Sub-Folder

Further details regarding the processing and storage of library documents can be found in the **Electronic Library Storage Strategy**.

The **\PHOTOS** folder houses digital photographs and icons (NPS arrowheads, SOPN logos, etc...). Further details regarding the processing and of photographs and images can be found in the and **Photo Management Strategy**.

The **\MAPS ** folder contains .pdf versions of finalized map products and digital versions of posters.

A.3.5 Monitoring Folder

This folder contains everything related to monitoring planning, including the scoping database, data management info, protocol development, and Phase I-III materials. More information on monitoring information can be found in the Vital Signs Monitoring SOP.

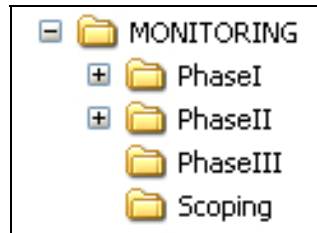


Figure A-4. Monitoring Sub-Folders

A.3.6 Projects Folder

The **\PROJECTS** folder houses all data and reports for projects that are not monitoring related, such as inventories and data mining projects. Completed projects are filed in the **\Complete** subfolder. Projects that are either in the planning stages or currently ongoing are files in the **\In_Progress** subfolder. Each project will have its own folder which is titled **\ProjectNumber_ParkCode_Title**. The project number is automatically assigned within the project tracking database. Individual project folders are further organized into a number of sub-folders that are shown below. An example folder structure can also be found in the **\PROJECTS\EXAMPLE** directory. All projects are tracked by the SOPN Project Tracking Database located in the **\Tracking** subfolder. More information on project management can be found in the **Project Management Strategy**.

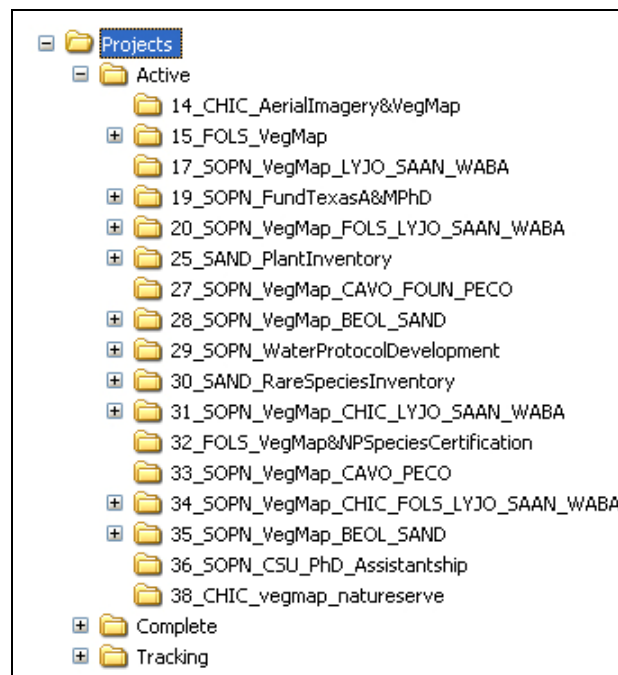


Figure A-5. Projects Sub-Folders

A.3.7 Transfer Folder

The **\TRANSFER** folder is a temporary work area used to transfer files between SOPN staff. Each staff has a folder over which they have complete ownership. Users should copy down files onto their individual computers as soon as possible.

A.3.8 Tools Folder

This folder contains the tools and applications used by the SOPN staff. Examples include NPSpecies, NatureBib, ThumbsPlus, etc...). Back-end data files and documentation is to be stored with the tool itself. If for any reason the data is not stored with the tool, it's location must be documented in a README file.

A.3.9 Trash Folder

The **\TRASH** is a temporary location for documents that are set to be trashed. Files are removed weekly.

A.3.10 Web Folder

The **\WEB** contains all files used to maintain the SOPN webpage. Access to this folder is restricted only to those working to maintain the webpage.

A.4 Roles and Responsibilities

The Network Data Manager is responsible for:

- Coordinating changes in the Network data structure SOP
- Modifying any root level changes to the directory structure
- Informing Network staff of changes to the directory structure
- Enforcing the SOP guidelines
- Providing the final decision in modifications to any part of the directory structure and file locations

All SOPN staff are responsible for:

- Regularly being informed of the directory structure and following the SOP guidelines
- Maintaining and organizing their folder in the **\TRANSFER** directory
- Adhering to the Network's sensitivity guidelines when storing and accessing sensitive information.

A.5 Directory Breakdown

The following is a detailed directory structure template. Primary folders are listed in **BOLD ALL-CAPS**. Secondary folders are listed in **bold**. These folders cannot be changed without approval from the Network Data Manager. Folders listed in plain text can be created or modified to accommodate projects needs.

ADMIN

Contains all administrative information handled by the SOPN.

Annual_Reports

All annual report and work plan information (database, reports, guidance, etc.)

FY0x

All administrative reports are to be organized by fiscal year

Budget

All expenditure information not used for AARWP

FY0x

All expenditure information is to be organized by fiscal year

Forms

Generic administrative forms.

Meeting

All meeting-related information including minutes and presentations

FY0x

Meetings are all divided into their respective fiscal year, which begins Oct 1

Date-Title-Location

Minutes

Handouts

Presentations

Memos

FY0x

Memos are organized by fiscal year

Organization

Stores general SOPN organizational and administrative function documents

Charter

Stores SOPN charter documents.

Agreements

Administrative agreements

Personnel

DataManager

NetworkCoordinator

<Other Staff As Added>

GIS

Houses all geospatial information.

GIS_Data

ESRI_Data

Sample data provided by ESRI

NPS_Data

Data pertaining to NPS park areas.

US_Data

Data covering the entire United States

Working_Files

Houses all intermediate and draft files. Finalized files will be documented and moved into the appropriate directories. Temp files will be deleted upon project completion

Projects

Houses all ArcMap project files.

Exports

Houses all exported map project files. Maps that will permanently kept should be files into the library structure.

LIBRARY

Digital library of all materials and documents that the SOPN is using. Drafts and unfinished documents should be filed in appropriate DRAFT folders.

Documents

Repository for digital documents

GeneralRefs

Documents produced outside of the SOPN and maintained for information purposes. These documents are not subject to QA/QC procedures.

Index

Adobe Acrobat word index of all documents(to be created)

MasterRefs

Documents produced by SOPN and subject to QA/QC procedures.

RefsToAdd

Temporary storage location for PDF documents that have yet to be recorded into ProCite and/or have not had their names changed to the proper naming convention

Photos

Library_Images

Contains all finalized images

Working_Images

Contains images straight from the digital camera or scanner. May require some editing.

Web_Images

Contains images that have been edited specifically for posting on the web

Tools

Contains example library image directory and thumbnail databases

Maps_Posters

Contains exported map files and posters produced by the SOPN

PROJECTS

Stores all project information. All project may not require each of the listed folders.

Final

Project Name

Admin

Houses administrative documents (task agreements, proposals, official correspondence, etc...)

Data

Houses project databases and photos.

Documents

Holds final versions of all reports.

In Progress

Houses projects that are currently being planned or are underway.

Tracking

Stores project tracking database and other related documents

TRASH

Temporary trash can. Files deleted once a week.

TOOLS

Computer tools and applications used by the SOPN staff

NPSpecies

NatureBib

NPStoret

NRDT

Plots

ProCite

ThumbsPlus

VSDatabase

TRANSFERS

Temporary area for transferring files between computers.

WEB

Stores local copies and development files for the SOPN website

Appendix B. Database Specifications

Update Frequency

As needed; Minimum Annually

Adapted From

Data Management Standards – Northeast Temperate Network
Database Specifications – Gulf Coast Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

B.1 Introduction

The purpose of this standard operating procedure is to create a set of standards for overall design and functioning of databases used for SOPN projects. This document should be used in tandem with a data dictionary for specific database in order to understand how the database functions and the contents contained within.

B.2 Scope and Applicability

The standards described in this document are relevant to all SOPN databases. While the specific fields included in the database may differ on a project by project basis, the general structure, organization and functioning of the database should be the same as the information presented here. Therefore, a separate data dictionary will be developed for each database to define all data elements; the data dictionary should be used in tandem with this document as a starting point and users guide to I&M Program databases.

B.3 Procedures and General Requirements

All databases from the SOPN I&M Program are based upon the concepts implemented in the Natural Resource Database Template (NRDT), available online at: <http://science.nature.nps.gov/im/apps/template/index.htm>. The NRDT is a relational database in MS Access that may be used as a stand-alone database or linked to ArcView GIS software using other tools from the I&M Program such as ArcView to Access (available online at: <http://www.nps.gov/akso/gis/>).

An additional component to the NRDT is the Front-end Application Builder (FAB). The FAB can be used to create an NRDT front-end (user interface) application that goes on top of a

standard NRDT v.3.2 back-end (database) and can also be found with the NRDT at <http://science.nature.nps.gov/im/apps/template/index.htm>

B.3.1 Natural Resource Database Template

The Natural Resource Database Template (NRDT) offers a good platform from which Network databases can be built. The design of the template is built around a series of tables that are designed to record project site location, sampling period, and actual field data. Each of the tables and fields incorporated into the tables are coded according to one of the following three categories:

Mandatory (core) tables and fields – These are the primary tables and fields that will be used to build a standardized NPS database. They manage the information describing the “who, where and when” of a project;

Mandatory if Applicable tables and fields – These tables contain commonly used attributes, but aren’t absolutely necessary; and,

Optional tables and fields – These are tables and fields that are needed for a specific project or protocol, but are less likely to be used in other databases.

The NRDT has been extensively reviewed by the Inventory and Monitoring Program data managers and has been applied to some of the biological inventory projects in the Program.

B.3.2 Front-end Application Builder

The Front-end Application Builder (FAB) is a Microsoft Access file that is intended to be used by developers of NRDT applications to create a front-end (user-interface) to an NRDT v.3.2 back-end (database). The FAB comes with many built-in features, including:

- table linking utility
- data backup
- compaction
- lookup table management
- main menu
- standardized data entry forms for core NRDT v.3.2 tables
- standardized data "gateway" form for retrieving records

Wherever possible, SOPN databases will be designed using the FAB in conjunction with the NRDT. This will allow developers have more time for protocol-specific form and report development. Using the FAB also gives NRDT applications a standardized look-and-feel, thus making it simpler for users to learn new applications if they've used a FAB application before.

B.3.3 Database Design Specifications

All databases created either by or for the SOPN should follow a set of design standards. These standards are listed below:

Required:

- Core tables from the Natural Resource Database Template (NRDT)
- The database is normalized to the third level

- Tables are properly defined and relationships are documented
- The database table and field names meet the Southern Plains Network naming standards
- Each table is defined with a primary key that uniquely identifies records in that table
- Each field is defined and described
- Each field value contains raw data, with no formats applied (e.g., Bold, italic, underline, etc.)
- The data have been verified using at least one standard data verification method

Strongly Recommended:

- A database model depicting general flow and operation
- The database is described in minimal or complete Biological Profile FGDC format

As appropriate:

- Each field, where appropriate, is defined by a domain of allowable values
- Each field, where appropriate, is defined with a display format and/or input mask
- Examples of field data collection form(s)

B.3.4 Quality Control/Quality Assurance

Databases can be designed to insure that the quality of data contained within. In order to insure data integrity, the following measures are to be included in all databases

- Set unique constraints (or unique key indexes) on every table in a database. Unique constraints are multiple key indexes set to allow no duplication, so as to prevent the entry of the same data record more than once. The index is set on the fields that make the records in a table unique. For child tables, it always includes the foreign key from the parent table. Duplication of entries is a common problem in databases without unique constraints.
- Implement all value constraints and business rules on the backend of the database, not on the forms used for data entry.
- Create separate forms for data entry/editing and review, or use mode control on single forms with both functions.
- Populate lookup tables as much as possible before data entry begins, and restrict access to them by data entry personnel.
- Set value ranges and validation rules on fields wherever possible to control the range of values that can be entered.
- To the extent possible, set the *limit to list* property to *True* on fields that receive input from a value list or lookup table.
- Include queries or programming modules that run checks for logical errors and out of bound values on calculations.
- Create field forms that best match data entry forms.
- When using hand-held computers in the field for data entry, the same set of controls should be placed on data fields as exist in the master database.

B.3.5 Metadata

In addition, a metadata record in the form of a descriptive document that clearly details the purpose of the database must be created to document the will be created. A text or Microsoft

Word document (i.e. the current NPS standard) describing the dataset shall accompany each database submission to provide necessary information for understanding the data submittal.

Overview of descriptive document contents

- File index (e.g., contents of the CD or zip file as a Readme file – see below)
- Description of the project
- Location of the project study plan and work plan
- Project leader's name and contact information
- Principal investigator's name and contact information*
- Data set contact's name and contact information*
- Description of the database model (entity relationship diagram and data dictionary)
- Sensitive data issues, if appropriate
- Description of data verification methods and results
- Additional comments/documentation references, where appropriate

The following example of a Descriptive Document entitled CODE_BirdSurvey_Readme.doc (or .txt) which accompanies a zip file containing all the database deliverables. In this example, "CODE" stands for the park's alpha code.

CODEBird.zip containing the following files:

CODE_BirdSurvey_Readme.doc (this descriptive document)
CODE_Bird_File_Names.doc (naming convention or codes used for file names - if applicable)
CODEBird.txt/.html/.sgml – FGDC metadata formats
CODEBird.mdb – MS Access database
CODE_Bird_Data_Dict.doc (data dictionary for CODEBird database)
CODE_Metadata.txt (minimal format metadata file)

CODEBird database contains survey sampling data from summer 2001 for ground nesting species in CODE. Surveys were conducted with modified transect sampling. Statistical analyses were produced with SysStat software.

None of the data contained in this data set is considered sensitive.

The project study plan and work plan are stored on the CODE data manager's workstation.

The database model is stored on the CODE data manager's workstation.

Project Lead:

Dr. John Smith, Ecologist
CODE Headquarters
234 Main Street
Anywhere, ST 00000
999-555-1111 voice
999-555-1122 fax
john_smith@nps.gov

Principal Investigator:

As above...

Data Contact:

Data Manager
CODE GIS Office
As above...

Two cooperators independently verified data after data entry by the principal investigator. Of the records in the CODEBird.mdb file, 0.03% had data entry errors which were subsequently corrected.

Additional comments as needed.

B.3.6 Data Normalization

Data normalization is the optimization of database tables. Normalization separates the fields from a large, generalized table into multiple, smaller related tables by removing all unnecessary or duplicate fields and ensures that each table represents a single subject. All SOPN databases should be normalized to third normal form.

Overview of Third Normal Form

- Each table contains data about a single subject.
- Each table is identified with a primary key.
- No table contains repeating fields.
- No table contains redundant data, or groups of repeated values for multiple records.
- Each table contains only fields that are dependent on the primary key, or directly related to the table subject.

B.3.7 Naming Standards

Standards are an important part of database design, as they allow for the development of consistent databases. This is extremely important when data are shared among multiple users and converted between database servers. Table and field names should be designed to clearly define the data being stored. These names should be meaningful to the entire organization.

In general, the maximum table and field name length should be around 20 characters. However, it is strongly recommended that spatial data or attribute data which could be imported into or linked to GIS or other use 8 or 10 character maximum for table and field names, respectively. In this software, table and

field names longer than 8 or 10 characters may be truncated upon import, potentially sacrificing information by resulting in duplicative or unclear table and field names.

File names for database files should conform with the SOPN file naming convention described in the Network file naming convention SOP, SOPN_2007_FileNamingConvention.doc

Overview of Table Names

Prefix. The prefix identifies the data object type (e.g. tbl for a data table).

Root Name. The root name is a noun or short phrase that clearly defines the table (e.g. Voucher).

Overview of Field Names

Prefix. The optional prefix identifies a field type as a Boolean (yes/no) (e.g. Is_Present, other prefixes include 'are' and 'has').

Root Name. The root name is a noun or short phrase that clearly defines the field (e.g. Event).

Suffix. The suffix identifies the field category (e.g. Event_ID, Park_Count, Start_Date).

Unit of Measure. The optional unit of measure abbreviation defines the required field unit (e.g. transect_length_km).

Overview of File Names

Files should conform to the Network file naming convention.

Do not use spaces or dashes in any file name.

B.3.8 Data Dictionary

A data dictionary does not contain any actual data, only book keeping information for managing data. It is a necessary part of database documentation, and a required element of databases submitted as part of Network projects. The dictionary identifies all of the pieces of the database, including tables, queries, and other elements upon which the system relies including field names, types, lengths, and descriptions. A data dictionary does not need to be long, but should be comprehensive. Data dictionaries typically contain field definitions, along with field data type information.

Overview of a Data Dictionary

- Defines database tables, queries, forms, macros, modules, and all other related information
- Describes stored SQL procedures
- Defines user permissions
- Outlines database process information
- Documents database relationships

This information can easily be extracted using the Metadata Exporter tool available at <http://science.nature.nps.gov/nrdata/docs/metahelp/metahelp.cfm>.

B.3.9 Primary Key

Each table in the database will be identified with a primary key. The primary key of a relational table uniquely identifies each record within the table. Each table needs a primary key so that a single row can always be accessed or modified without altering any other records in the table. The values that compose a primary key must be unique; no two values can be the same. The primary key field(s) will always be required; no value can be null. The primary key can be a single field that is populated by the user or auto-generated by the system. Two or more fields will sometimes comprise the primary key, in cases where only the concatenation of multiple values forms a unique combination.

Any field or group of fields that is eligible as a primary key (i.e. will have a unique value) is called a candidate key. A table can have any number of candidate keys. One candidate key is chosen as the primary key and the remaining become alternate keys. Candidate keys may be noted in the field descriptions.

B.3.10 Field Description

A field description includes a definition statement that clearly states the purpose of the field. Filling in this field is an integral part of creating a comprehensive Data Dictionary and is one of the fields used by the metadata harvester. The description can be used to further clarify any information about the field that may not be apparent by the field name alone. These definitions are documented in the database during table creation.

B.3.11 Data Storage

A database is most efficient when populated with raw, unformatted values. Since formatted data can only be saved in text fields, formatted numeric and date values must be converted to text from their native data type. Users of the database lose the benefits of the numeric and date data types, specifically the calculations and functions that can be performed on those fields. Data

entry time increases when formatted text is keyed in. Additionally, data formats are more difficult to control and cannot easily be modified without updating each record individually. Sorting performed on formatted values is not reliable. Special characters are taken into account during the ordering. But, more importantly, a sort performed on numbers or dates stored in a text field will return unexpected results since the values are ordered by the ASCII code of the individual characters rather than the value as a whole.

There are two areas where formatting may be acceptable. Tables often contain description or comment fields. These fields are defined with text (maximum of 255 characters) or memo data types and contain written verbiage, often in paragraphs. Any formatting that is embedded within this style of text is allowed. Also, efficiency or security requirements may necessitate storing calculated fields (i.e. trading storage space for speed or storing single values in a secure table, but calculated values in a non-secure table). In the second case, consult with the data manager for approval of the calculated fields. Be sure such fields are documented clearly in the field description and data dictionary.

B.3.12 Data Verification

Manual effort is generally required to get data into electronic format. Any errors made during typing will accumulate in the permanent database unless the data is verified and errors are detected. A data verification practice should be implemented in order to reduce and possibly eliminate errors.

Overview of Data Verification Methods

- Visual review at data entry. The data entry person verifies each record after it is input. The values recorded in the database are compared with the original values from the hard copy and any errors are corrected immediately. This method is the least complicated since no additional personnel or software is required. The accuracy of this method depends wholly on the person keying data and is generally the least reliable of the data verification methods.
- Visual review after data entry. All records are printed upon the completion of data entry. The values on the printout are compared with the original values from the hard copy. Errors are marked and corrected in a timely manner. The reliability of this method increases if someone other than the person keying data performs the review. Again, no special software is required.
- Duplicate data entry. The data entry person completes all data input, as normal. Random records are selected (every nth record) and entered into an empty replica of the permanent database, preferably by someone other than the person keying the permanent data. A query is run to automatically compare the duplicate records from the two datasets and report on any mismatches of data. These disparities are manually reviewed and corrected if necessary. This method involves the overhead of re-typing the selected records, as well as the creation of a comparison query (which requires additional effort, but is not time-consuming). This method becomes increasingly successful as the value of n decreases.

Each method has a direct correlation between effectiveness and effort. The methods that eliminate the most errors can be very time consuming, while the simplest and cheapest methods will not be as efficient at detecting errors.

B.3.13 Data Normalization

Data normalization is the optimization of database tables. Normalization separates the fields from a large, generalized table into multiple, smaller related tables by removing all unnecessary or duplicate fields and ensures that each table represents a single subject. This includes the process of converting data from a flat file (i.e. spreadsheet) into a relational database. SOPN databases should be developed to the third normal form. Specifics of this form include:

- Each table contains data about a single subject.
- Each table is identified with a primary key.
- No table contains repeating fields.
- No table contains redundant data, or groups of repeated values for multiple records.
- Each table contains only fields that are dependent on the primary key, or directly related to the table subject.

B.4 Roles and Responsibilities

Project Scientist

The project scientist will work with the data manager at the outset of the project to develop a database that supports both project (protocol) and programmatic needs. Please review the database specifications and the data dictionary that were developed specifically for your project, prior to starting field work, to ensure that the database will meet project needs and will capture all raw data. In addition, please use the database as provided or discuss necessary changes with the data manager. Changes to the database may result in problems with the database itself, or incompatibilities with other I&M Program data management needs. Finally, please work with data entry personnel (especially those not involved in data collection) to ensure they understand the database and your field data sheets before entering any data.

Data Manager or Project Leader

The data manager will work with the project scientist to develop a database that meets both project and I&M Program needs. Database development is typically a back-and-forth process that results in an implementation that works for everyone involved. Upon completion of the database, the data manager will develop a data dictionary that described all data fields in the database, to ensure the greatest level of understanding by all database users and data entry personnel. Finally, the data manager will also work with data entry personnel to ensure that data are being entered properly and that quality assurance methods are being followed.

Data Entry Personnel

Please review the data dictionary and the database specifications document before attempting to use the database you have been provided. Also, familiarize yourself with the project's field data sheet before beginning data entry. In general, the basic rule is: don't hesitate to ask any questions before beginning to enter data – you certainly don't want to go back and delete entries due to some misunderstanding.

Appendix C. Digital Document File Naming Conventions

Update Frequency

As needed; Minimum Annually

Adapted From

File Naming Conventions - Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

C.1 Introduction

This document provides guidance for the naming of all digital document files used by the Network staff. Consistent naming conventions are an effective means of quality assurance because it minimizes confusion over file versions and purpose.

There are two considerations when outlining the guidance. First, it is recognized that file naming conventions will change through time as staff, NPS and Network Policies, technology, formats, and the uses of the information change. Therefore, the first part of this SOP addresses the goals that any naming convention should meet. The second part of this documents the current standards.

It should be noted that this document only covers document files, such as reports, letters, presentations, and other word-processed documents. File extensions frequently associated with these formats are (*.doc, *.txt, *.rtf, *.ppt). Data and geospatial file formats will be covered in their respective strategy documents.

C.2 Standards

As naming conventions change and are updated, the file naming conventions should:

- Clearly distinguish between final and in-progress documents;
- Minimize confusion over file versions;
- Ensure the file names are unique;
- Be consistent with other NPS and Federal Standards when files are shared externally.

C.2.1 General

The following general standards apply to all files:

- File names will be no less than 8 characters and generally not be greater than 30 characters in length. They must never have spaces or special characters (e.g., \$%@!)
- Author names will only be the first author. Acronyms are only acceptable for state and federal agencies. Except when necessary, the author of all network/park publications will be the network/park code. Unknown authors will be referred to as “NoAuthor”
- Dates will be one of the three following formats. YYYYMMDD, YYYYMM or YYYY. Unknown dates will be referred to as “0000”
- Titles will be as descriptive as possible. Titles will follow the proper case (e.g., FirstSecondThird). An underscore is optional following an acronym (e.g., PECO_BugReport). All references will have a title. “NoTitle” is not allowed.
- Files that have not been finalized will carry the _DRAFT suffix in order to easily distinguish these from finalized files.

C.2.2 In Progress Files

Files *in progress* are those that are draft, incomplete, currently being edited, or have not been evaluated for quality. In progress documents will be named:

[ParkCode]_Title_Date_[WorkingAuthor]_DRAFT.xxx

[WorkingAuthor] is optional and applies when two or more staff are working on the same draft. For example, the SOPN_AARWP2005_20051021_DRAFT.doc may be the primary working document while SOPN_AARWP2005_20051021_Perkins_DRAFT.doc and SOPN_AARWP2005_20051021_Sosinski_DRAFT.doc are modifications of that draft by those respective authors. Ultimately, these modifications will be integrated into a single draft with a different date (e.g., SOPN_AARWP2005_20051029_DRAFT.doc)

When practical, the draft should be incremented by the date of edit each time a document is edited, with the date is represented by YYYYMMDD. In cases where two different drafts are created on the same date, the file should be incremented by letter of the alphabet after the date (e.g., 20060512a, 20060512b).

Document format (xxx) is specified by the appropriate 3-letter extension (e.g., doc, ppt, txt).

Examples of in-progress files include:

- BEOL_ArchWetlandReport_20060621_Smith._DRAFT.doc
- SAND_RarePlantInventory_2004_DRAFT.mdb
- LYJO_ParkBoundary_20060412_DRAFT.shp

C.2.3 Final Files

Files are final when they are complete for their respective version, finished, and have been evaluated for quality. All final reports received the SOPN will be renamed to match this format before being processed into the library. Final document files will be named:

Author_Year_[ParkCode]Title.pdf

The date should only include the year the document was written in YYYY format.

[ParkCode] should be appended to the title if the document specifically relates to an NPS unit (park or network) and was not written by an outside source (e.g.

Sanders_2005_LYJOPlantInventory.pdf). ParkCode can also be included if the document was

written by the network, but refers to a specific park (e.g. SOPN_2005_FOLSScopingReport.pdf). Do not include [ParkCode] if it is the same as the author (e.g. LYJO_2005_PlantInventory.pdf)

PDF is the preferred extension because it is the Network policy that all final documents be in portable document format (pdf).

Example names of final document files are:

- Smith_2006_CHICWaterQualityAssessment.pdf
- WABA_2006_ResourceManagementPlan.pdf
- SOPN_2005_PhaseIIMonitoringPlan.pdf

C.3 Roles and Responsibilities

Network Data Manager

The SOPN data manager is responsible for ensuring that network staff adhere to the directory structure guidelines, and for maintaining project Readme files. Additionally the data manager is responsible for maintaining the directory structure of the SOPN Central_Files directory..

SOPN Staff

All network staff are responsible for ensuring that current versions of their project files (which are often stored on their individual local drives) are stored in the appropriate locations on the shared drive(s).

Appendix D. GIS Specifications

Update Frequency

As needed; Minimum Annually

Adapted From

GIS Specifications - National Capitol Region Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

D.1 Introduction

This SOP identifies the standards (data formats, coordinate systems, spatial scale and resolution) for all spatial data collected and managed by the Southern Plains Network.

The standards outlined in this SOP are applicable to all geographic datasets created or managed by Network staff or cooperators. This document does not provide guidance relating to the collection of GPS data but is applicable to how such data is formatted after collection. For detailed information regarding the collection of GPS data, refer to the SOPN standard operating procedure for GPS data collection.

D.2 Procedures and General Requirements

D.2.1 Data Formats

All vector data will be supplied as an ESRI Shapefile. Data may also be submitted as an ArcGIS Geodatabase in addition to a shapefile (not instead of) that is compatible with the current version of ArcGIS.

All raster data will be supplied as an ArcINFO GRID or ArcINFO interchange file (*.e00) that is compatible with the current version of ArcGIS.

Note: Be aware that when ArcINFO GRID files are converted to interchange files (*.e00) the interchange file size is often much larger than the original GRID. Therefore, this may not be the most appropriate method of transferring this data.

Digital imagery (e.g. aerial photos) is to be supplied as tagged image file format (.TIFF) with the proper header file for geo-referencing purposes. Depending on the intended use of the imagery, it may be preferable to receive and store the imagery in an uncompressed format therefore, consult the project leader or data manager prior to storing imagery in a compressed format such

as MrSID. All digital imagery will be properly orthorectified unless it is decided ahead of time that two dimensional georeferencing is appropriate. All imagery must be accompanied by appropriate header or world files.

D.2.2 Data Requirements

Data file names should not contain spaces. If a space is desired in a field name, use and underscore (“_”). In addition, field names should not exceed 10 characters due to limitations in ArcINFO and dbase.

All GIS layers (rasters, vectors and imagery) should all be submitted with complete and FGDC compliant metadata. Metadata should be created based on the NPS Metadata Templates. Please refer to the SOPN Documentation standard operating procedure for more details on.

All spatial data, regardless of format, must have defined projections (in the case of shapefiles, an accompanying *.prj file).

D.2.3 Coordinate Systems

All spatial data collected for and/or submitted to the SOPN will be projected as UTM, NAD83 (meters) in the appropriate area’s zone (Zone 13 or 14). Note that individual parks may maintain older geographic data in a different coordinate system. Any data the network receives from the parks in other projections should be projected to the above coordinate system. The steps used to transform data to these standard projections must be documented in the accompanying FGDC compliant metadata. Prior approval from the project or data manager must be received in order to deviate from these specifications.

D.2.4 Spatial Scale and Resolution

Specific scale and spatial resolution requirements for image data will be specified in the contract or cooperative agreement for each project. For example, vegetation classification projects under the NPS/USGS vegetation classification and mapping program will use 1:12,000 color infrared aerial photographs (or better) with 60% overlap (endlap) and 30% sidelap.

In general, new data should be compiled with an accuracy level better than US National Map Accuracy Standards (NMAS) for a 1:24,000 scale map; unless other requirements exist (which would then be included on a protocol-specific basis). However, all spatial data collected will be analyzed for their spatial accuracy and will meet or exceed NMAS for the appropriate scale (for more information, please see <http://rockyweb.cr.usgs.gov/nmpstds/nmas.html>).

For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground: monuments or markers, such as benchmarks and property boundary monuments; intersections of roads and railroads; and corners of large buildings or structures (or center points of small buildings). In general, what is well defined will also be determined by what is plot-able on the scale of the map within 1/100 inch.

Table D-1. Standard projections used by parks in the Southern Plains Network.

Park	Projection	Datum	Spheroid	False Easting	False Northing	Units
All	UTM	NAD83	GRS 1980	500,000	0	Meters
All	Geographic	NAD83	GRS 1980			Decimal Degrees
ALFL	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
BEOL	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
CAVO	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
CHIC	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
FOLS	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
FOUN	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
LAMR	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
LYJO	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
PECO	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
SAND	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
WABA	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters

Any calculations done with location data should be done at double precision with the results rounded or truncated to the appropriate propagated error limits. All calculations and processing completed on the spatial data shall be reported in the FGDC compliant metadata that accompanies the GIS layer.

Table D-2. Allowable error based on USGS National Mapping Accuracy Standards.

Scale	Allowable Error
1:40,000	33.8 meters (111 feet)
1:31,680	16.1 meters (53 feet)
1:24,000	12.2 meters (40 feet)
1:20,000	10.1 meters (33 feet)
1:12,000	6.1 meters (20 feet)
1:9,600	4.9 meters (16 feet)
1:4,800	2.4 meters (8 feet)
1:2,400	1.2 meters (4 feet)
1:1,200	0.6 meters (2 feet)

D.3 Roles and Responsibilities

Project Staff (NPS or cooperator/contractor)

The staff member creating or editing either geo or non-geospatial data is also responsible for ensuring that the data meets the standards listed above. If there are any questions regarding these standards, please contact the SOPN Data Manager.

Network Data Manager

The SOPN Data Manager is responsible for reviewing geospatial data products received from cooperators or produced by SOPN staff members to ensure that the products meet the standards described above. If standards are not met, the personnel responsible for creating the data set should be contacted and instructed to address the issues. The Network GIS Specialist is also responsible for properly storing and archiving all GIS products.

Appendix E. GPS Specifications

Update Frequency

As needed; Minimum Annually

Adapted From

GPS Specifications – Gulf Coast Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

E.1 Introduction

This document describes the procedures used to collect GPS data of acceptable quality in the field. It also provides information on instrument settings, field operations, and standards in the recording of positional data.

GPS (Global Positioning System) is currently a constellation of 25 Department of Defense satellites that orbit the earth approximately every 12 hours, emitting signals to Earth at precisely the same time. The position and time information transmitted by these satellites is used by a GPS receiver to trilaterate a location coordinate on the earth using three or more satellites.

The standards described in this procedure pertain to all data collected with hand-held or backpack GPS receivers. This document focuses upon field operations and instrument settings to be used when collecting GPS data, as well as including some recommended standards for the collection of positional data. This document is not intended to serve as a training manual for those new to GPS data collection. More detailed information regarding the collection of GPS data can be found at the GPS for GIS Workflow site located at <http://www.nps.gov/gis/gps/gps4gis/>.

E.2 Procedures and General Requirements

E.2.1 Data collection procedures for all GPS units

All data should be differentially corrected. The preferred method is to employ real-time correction. The method can vary (DGPS, WAAS) depending on which model of receiver is used. If real-time correction cannot be employed, data should then be corrected via post-processing if possible.

During data collection, the graphics data collection screen should be checked regularly for any multi-path or other apparent distortions to the data. Garmin and PLGR's require the user to

monitor the screen and stop data collection during poor PDOP or SNR windows. Trimble receivers set to the appropriate mask (see above) will stop collecting data automatically. If there is a possibility of multi-path interference, use offsets or other methods to keep the antenna away from building overhangs, tall fences or walls, and heavy canopy, whenever possible.

If maximum accuracy is required, it is important to sync the collection rate with the base station logging rate. Stations log anywhere from 1 to 30 second data. It is recommended that logging rates be in multiples of 1 or 5 for best differential corrections. Setting logging rates other than 1 and 5 may reduce the number of positions that are in sync with base data and reduce accuracy.

All features in a single area should be mapped over the course of a single day. If this is not possible, mapping should continue the consecutive day.

E.2.2 Park Unit Data Standards

All digital geospatial data should reference the coordinate system appropriate for its use and it should be documented in the metadata. When collecting GPS data in the field, the standard projection for the SOPN is the Universal Transverse Mercator (UTM) within Table E-1.

Table E-1. Standard Data Projections for the SOPN

Park	Projection	Datum	Spheroid	False Easting	False Northing	Units
All	UTM	NAD83	GRS 1980	500,000	0	Meters
All	Geographic	NAD83	GRS 1980	n/a	n/a	Decimal Degrees
ALFL	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
BEOL	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
CAVO	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
CHIC	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
FOLS	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
FOUN	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
LAMR	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
LYJO	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters
PECO	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
SAND	UTM, Zone 13	NAD83	GRS 1980	500,000	0	Meters
WABA	UTM, Zone 14	NAD83	GRS 1980	500,000	0	Meters

E.2.3 Horizontal/Vertical Accuracy and Precision

All spatial data collected will be analyzed for spatial accuracy and will meet or exceed the National Map Accuracy Standards for the intended scale and use. (More information can be found at <http://mapping.usgs.gov/standards>). Any calculations done with location data should be done at double precision with the results rounded or truncated to the appropriate propagated error limits. All calculations and processing completed on the spatial data will be reported in the metadata.

Positional coordinate data should not be recorded in NAD27 in the field. Datum conversions should be done as an office, post-processing activity using software that utilized a full NADCON datum conversion in order to assure accuracy and precision.

To state again, real-time differential correction techniques should be employed whenever possible for efficiency and time savings. The distance between the base station and the remote GPS receiver should be kept to a minimum, preferably less than 150 miles.

E.2.4 Specific settings for Garmin and PLGR units

- Estimated Horizontal Error (EHE) should be less than or equal to 12 meters. This will keep you just within National Map Accuracy Standards for a 1:24,000 scale map – which is the maximum acceptable.
- Use a minimum of 4 satellites (3D) for every position.
- For point data, collect 90-120 positions at 1-2 second intervals and averaged.
- For line or polygon data, use a 2-5 second interval for walking and road driving, depending upon the road type and speed of the vehicle. Force (e.g. wait for) a position at each corner and use a minimum of 3 positions to define any curve or change in direction.

E.2.5 Specific setting for Trimble Pathfinder Units (GeoExplorer, GeoXT, Pro XR)

- Positional dilution of precision (PDOP) should be less than or equal to 6, however, start with a maximum PDOP setting of 4 and shift to 5 if data collection is not successful. This will allow you to meet National Map Accuracy Standards for a 1:5,000 scale map.
- Use a minimum of 4 satellites (3D) for every position.
- Signal to Noise Ratio (SNR) should be less than or equal to 5.
- Set Elevation Mask to 15.
- Check the Antenna Height setting – which should be the typical height at which the antenna will be carried. If the antenna is attached to a pole, it must be located above the user's head and the antenna height setting should be the height at the top of the pole. Whenever possible, the antenna should be clear of any obstructions.
- For point data, collect a minimum of 30 positions at 1 second intervals and averaged.
- For line or polygon data, use a 2-5 second interval for walking and road driving, depending upon the road type and speed of the vehicle. Force (e.g. wait for) a position at each corner and use a minimum of 3 positions to define any curve or change in direction.

E.3 Roles and Responsibilities

Data Collectors:

Be certain that you understand how to use the GPS unit, data logger, and any study-specific data collection forms prior to going into the field and collecting data. Don't be shy, ask questions or request training as needed. There is nothing worse than wasting a day, or more, of field work due to improper use of the equipment. Plan your trips to the field in advance, and target times of the day when the most satellites will be overhead (Check the latest almanac at <http://www.trimble.com/gpsdatasources.html>) to get the most of your time in the field. Also, spend time (at the beginning of the project) going over the data you are collecting and differentially correcting to make sure you are collecting everything that is needed, in a proper way. Don't wait until the end of the project to do this or an entire field

season may be wasted when errors could have corrected early on. If something doesn't seem right to you, please ask.

Network Data Manager or Project Leader

Provide data collection personnel with training and/or instruction in the use of all GPS units, data loggers, and any study-specific data collection forms prior to sending them out into the field to collect data. If possible, accompany all new data collectors in the field until you both are certain about and comfortable with all data collection procedures. Be available to answer questions from data collection personnel and require that early data collection efforts be thoroughly analyzed to minimize systemic mistakes that could really diminish the usefulness of the data collected. If possible, examine data from initial data collection efforts as soon as possible, to catch any systemic errors that need correction.

Appendix F. Library Management Strategy

Update Frequency

As needed; Minimum Annually

Adapted From

Library Operation – Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

F.1 Introduction

The Library Operation is concerned with the management of digital and analog publications, including maps, NPS publications and guidelines, reports, and peer-reviewed scientific manuscripts. Most of these publications are likely to be specific to either one of the Network parks or the Network itself. However, publications may also be those that serve as references for vital signs monitoring.

F.2 Acquisition

The acquisition step determines whether a document fits within the scope of this operation. The scope of the Library Operation is further defined by the format, status, subject, and age of the document. First, all documents should either be in hard copy or portable document format (PDF). Digital versions that are not in PDF format must be converted before further processing. Second, documents should be in **final form** – drafts are not acceptable. This rule may be relaxed if the “draft” version is the *de facto* “final” version, however this version must be replaced by a final version once acquired. Documents acquired and processed into the Network Library will be placed in one of two categories (Network References and General References).

F.2.1 Network References

All documents specific to the Network or a network park fall into the Network References category. These documents, regardless of age, are important to acquire and maintain indefinitely. All documents that meet the Network Reference criteria are to have both a hard copy and a digital PDF versions. For a document to be considered a Network Reference, it must meet at least one of the following criteria:

- It must be published by or be about the network
- It discusses natural resources in one of the member parks

- It has been determined to be a key network resource

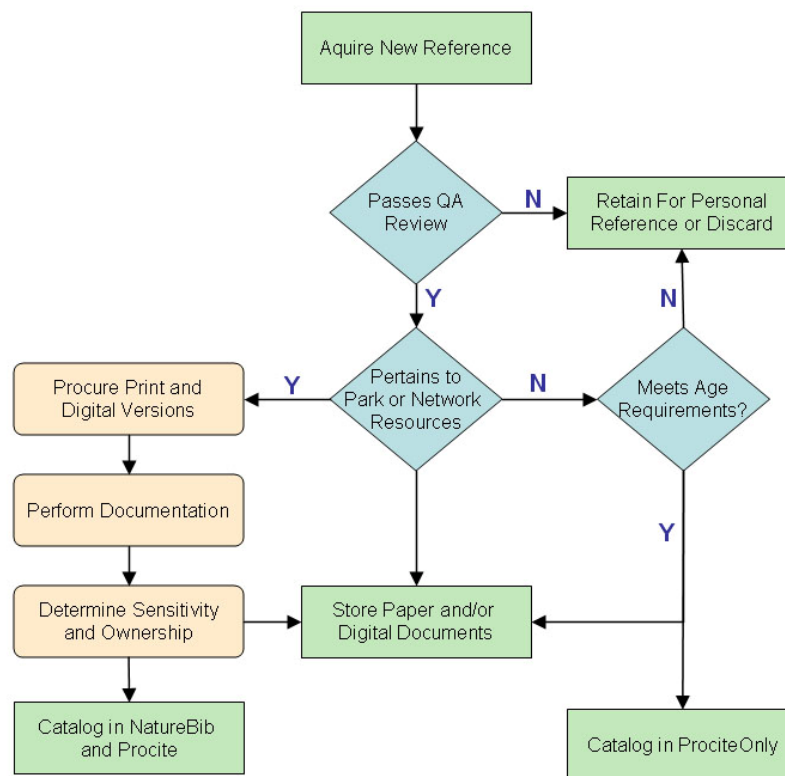


Figure F- 1. Library operation general workflow

F.2.2 General References

General References are documents that provide useful reference material, but do not meet the Network Reference criteria. These documents do not require that both hard copy and digital versions be available and will be processed into the library in the format received. Incoming general reference documents should be reviewed to determine their age and acquired if they are no older than:

- Books – < 20 years
- Publications and gray literature – < 10 years
- Periodicals – < 1 year
- Journal Articles – < 10 years
- References – < 5 years
- Photos – < 10 years
- Maps – < 20 years

Documents that are either older than the ages listed above or are not relevant to either the Network or a network park will not be processed into the library. Instead, these documents should be either kept for personal reference or discarded.

F.2.3 Incoming Document Processing

Incoming digital documents that meet the Network Reference criteria will be placed in the M:\LIBRARY\DOCUMENTS\INOCMMING\NetworkRef directory. All other documents will be placed in the M:\LIBRARY\DOCUMENTS\INCOMMING\GeneralRef directory. Hard copy documents will be placed in a bin on the Data Manager's desk for processing. In cases where a hardcopy requires digitization, or a digital copy needs information added that is not immediately obvious from the document, Network staff should complete the "Add Document to the Library Request" form (Appendix A).

F.3 Quality Assurance

All library documents are to meet a set quality standard. For a document to be of sufficient quality, it should meet all the following criteria:

- Contain all pages - Missing pages should be identified and the document flagged.
- Have pages in the correct order - visible page numbers should be present on each page
- Be citable - having a known author, year, title, and place of publication
- Be in final version - drafts are not acceptable unless it is considered a *de facto* final
- Digital versions should have no erroneous bookmarks

Any reference that do not meet this criteria will not be added into the Network Library until the issues have been addressed. Draft versions can be added if it is a *de facto* "final" version and must be flagged as such when catalogued and stored. Documents with missing pages can be added only if no other version is currently available and the missing pages are clearly identified. These document are to immediately be replaced should higher quality versions become available.

F.4 Documentation

Digital network references must meet additional document requirements. General reference documents do not require any additional level of documentation. These requirements are:

- All pages should be numbered to match the Table of Contents.
- All documents that are > 30 pages should have bookmarks created for major chapter/section headings.
- All documents must have basic metadata fields filled out in the "Description" tab. This includes the title, author(s) and at least three keywords. (see Figure 2)
- All documents scanned as images should have optical character recognition (OCR) used for all pages.
- All documents (both PDF and hard copy) that either have an unclear or no title page should have a new one created and added to the front of the document. The new title page should very clearly show the title, author, year of publication, and any other information that helps define the citation, including project number.
- All documents should have the "Initial View" properties set to "Resize window to initial page" and to "Show bookmarks panel and page" (See Figure F-2).

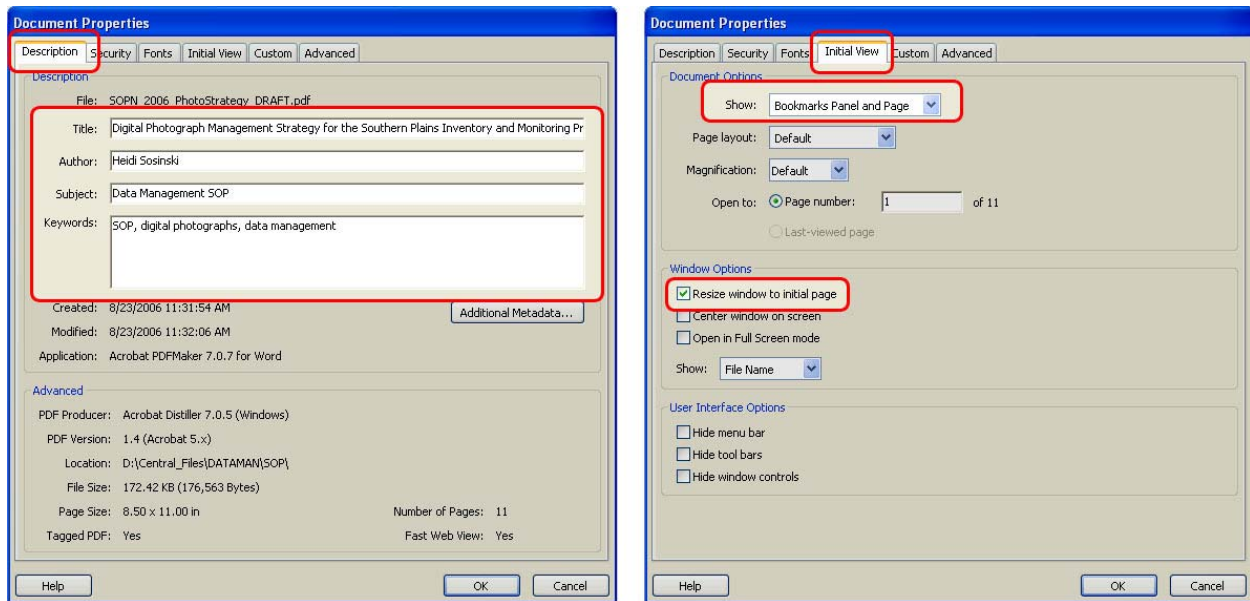


Figure F-2. Adobe Acrobat document properties for network reference document

F.5 Sensitivity and Ownership

Documents determined to be sensitive or proprietary should be noted accordingly, since their status will affect where they are stored and cataloged.

In general, a document is considered to be sensitive if it contains information where its use by unauthorized individuals will either threaten or cause harm to a parks' natural and/or cultural resources, and/or legal obligations. A document can be marked sensitive if it contains information about:

- Endangered, threatened, rare or commercially valuable NPS resources (species and habitats)
- Mineral or paleontological objects
- Objects of cultural patrimony
- Significant Caves

Ownership can refer to either proprietary/copyright information, or to the person or entity who ultimately holds authority over the information. Documents produced either by the network or by cooperators or contractors working on behalf of the network can be made available via the internet, intranet, and/or other means. Documents produced by a park remains the property of that park. In this case, public release of these documents should be handled by the park itself. Copyrighted documents (e.g., publications resulting from research in parks) are not owned by the network and will not be posted or distributed to the public unless written permission is provided by the copyright holder.

Further details regarding sensitivity and ownership can be found in the Chapter 9 –Dissemination of the SOPN Data Management Plan.

F.6 Archiving/Storage

The location where documents are to be stored is determined by their format, content, and sensitivity.

F.6.1 Digital

The main subfolders within the Library Operation include:

- **GeneralRefs** – Finalized documents in PDF format. These documents serve a reference to the Network, although do not refer directly to the Network or Network Parks. This is read-only to Network staff.
- **Incoming\GeneralRefs** – The temporary repository where new general references are added by Network staff. Once process, these documents will be moved to \GeneralRefs\
- **Incoming\NetworkRefs** – The temporary repository where new Network References are added by Network staff. Once process, these documents will be moved to \NetworkRefs\
- **Index** – Contains the Adobe Acrobat word index
- **NetworkRefs** – All finalized and quality-checked documents in PDF format. All of these documents are read-only to Network staff
- **ProCite** – Contains the Pro-Cite database of all references in NatureBib that are held by the Network.

The NetworkRefs folder contains individual subfolders for each park and one for the network. Documents referring to the Network or at least two parks will be placed in the network subfolder. Additionally, the NetworkRefs directory contains a \SENSITIVE\ subfolder specifically to store sensitive documents.

F.6.2 Hardcopy

All non-sensitive documents with a solid binding (i.e., are strong enough to stand vertically), will be stored on the bookcase located next to the biological technician's computer. Unbound and softbound documents will be stored in the central library file cabinet. All documents and books will receive its own manila folder and be organized by its assigned call number. All sensitive hardcopy documents will be stored in a separate drawer in the central library file cabinet.

Call Number Generation

All hard copy documents will be assigned a call number. The call number will subsequently be recorded in the ProCite call number field and in the NatureBib holding location field (if recorded in NatureBib). Call numbers are generated as:

NN.AAAA.YYYY.TTTT.xx where

- **NN** = NPS Record Schedule Number (See NPS-19 for details)
- **AAAA** = First four letters of the either the first listed author's last name or organization name. Park and network documents will use the Park Code. General National Park Service documents with no specific author given will use NPS for the Author Field. If no author information is available, "NoAuth" should be used. (**NOTE:** This is never acceptable for network references and should be avoided wherever possible for general references.)

- **YYYY** = Year the document was published or written if unpublished. If no year is present, use “NoDate”. (**NOTE:** This is never acceptable for network references and should be avoided wherever possible for general references.
- **TTTT** = First four letters of the title. (exclude common words such as A, The, An, etc..)
- **xx** = Optional numerical identifier used to differentiate call numbers should two separate documents generate duplicate call numbers. All duplicate call numbers will be numbered sequentially 01, 02, 03, etc...

Examples:

N3041.ANDR.1998.ASSE

Andrews, William. 1998. “Assessment of water quality in the Washita River at the Washita Battlefield National Historic Site near Cheyenne, Oklahoma”. N3041 – Water (NPS Record Schedule)

N1433.PECO.1993.ALIE

Pecos National Historical Park. 1993. “Alien plant species on Pecos NHP” for 1993” N1433 – Plants (NPS Record Schedule)

F.7 Cataloging

All documents are catalogued using three different systems, each of which supports a specific need. The Network will use NatureBib as the primary means of cataloguing network documents. NatureBib is one of the 12 Natural Resource Challenge related inventories (bibliography) and is an online central cataloging system for natural resource-related materials. ProCite is a desktop-based citation manager which will be used to locally manage hard copy documents. This will include references to documents that fall outside of NatureBib’s scope. Digital documents will be indexed using Adobe Acrobat.

F.7.1 NatureBib

NatureBib is the primary means of cataloging all network references. Only network references are catalogued in NatureBib due to it’s scope being limited to references that pertain to NPS resources. Special care must be taken when creating new citations because NatureBib will be made available to the public. Documents that are non-sensitive and non-proprietary are to have the Citation Sensitivity set to “Public” (see Figure F-3). Documents determined to be sensitive can have the citation marked as “Public” provided the citation itself does not release any sensitive information. If a citation cannot be created without releasing sensitive information, it **MUST** be listed as “NPS Only”. Additionally, PDF versions of these documents **MUST** either be set to “NPS Only” or “Park Only”.

National Park Service
Nature & Science

Welcome: Heidi Sosinski
Network User, editor

NatureBib

Simple Search | Expert Search | Add Citation

Basics | Author | Keyword | Link Park | Link Holding | Abstract/Notes | Upload | Biodiversity | SUBMIT

Unpublished report basics ?

Unpublished report title

Number of pages: Packaging method:

Producer:

Place produced:

Date produced (month/day/year):

URL:

URL accessed on:

Citation sensitivity ☒ Public ☐ NPS only

Database system: NRBIB

Topic area (For park permit coordinators only): none

Save >>

Figure F-3. Location in NatureBib to mark a citation sensitive

There are two ways to catalog documents in NatureBib. All NatureBib citations are to include holdings information stating that a hard copy is held by the network (see Figure F-4). Additionally, NatureBib also functions as an official repository of digital documents in PDF format. Therefore, all Network References will have PDF versions uploaded to NatureBib. Any PDF documents uploaded to NatureBib should have the document properties set to disallow editing.

Figure F-4. NatureBib form to link reference holding to the Network

Files created by available for documents uploaded to NatureBib depends on whether they are public domain, proprietary or sensitive. Documents that are not sensitive and not copyrighted is to have the file sensitivity set to Public (see Figure F-5). Copyrighted documents (from Section 2.5) should be marked NPS only. This enables the citation to be released to the public, but prevents the NPS from distributing copyrighted materials without permission. Sensitive documents (from Section 2.5) should be marked Park/Office only, thus enabling PDF versions to only be available to those with an appropriate login

Figure F-5. File sensitivity designation in NatureBib.

F.7.2 ProCite

ProCite is used to locally manage the network's library. All documents added into the network library (hard copy and digital) are to be listed in ProCite. General references will have citations created directly in ProCite. Network reference citations will be exported from NatureBib so as to reduce duplicate data entry.

Importing NatureBib references is accomplished by first searching for the Network holdings. This is accomplished by conducting an expert search specifying the following criteria (Figure F-6):

- Select "Include citations where copy is held in park/office/network"
- Select "Southern Plains Network"

The screenshot shows the NatureBib Expert Search interface. The left sidebar contains navigation links: My Login, Simple search, Expert search (highlighted), Add citation, Change password, My profile, Audit report, Logout, Help (Data entry help, Workform help, Search help, Report help, Help in Spanish, Privacy policy), and Feedback. The main search area has tabs for Expert search, Results, and Reports. The Expert Search tab is active, showing a search form with fields for Author last name, Starts with, and a search button. Below the search fields are options for 'Search citations linked to documents', 'Year from' to 'Year to', 'Limit by' (All workforms), and 'Limit by' (All databases). The 'Pick a Park' section has a checkbox 'Include citations where copy is held in park/office/network' which is checked and highlighted with a red box. Below this is a list of parks: All Parks, Abraham Lincoln Birthplace National Historic Site (ABLI), Acadia National Park (ACAD), and Adams National Historic Site (ADAM). The 'Pick a Network' section has a checkbox 'Include parks within the networks' which is unchecked. Below this is a list of networks: Southern Colorado Plateau Network (SCPN), Southern Plains Network (SOPN) (highlighted with a red box), Southwest Alaska Network (SWAN), and Upper Columbia Basin Network (UCBN).

Figure F-6. Search Criteria in NatureBib to Produce Network Collection

Records are exported by generating a report of the search results using the "National Library Program" format. This provides a file in comma delimited format that captures key citation fields (title, author(s), date, format, publisher). However, it does not include holdings data or Bibkey ID's. Both of these will need to be entered manually. This file should be downloaded to the \TEMP\ folder because it will be immediately discarded after importing into ProCite.

When started, ProCite should open directly to the SOPN Library file. If it does not, have ProCite open the Network ProCite database located in the M:\LIBRARY\ProCite\SOPN_LIBRARY.pdx. Add the NatureBib records by selecting the "Import Text File..." option is located under the tools menu (Figure F-7). Open the file downloaded from NatureBib and then click "Transfer" to complete the operation.

Note Regarding Duplicate Records: ProCite includes a citation linking tool for MS Word which inserts records via a Record ID internal to ProCite. Thus it is critical to **NOT** delete

records from the ProCite or completely re-create the ProCite database. Both these operations completely erases the record ID. To ensure that duplicate records are not imported, the “Discard Duplicates When Importing” option should be checked (Figure F-8). Due to the possibility of overwriting critical data, the Data Manager will be responsible for implementation of this step.

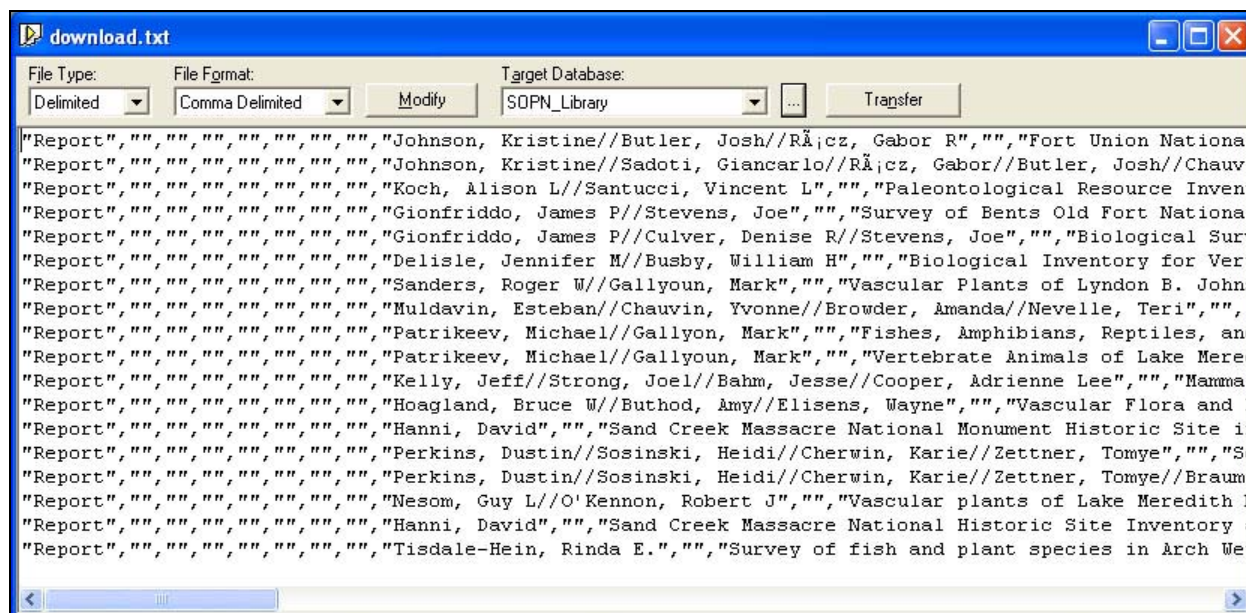


Figure F-7. Import Text File Into ProCite Database

Like NatureBib, cataloging documents is not the primary purpose of ProCite. However, it does contain fields that can be used to record cataloging information and track document status. The “Reprint Status” field is used to show whether a document is currently in the library or is checked out. All documents currently present are to have this field set to “In File”. Any time a document is check out, the field should be changed to “On Request” and the borrower’s name and date removed listed next to it. Additionally, an “OUT” folder must be placed in the document’s manila envelope with the borrower’s name and date remove recorded.

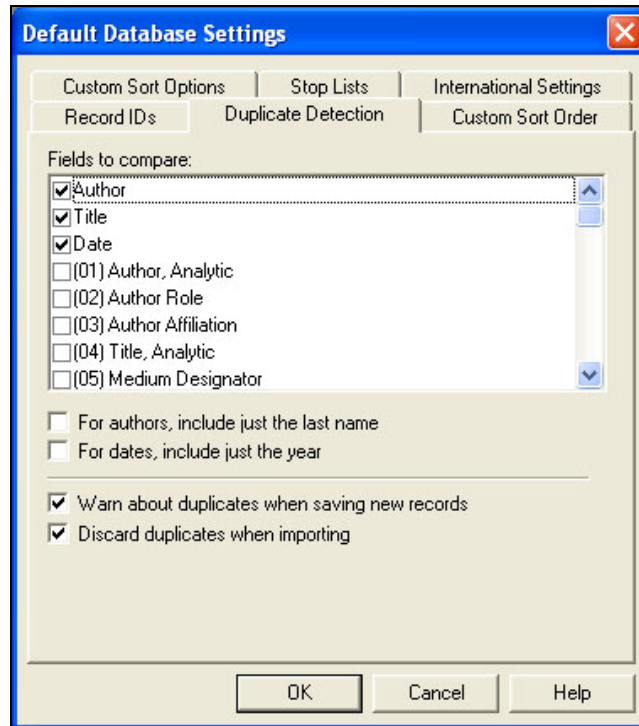


Figure F-8. Duplicate Detection Settings

All network references and hard copy-only general references will have a call number generated and listed in the record (Figure F-9). Exports from NatureBib currently does not include holdings information, thus call numbers will have to be manually added to imported records. General documents that are maintained only in digital format will have “Digital Only” listed in the call number field.

All records imported from NatureBib should have the Bibkey ID’s recorded in the Report ID field (Figure F-9). This information is currently not saved by the NatureBib export and needs to be added manually. All Bibkey ID’s must be prefaced by NRBIB in order to identify it as coming from NatureBib.

Specific guidance for creating ProCite entries can be found in the ProCite Guidelines.

SOPN_Library:Edit Record

Workform: Report Record ID: 5730

Author, Analytic (01):
 Author Role (02):
 Author Affiliation (03):
 Section Title (04):
 Medium Designator (05):
 Connective Phrase (06):
 Author, Monographic (07): Middleton, John
 Author Role (08):
 Report Title (09): Bank erosion at Lyndon B. Johnson National Historical Park
 Reprint Status (12): In File Date:
 Edition (15):
 Author, Subsidiary (16):
 Author Role (17):
 Place of Publication (18):
 Publisher Name (19):
 Date of Publication (20): 2004
 Report ID (23): NRBIB 627405
 Extent of Work (26): 15
 Packaging Method (27): Pages
 Series Title (32):
 Series Volume ID (33):
 Series Issue ID (34):
 Connective Phrase (36):
 Address/Availability (37):
 Location/URL (38):
 CODEN (39):
 Notes (42):
 Abstract (43): The report compiles information related to flooding and stream bank erosion along the 1.4 mile stretch of the Perdenales River located in LYJO. Gathering this information is the first step to determine a.) the structural integrity of the 3 dams located within the park, b.) trends in channel migration and bank erosion, c.) effectiveness of bank stabilization and d.) impact of upstream allocations. This report only represents the start of work towards this project.
 Call Number (44): N3041.MIDD.2004.BANK
 Keywords (45): Erosion/River/Surface water/Hydrology/physical sciences

Figure F-9. ProCite Cataloguing Fields

F.8 Digital Reference Index

All digital documents will be word-indexed using Adobe Acrobat. This enables a complete word search of the entire holdings within the Library Operation. The Library Tech (or Data Manager if no Library Tech is designated) will update this regularly. The file is titled SOPN_Library.pdx and is located in the M:\LIBRARY\DOCUMENTS\Index\ directory. In order to open this file in Adobe Acrobat or Acrobat Reader, you will need to change the file type to view "All Files" (Figure F-10). Opening the index file will call up the Acrobat search dialog box. Searches will now be performed across all documents in the library folders.

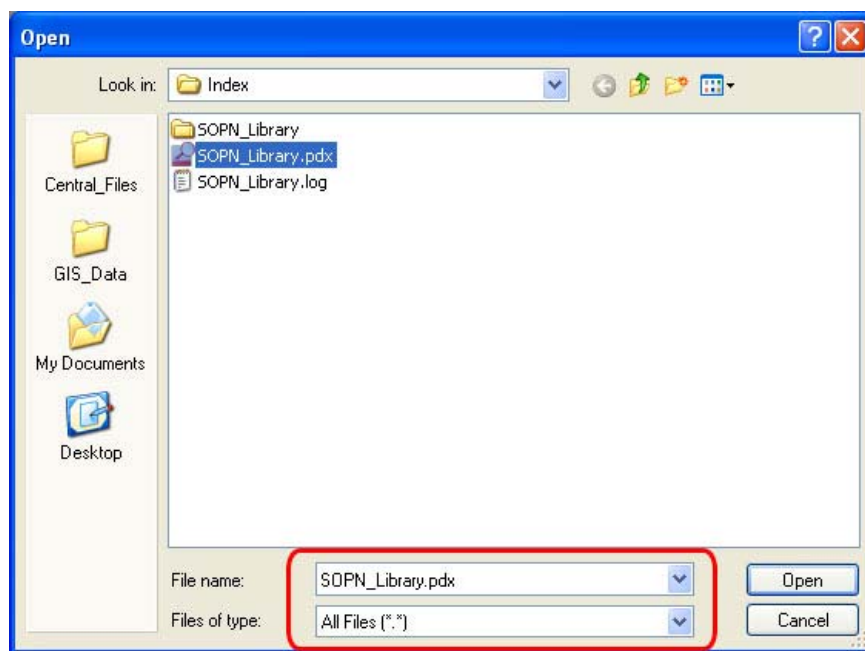


Figure F-10. Adobe word-index file

F.9 Analysis & Reporting

To ensure that the documents remain current, it is necessary to regularly analyze the library contents. All documents that are considered to be general reference (i.e., not pertaining to the Network or specifically to a network Park), should be evaluated annually for being out-of-date following the criteria established in Section F2.2 of this SOP. In cases where the document is older than the guideline, the Data Manager will check with the Network staff to determine whether the document should be purged or retained.

The Library Operation regularly reports to:

- NatureBib – All PDF documents added to the NetworkRefs folder should be uploaded to NatureBib
- ProCite – All documents held by the library are to be recorded in ProCite

F.10 Roles and Responsibilities

Network Data Manager

- has full responsibility for this operation
- will notify Network staff regarding the purging of documents

Currently the Network Data Manager is responsible for the following items. These responsibilities will be transferred to a Library Tech if and when the network creates such a position:

- The day-to-day updating of NatureBib references maintained by the Network
- Maintaining a current ProCite database
- Checking documents in and out of the Network library
- Updating the Adobe Acrobat Index

Network Staff

- Understand and following the guidelines herein
- Respond to the notices regarding the purging of outdated documents
- Regularly submit key documents to the Library Operation
- Immediately notify the Data Manager concerning problems with the applications, workflows, and/or guidelines

Library Addition Request

REQUESTOR: _____

DATE: _____ NatureBibID (if known): _____

DOCUMENT PATH AND FILE NAME (if digital): _____

Only fill out the following fields if this information is not immediately obvious:

AUTHOR(s): _____

YEAR OF PUBLICATION: _____

TITLE: _____

PUBLISHER OR SOURCE: _____

KEYWORDS: _____

SENSITIVITY: ☐ PARK ONLY ☐ NPS ONLY ☐ PUBLIC

COPYRIGHTED: ☐ YES ☐ NO

DOCUMENT TYPE ☐ Network Reference ☐ General Reference

PARKS/NETWORK:

☐ ALFL	☐ BEOL	☐ CAVO	☐ CHIC
☐ FOLS	☐ FOUN	☐ LAMR	☐ LYJO
☐ PECO	☐ SAND	☐ SOPN	☐ WABA

OTHER PARKS:

NOTES:

Appendix G. Metadata Specifications

Update Frequency

As needed; Minimum Annually

Adapted From

Documentation - Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

G.1 Introduction

This document describes the Network's procedures and decisions necessary for meeting the minimum standards for documenting data and information. Documentation, in this context, refers to the development of metadata, or data about data.

For something to be worthy of being documented, it will already have been evaluated and determined that it (1) fits into the scope of collection (i.e., deemed to be of use to the Network); and (2) meets a sufficient level of quality to warrant the effort. All datasets and other information produced or used by the network in its vital sign monitoring function will be documented.

All information, regardless of whether it is a dataset, publication, or photograph, requires basic metadata. This metadata should provide a brief synopsis of what it is, how to interpret it, how it was collected, how it should be cataloged, and whether it is related to other datasets and information. The degree of documentation depends on its source, format, and whether it is associated with other information elements that were co-produced as part of a project. Figure 1 provides a conceptual model of the general steps and decision points to follow when documenting data and information.

G.2 Source

Because the Network has no control over externally-generated information, it is inappropriate for network staff to devote time to creating this documentation, particularly since the risk of misrepresentation is high. Thus, information acquired by the Network from external sources will not be subjected to the same metadata standards as information generated by the Network.

It is important to note that external information of any kind that does not have sufficient documentation provided by the originating source will neither be modified nor distributed by the Network.

G.2.1 External Information

It is still important to confirm that metadata is correct and sufficient for accurate interpretation of any external information the Network gathers and plans to manage. If necessary, augmenting the metadata may be necessary to ensure that network staff can trace the information back to the original source.

External Documents

When an external publication is received, the following are the minimum attributes to be confirmed as being correct and completed:

- Title
- Author(s)
- Year of Publication

In some cases, a document will be missing a title page or the title page does not accurately reflect the document (e.g., author names not present). In this case, it will be necessary to create a title page containing these minimum elements to ensure that the publication can be properly stored/archived and referred by the system cataloging it. In cases where an author or year of publication is impossible to discern, they will be labeled “No Author” or “No Date”, respectively. If a title is nonexistent, a descriptive title will be created; “No Title” is not acceptable since multiple NoAuthor-NoDate-NoTitle combinations are undistinguishable. In cases where a title page is created, a statement at the bottom of the page will state how the title page was created. One example might read:

This page was inserted by Heidi Sosinski, Southern Plains Network Data Manager - National Park Service, on August 17, 2008 because a clear title page was missing from the source document. The title is based on the contents of the source document. The authors were inferred from page 36, which appears to list the contributing authors. The year of publication is estimated based on the dates found within the methods and results sections (pages 23 and 43) and the referenced materials found on page 38.

External Tabular Datasets

When an external dataset is received, the following will be confirmed to be correct and augmented as necessary:

Section 1 - Identification Information

- Citation
 - o Originator
 - o Publication Date
 - o Title
 - o Online linkage
- Abstract
- Time Period of Information
- Point of contact
 - o Name
 - o Organization
 - o Phone number
 - o Email
- Status
- Progress
- Use Constraints – Set to “For Network Use Only – Not Intended for Distribution”

When these fields are incomplete or incorrect, it will be necessary to change them accordingly.

External Spatial Datasets

In addition to the fields defined for the tabular datasets, the following additional fields will also be required:

- Projection
- Datum

External Photographs

Externally-generated photographs that are used by the Network will at least have the following metadata fields:

- Date of photograph (year is acceptable)
- Photographer/contact
- Location of photograph

G.2.2 Internal Information

Much of the background information that will be needed for documentation will be accumulated during the development of the data and it is therefore important to retain all for preparation of the metadata.

Internal Documents

All documents generated by the Network will have a title page with the following information:

- Title
- Author(s)
- Date of Publication
- Place of Publication
- Recommended citation
- Abstract
- Access Constraints

Internal Datasets

All datasets produced and owned by the Network, or a modification of a dataset developed externally, will be documented using the NPS Metadata Tool and Editor (available at <http://science.nature.nps.gov/nrdata/tools/>). This enables full editing in xml format, provides stylesheets specific to the National Park Service, and includes the metadata parser tool. The NPS Metadata Tools Help Page (<http://science.nature.nps.gov/nrdata/docs/metahelp/metahelp.cfm>) (also provides detailed guidance for the development of metadata.

Any tabular data must include full data field definitions including data type, width, name, range of values, and relevance of values. For example; a numerical field, 12 bits wide with two decimal places, named “Specimen Height”, with a range from .5 to 12 meters, containing the height of trees in the study area. Data that is stored in an Access database can have this information extracted using the Metadata Exporter tool will be used to export table and attribute definitions.

At a minimum, all datasets will have minimum documentation, which closely approximates the NPS_Basic_Edit stylesheet. These requirements are detailed in the Creating Metadata (NPS 2006) Guidance document.

Fields that are automatically filled in are not discussed.

Section 0 – National Park Service Only

- Metadata Purpose
 - o OnlineData - if associated data exist on any accessible server
 - o CSDGM - if the metadata is full or minimal Content Standard for Digital Geospatial Metadata
 - o DataCat - if the metadata originated in the NPS Dataset Catalog desktop application
 - o Other if the metadata does not fit in any of the other categories
- NPS_Unit_Information
 - o NPS Unit Alpha Code – four letter code for park
 - o NPS Unit Type - specifies whether it is a park or network
- Data Store Information
 - o NPS Theme Category
 - o Data Site
 - o Data Steward

Section 1 - Identification Information

- Citation
 - o Originator
 - o Publication Date
 - o Title – The version of the dataset should be part of the title
 - o Online linkage
- Abstract
- Purpose
- Time Period of Information
- Theme Keywords (minimum of two)
- Place Keywords (minimum of one)
- Access Constraints
- Use Constraints
- Point of contact
 - o Name
 - o Organization
 - o Phone number
 - o Email
- Status
- Progress

Section 6 - Distribution Information

- Contact Information
 - o Name
 - o Organization
 - o Phone
 - o Email
- Data Distribution Liability Statement

Section 7 – Metadata Reference Information

- Date Metadata was Created
- Metadata Contact

Internal Spatial Datasets

The following fields are also required for in addition to the fields required for internal tabular datasets

- Projection
- Datum
- Bounding Coordinates

Internal Photographs

In most cases, photographs will be treated as a collection of photos and will be documented as a dataset. It is only in cases where photos require individual documentation that the following standards apply.

- Title - who or what is in the image
- Image_Content_Place – where the image was taken
- Image_or_Set_Create_Date – when the image was taken
- NPS_Unit_Alpha_Code – (e.g. Park code) used for managing or filtering groups of records and/or for linking systems
- Metadata_Access_Constraints – who may view the record/image (e.g. public, staff only)
- Copyright_Information => Copyright_Description – restrictions on using the image
- Contact_Information => Contact Organization – who to contact for further information

Further details information regarding photographs can be found in the SOPN Digital Photograph Management Guidelines.

G.2.3 Biological Profile

The objective of the FGDC Biological Data Profile is to “provide a common set of terminology and definitions for the documentation of biological data” (FGDC, 1999). The purpose of this section is to provide an implementation of these standards.

Any dataset that contains references to biological data will have FGDC metadata extensions included in the biological profile completed. The NPS_BioProfile_Edit.xml stylesheet in the NPS Metadata Tool and Editor provides the appropriate fields.

Figure G-2 provides the general decision steps for adding biological metadata. Key decision points include (1) whether the standard rectangular coordinates common to geospatial datasets are representative of the biological data collected, (2) the source of biological data (taxonomy, model analysis, or lab work), and (3) if the methodology is described elsewhere.

G.2.4 Representative Spatial Domain

In cases where the rectangular coordinates of the area of interest are not applicable or insufficient to adequately describe the dataset, the Description of Geographic Extent provides a short description of the geographic domain of the data set. Examples include, "Manistee River watershed", "extent of 7 ½ minute quads containing any property belonging to Rocky Mountain National Park", or "ponds and reservoirs larger than 2 acres in Larimer County, Colorado".

G.2.5 Data Sources

There are generally three sources of biological data, each of which requires different documentation. The three are field work in which a researcher collected biological data and possibly voucher information, the results of lab work involving biological specimen, or modeled data.

Field Work

A general description of a publication containing a description of field work methods is required.

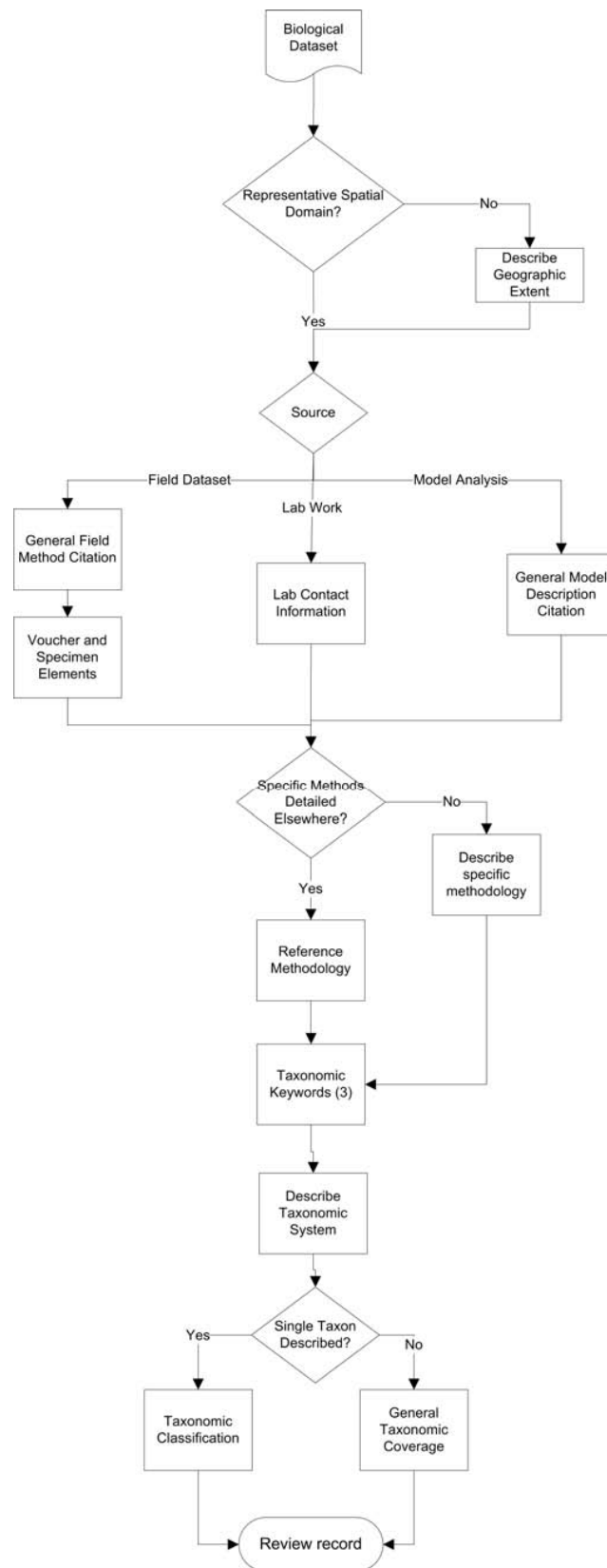


Figure G-1. Biological Data Documentation Decisions

Lab Work

Datasets may include, or consist entirely of, the results from biological lab work. In this case, a brief description of what the lab work represents and the lab that completed the work will be provided.

Analytical Tools, Models, and Statistical Processes

Tools, models, or statistical procedures that the data set is intrinsically bound to and are available for use in analyzing the data set. Examples include reconstructions of phylogenies, population viability analyses, community ordinations, most atmospheric and hydrological transport analyses, and inferences on the effects of climate change on forest composition and productivity. In this case, the analytical tool will be described with enough information such that a potential data user can easily determine why they might wish to acquire the analytical tool, and the methodology to acquire it. The tool contact is the party from whom the tool, model, or statistical procedure may be obtained.

G.2.6 Methodology

The description of the specific methodology will only be required when not described elsewhere, as in a related report. Such reports must be cited and should be included with the documentation whenever possible.

Methodology is information about a single step of field and/or laboratory work. Each methodology will have a methodology description, which is equivalent to "Materials and Methods" in a journal article. It will be important to describe the physical methods used to gather data, the experimental design, sample frequency, treatments or strata, statistical and spatial design of the sampling, and sample completeness, representativeness, and biases. For example, in a bird survey, relevant elements would include the methods used to detect species occurrences (casual sightings, transects, focal point surveys, vocalizations, mist nets), whether or not evidence of breeding activity was required, descriptions of the habitat strata in a stratified design, and known biases (e.g., non-territorial birds were undersampled, and some juveniles could not be identified to species.)

G.2.7 Taxonomy

Taxonomic Keywords

Every biological dataset will be documented with at least three taxonomic keywords. Examples include "collection" "multiple species" "single species" "amphibians" "animals", "bacteria" "fungi" "invertebrates" "lichens" "mammals" "mosses" "plants" "protists" "reptiles" "vegetation" "vertebrates" "viruses". For each keyword, the taxonomic keyword thesaurus will be specified, which is a reference to a formally registered thesaurus or similar authoritative source of taxonomic keywords.

Taxonomic System

When used, the taxonomic system will be detailed. This involves describing the classification system authority and any supporting classification system citations, including monographs (e.g., a regional flora) or on-line data sets (e.g., the USDA PLANTS database), etc. When appropriate, the Integrated Taxonomic Information System (ITIS; USDA 2006) will be used. Any modifications to the classification system will also be noted. Taxonomic procedures describe the methods used for the taxonomic identification and may include specimen processing, comparison

with museum materials, keys and key characters, chemical or genetic analyses, etc. Taxonomic completeness details information concerning the proportions and treatment of unidentified materials (i.e., materials sent to experts, and not yet determined); estimates of the importance, and identities of misidentifications, uncertain determinations, synonyms or other incorrect usages; taxa not well treated or requiring further work; and expertise of field workers. If vouchers were collected, information regarding the types of specimen, the repository, and the contact information of the individuals who identified the vouchers will also be provided.

General Taxonomic Coverage

If the study is not specific to a particular taxon, but is more comprehensive (e.g., survey) the general taxonomic coverage describes the range of taxa addressed in the data set or collection. For example, “all vascular plants were identified to family or species, mosses and lichens were identified as moss or lichen.” This provides the capability to document the taxa addressed in the data set or collection via a free text description. This is especially important with data sets or collections which contain examples of a many taxonomic levels.

Taxonomic Classification

If the study and data refer to a specific taxon, the taxonomic classification will be identified. One will provide information starting from the taxonomic rank of kingdom to the most specific level which reflects the data set or collection being documented. The levels of Kingdom, Division/Phylum, Class, Order, Family, Genus, and Species will be included as appropriate.

G.3 Metadata Parser

The Metadata Parser program is used to validate metadata records by checking the syntax against the CSDGM and to generate compliant output files for posting to clearinghouses. It generates a textual report indicating errors in the metadata, primarily in the structure, but also in the values of some of the scalar elements where values are restricted by the standard.

To prevent erroneous parsing errors, the NPS Profile Metadata Parser configuration file (available at http://science.nature.nps.gov/nrdata/docs/metahelp/NPS_Profile_Config.zip) must be used. The configuration file installs by default when the NPS Metadata Tools and Editor is installed in C:\Program Files\NPS\Metadata. Refer to the NR-GIS Metadata Parsing Guidance instructions (<http://science.nature.nps.gov/nrdata/docs/metahelp/metahelp.cfm>) and the NPS Metadata Tools and Editor documentation (<http://science.nature.nps.gov/nrdata/docs/metahelp/metahelp.cfm>) for details.

Once an XML is parsed and completed, it will be necessary to replace the original XML with the final.

G.4 Project Documentation

Any known project creating Data or information will also require documentation. The following metadata is required:

- Project Identification – Unique project identification code. When possible, this will be the same as the code used to develop and/or manage the project (e.g., RPRS Project Code).
- Project Title – Name of the project

- Project Contact – Principal Investigator or other contact who was involved in the project or is familiar with the project
- Project Start Date – Date project was initiated. This date will be earlier than the date the information was generated/collected
- Project End Date – Date of final close-out for the project.
- Project Abstract – General description of the purpose and objectives of the project
- Project Products – Cross-reference to dataset, document, and image metadata records.
- Entity Identification and Description – Each element of the project archive will be listed as an entity and have a brief description.

G.5 ESRI ArcCatalog Setup Specifications

ESRI's ArcCatalog will require a few modifications to its default setting which will facilitate better metadata development. First, it is imperative that the Automatically Update and Create Metadata options are turned off (Figure G-2).

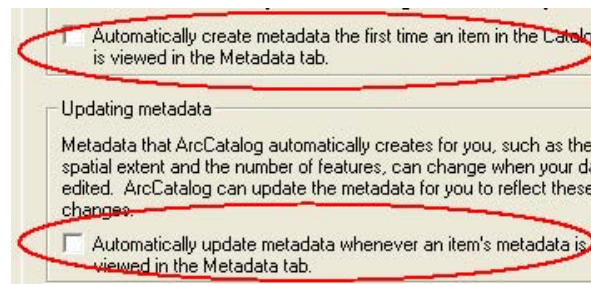


Figure G-2. Metadata Options in ArcCatalog

Second, ArcCatalog does not natively recognize zipped files. Therefore, it is necessary to add the ZIP extension to the registry (Tools>Options>File Types). Likewise, ArcCatalog will give the ZIP extension a generic icon. Browsing to and selecting the WinZip executable will give all zipped files a more appropriate graphical representation in the ArcCatalog interface.

G.6 Roles and Responsibilities

Principal Investigator (NPS):

The person creating or modifying data as part of any NPS I&M project is also responsible for initiating metadata development. NPS-compliant metadata must accompany all data sets (metadata for geospatial data sets must in addition be FGDC-compliant) and are due when the final report and deliverables are submitted to the SOPN and/or to the parks included in the study. The Principal Investigator may choose to delegate this responsibility depending upon who is assigned the role of data set developer/administrator. Individuals unfamiliar with metadata generation should use the guidance provided in this document and reference materials. For additional assistance the Data Manager or GIS Specialist may be contacted.

Principal Investigator (Non-NPS):

If data originate outside the NPS, the Principal Investigator will have primary responsibility for compliance with the metadata standards as set forth in this document and providing documentation of the data set in the form of a metadata XML file as stipulated by written agreements with SOPN parks (contracts, cooperative agreements, study plans, research permits). NPS-compliant metadata must accompany all data sets (metadata for geospatial data sets

must in addition be FGDC-compliant) and are due when the final report and deliverables are submitted to the SOPN and/or to the parks included in the study.

Data Manager (NPS):

The Data Manager must ensure that NPS-compliant metadata are generated for all non-spatial I&M data received from the Principal Investigator (NPS or Non-NPS). The Data Manager also must ensure that all geospatial data resulting from an I&M project are FGDC- and NPS-compliant. The Data Manager can provide assistance in metadata creation.

G.7 References

FGDC (1999). Biological Data Profile, Federal Geographic Data Committee Endorsed Standards, [http://www.fgdc.gov/standards/standards_publications/index_html], November, 2006.

NPS (2006). NPS Data Store: Creating Metadata, Natural Resources GIS Program, [<http://science.nature.nps.gov/nrdata/docs/metahelp/NR-GISCreatingMetadata.pdf>], November, 2006.

USDA (2006). United States Department of Agriculture, Integrated Taxonomic Information System (ITIS) [<http://www.itis.gov/>], November, 2006.

Appendix H. Guidelines for Maintaining and Updating NPSpecies

Update Frequency

As needed; Minimum Annually

Adapted From

NPSpecies Guidelines – Data Management Operation - Rocky Mountain Network

Appendix D – NPSpecies – Northern Colorado Plateau Network Data Management Plan

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

H.1 Introduction

The NPSpecies database was developed by the National Park Service Inventory and Monitoring Program to store, manage and disseminate scientific information on the biodiversity of organisms in National Park Service units throughout the United States and its territories. The database can list all species that are entered for each park unit, and list all park units for which a particular species has been recorded. Additionally, NPSpecies documents supporting evidence for a species record, which can include references, vouchers and observations.

H.2 Workflow

NPSpecies is available through both an online web version and a desktop database version. Both versions store the same data. Each is best suited for certain data management tasks, hence they will both have their own separate workflows.

H.2.1 Small Batch Updates

The online version is considered the “master version” of NPSpecies because it housed the most up-to-date data for all parks in the NPS. Any updates made to the online version are immediately available. However, it does not have the tools needed to efficiently update multiple records. Hence, it is best to use the online version if you are adding or updating a small number of records (typically <50 records).

H.2.2 Large Batch Updates

The main advantage to the desktop version is that since it is a local database, multiple records can be created and/or updated very efficiently. However, the data files for the desktop version only

represent a snapshot of the online database. All updates made using the desktop version must be sent to Fort Collins to be appended to the online master version.

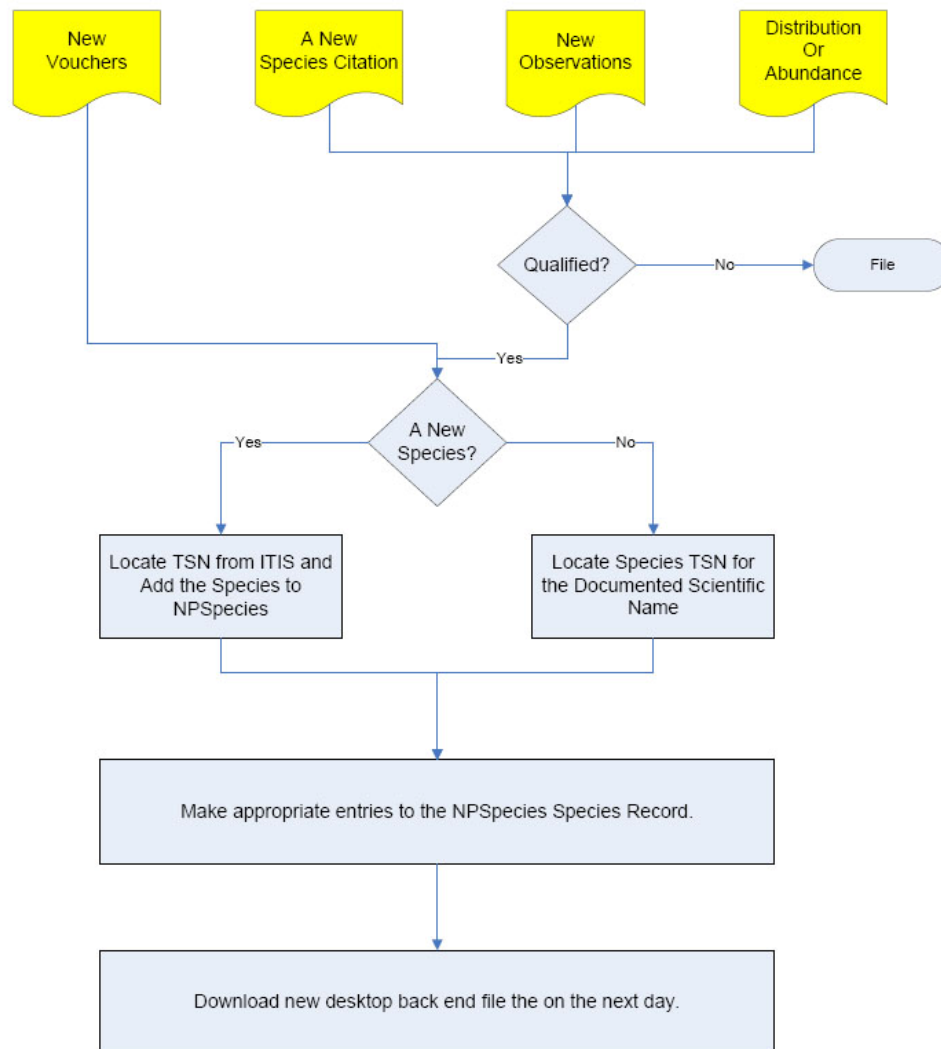


Figure H-1. Workflow for Adding or Editing NPSpecies Records

H.3 Guidelines

H.3.1 When to update?

NPSpecies is meant to be a dynamic database that reflects the current species record of a park. Updates can be processed to the database whenever one of the following conditions happens:

- New vouchers are accessioned
- A new species is detected
- New qualified observations are made
- A species' park status, abundance, residency, and/or nativity changes

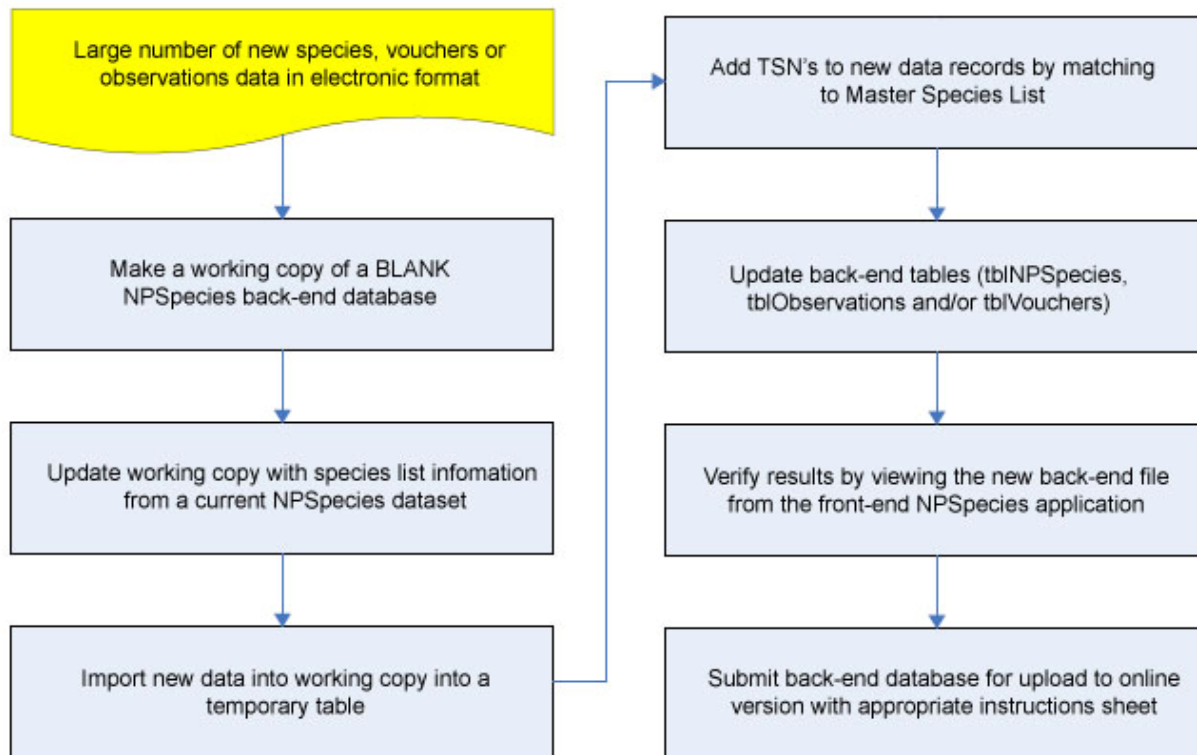


Figure H-2. Workflow for Batch Updating of NPSpecies Records

H.3.2 Maintaining quality data

All data must be reviewed for quality and be well documented before it can be processed into NPSpecies. Although it is impossible to define a completely objective means for determining qualification, the following cases meet the case

- A properly documented voucher.
- A citation for species information from a peer reviewed scientific publication.
- Species lists generated from documented inventories(i.e. vegetation plots, transect surveys, etc...)

Observations need to be carefully reviewed as to their source and repeatability before being entered into NPSpecies. Any sources of species information that are at all doubtful should only be entered into NPSpecies at the instruction of the proper park representative.

In order to maintain information in a dynamic system such as NPSpecies, the data will need to be reviewed on an intermittent or periodic basis. The certification review insures that:

- the data housed in NPSpecies remains accurate and up-to-date
- species are listed according to their locally-accepted taxonomic nomenclature

At minimum, a certification should be completed after the first formal review of a species checklist for a park and a taxa category. The need for subsequent reviews and certification will vary from a few to many years depending on changes to park boundaries, manmade or natural

events affecting biodiversity, and the extent of data added or edited after the time of the previous review.

Upon completion of the QA process, the participants will fill out a form documenting what was reviewed, when the review took place and who participated. The information on the form will be included in the on-line version of NPSpecies as a permanent part of the database. Once completed, users and managers of information in NPSpecies will know at any time the history of reviews and can gauge the appropriate use of the information.

H.3.3 Online vs. Desktop

The online version can be accessed at <https://science1.nature.nps.gov/npspecies/web/main/start>. This version is to be used for:

- Directly adding and/or updating small number of species records
- Linking NPSpecies records to references located in NatureBib is to **ONLY** be done online

The desktop version is located in the central files at M:\TOOLS\NPSpecies\NPSpeciesXP.mdb. This version is to be used for:

- Processing large groups of additions and/or updates
- Locally viewing species data lists

H.3.4 Data Entry Details

Documentation and training materials regarding data entry can be found in the Central Files at M:\TOOLS\NPSpecies\documents\training. Information is also on the main NPSpecies application webpage at <http://www1.nature.nps.gov/biology/biologicalinventories/npspecies/documents.cfm>.

H.3.5 Local Database and Application Updates

A new back-end species list must be downloaded and maintained locally whenever any updates are made to the master online database. New downloads can be obtained from the “Secure Utilities” section of NPSpecies. Updates are processed nightly, thus updates will not be available for download until the next day.

Additionally, updates to the desktop version and master data files list must be implemented once they are made available. Application updates can be downloaded from: <http://www1.nature.nps.gov/biology/biologicalinventories/npspecies/desktopapp.cfm>.

H.3.6 Public Data Access

A public web version of NPSpecies is currently under development. Until this is released, data can be shared by sending a direct download that contains the specific data needed by the requestor. All requests for data are to be handled by the designated NPSpecies Point-of-Contact (POC). Only data that has both undergone the QA/QC certification process and has the sensitivity level set to Public can be released. Anyone requesting data must agree to use the data only for non-commercial, educational and/or research purposes only. Additionally, the requestor

is to provide the POC with copies of all documents, reports and datasets generated directly or indirectly from the use of NPSpecies.

H.4 Roles and Responsibilities

NPSpecies is a dynamic, living, database that is designed to have long term value to the parks, the network, and the service. Maintaining and enhancing its value requires a continuing effort and commitment. Currently the main focus of NPSpecies is to record data regarding vertebrate animals and vascular plants. However, it does have the capability to record data on other taxa categories i.e., butterflies, spiders, mosses, and lichen. NPSpecies should be updated with this information as it becomes available. This can only happen with a joint effort by the parks and network.

Currently, the Network Data Manager is the POC for all parks in the SOPN due to the few number of resource management staff in the Network. As such, the network will be undertaking a greater role in maintaining the NPSpecies datasets for the parks. This may change should a park have a resource management staff capable of handling updates locally. Should this occur, the network instead provide technical assistance in maintaining the database.

Park Resource Management Staff.

- Notify the POC of any updates that need to be made to species lists, vouchers, and observations with information from permitted research, or park operations.
- Provide reports and species lists to park managers, principle investigators, or other members of the public as necessary.

Network Data Management Staff

- Update species lists, vouchers, and observations with information from network monitoring and data mining operations.
- Perform batch updates to NPSpecies when appropriate.
- Provide access to NPSpecies as needed by park staff.
- Provide assistance with database updates

Appendix I. Digital Photograph Management Guidelines

Update Frequency

As needed; Minimum Annually

Adapted From

Digital Photograph Management Strategy for Alaska Inventory and Monitoring Program.

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

I.1 Introduction

Photos are taken and used by NPS personnel for a variety of purposes. NPS photo users vary tremendously in their knowledge and access to imaging software and hardware. While it is impossible to anticipate every use/collection scenario, most photos should fit into one of the general “photo type” categories defined below:

- Library Photos. These photos are final products that have been edited, documented, reviewed and added to the networks digital photo library. Metadata for these photos is stored in a central database using approved software. These photos can be used for multiple purposes by a variety of staff. They are public domain.
- Working photos. Photos in this category are “works in progress”. Working photos should be documented and moved into the parks photo library or they should be deleted. Metadata for working photos does not exist but is in progress. Working photos are stored in centrally located employee specific folders adjacent to the park photo library.
- Data Photos. Data photos are photos collected as data. Examples include: 1) site specific photos documenting a wetland delineation and, 2) photos taken as part of a maintenance facilities assets inventory. Data photos are collected as part of a well-defined data collection protocol. Metadata for these photos is stored in a project level database. Data photos are stored in the project folder structure. Representative, unique and instructive data photos should be added to the parks digital photo library.
- Aerial Photos. These are usually produced professionally by a contractor, where very clear specifications are made. Digital aerial photos standards are discussed but are beyond the scope of this document to be described in detail. (Note: This refers only to orthographic photos, not oblique snapshots out of an airplane door or window.)

1.1.1 Digital Photo Cycle:

The “digital photo cycle” typically runs through the following steps. Photos are acquired, stored, viewed, renamed, edited, documented, stored in a photo library, archived and, in some cases, deleted. Some of the issues and questions which crop up along the cycle include:

- **Acquisition**
 - Digital cameras – What is the best quality and size?
 - Scanning images – What parameters to use?
- **Processing**
 - Download and Storage – Where? For how long? Naming standards?
 - Viewing – With which software? Or as contact sheets?
 - Renaming – Manually or batch? Naming standards?
 - Editing – Which software? Should you write over the master or make a copy?
 - Documenting – Which attributes should be documented? How is the documentation ‘attached’ to the photo?
- **Long-term Storage**
 - On-line storage – Where? Managed by whom? For how long?
 - Off-line storage and archiving– Where and when? When to delete?

This document will attempt to address these questions and provide logical standards and guidelines to facilitate good photo management. This document discusses imaging standards and how digital photos will be stored in a repository, documented and cataloged. Figure I-1 summarizes the general photo management process.

I.2 Acquisition

1.2.1 Digital Cameras

If digital cameras are used to capture images, they should be set at the highest resolution possible to allow for the highest level of use for a photo. A minimum of 3 megapixel cameras is recommended; however, 5 megapixel cameras are preferred in order to capture the highest image quality. We recommend adjusting your camera image quality setting to fine or super fine to ensure high resolution. Remember that images can be decreased in resolution for purposes such as web use or thumbnails, but cannot be adequately increased in resolution greater than the original resolution settings. While lower image quality settings may seem to meet your needs for a whole photo, having extra detail will help maintain high quality if you need to crop and enlarge an image or later use it in a publication.

1.2.2 Film Cameras

Where possible, it is recommend that staff and contractors provide photos as 35 mm slides (preferably Kodachrome or Ektachrome). This is because slides are a proven stable medium. Alternatively, but less preferred, 4x6 color prints are requested. Slides should be labeled using indelible pigment ink, or using laser-printed archival-quality slide labels. Slide labels should include: a unique ID (should be the same as digital file image name, if provided), project name, photographer, photo date, a brief identification of contents (e.g., species name, plot ID), and

geographic location (UTMs or description). Slides should be stored in polypropylene slide sleeves. Light Impressions (www.lightimpressionsdirect.com) is a recommended source for archival storage materials. If photographs are provided, they should be delivered in individual polypropylene sleeves and within archival-quality boxes. Each photo should be labeled on the back, using archival-quality labels, with the same information elements required for slides. If a contractor is submitting photographs, corresponding digital files in .tif format must also be provided on CDs and meet the scanning specifications listed below.

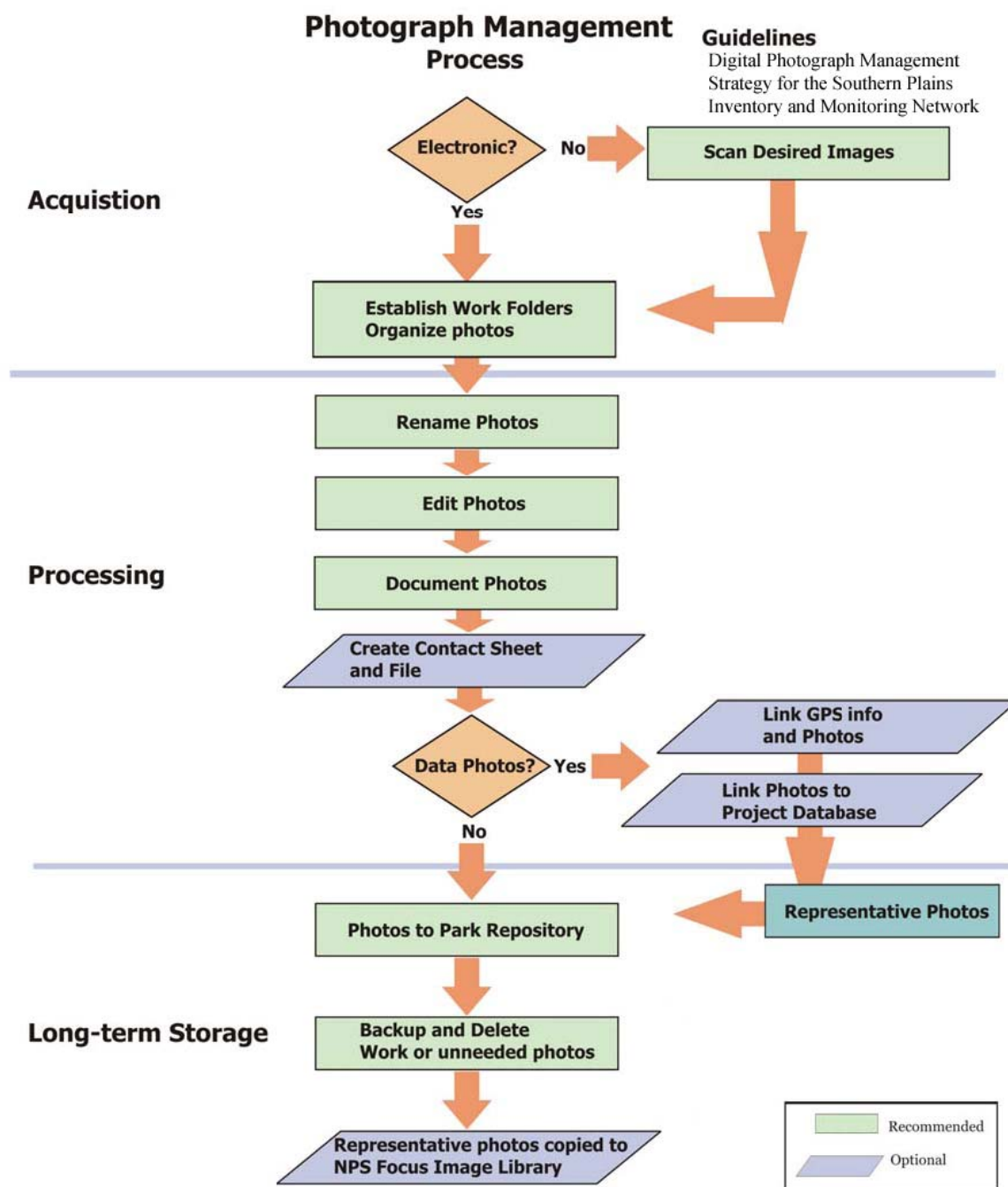


Figure I-1: Photograph Management Process

I.2.3 Scanning Specifications

The resolution is selected based on the size of the original. The smaller the photo, slide, or other material, the higher the resolution should be used to acquire a detailed scan. When scanning slides, always use a scanner that provides a light source though both sides of the slide. Scanners that reflect light back though the slide create muddy images and are not capable of producing high quality results.

Below are the minimum recommended scan resolutions for different formats. Higher resolution scans are always preferred and will yield larger and better quality images.

Photos and slides should be scanned at a resolution that allows good representation of detail but also have a reasonable file size (1-2 megabytes). The original slide is always accessible if greater resolution is needed. Whether the work is done internally or is contracted, the recommended scanning settings are as follows:

- Tagged Image File Format (tif)
- 600 dpi (minimum for prints and slides)
- Scanned at the original size of the image (e.g., 1.37 x 0.9 inches for slides)

The advantages of scanning an image as an uncompressed tif file are improved print quality and no image degradation. Images scanned as JPEG files will lose image data over time with each editing event. If images are needed for web pages or other uses, the tif must be saved as an alternate JPEG file. Do not overwrite the tif image.

All scans should be done at a minimum of 600 dpi. However, if a slide is needed for a project where the resulting images will be edited (example: cropping and enlarged) or in a print publication such as a poster or a publication, the scan resolution should be raised to 2400 dpi. This is due to the images smaller size.

I.3 Processing Overview

Effectively dealing with hundreds of photos requires consistent downloading, naming, editing and documentation. This section describes the general process for managing photos and will provide additional information for each type of photo as defined in the Introduction.

After the images have been acquired, either by digital camera or scanning, the general processing of photos are as follows:

1. Establish a file organization for photos
2. Rename the photos
3. View, delete and edit the photos
4. Document the photos
5. Prepare photos for on-line long-term storage or off-line archiving.

Special note for Data Photos: Data photos are photos collected as part of a documented data collection protocol. The project's data processing protocol should contain a detailed section on processing data photos. This protocol should include information, such as:

- File folder structure conducive to data entry and linking.
- Photo naming standard conducive to data entry and linking.
- Field collection method for uniquely linking each photo to its related field data sheet/record.

- Consistent photo database that facilitates linking of photos to the projects data.
- Step-by-step procedural documentation.

I.3.1 Organization

I.3.1.1 Original and Edited Photos

Raw, unaltered photos should be carefully preserved. The names of folders containing raw photos should clearly indicate that the folder contents are unedited originals. Raw photos folders may include multiple photos of the same subject, blurry pictures, or other less desirable photos. This original set of photos should be preserved as is. Copies of raw photos should be saved in clearly named folders for review and editing. For example:

```
/Subject_A
  /Originals – raw, downloaded photos, including poor photos
  /Edited –photos which have been processed: renamed and edited.
```

After downloading or scanning photos to the /Originals directory, this directory should be set to “read-only” permissions to prevent inadvertent edits.

I.3.1.2 Working Photos

Photos should never be directly downloaded from the scanner or camera directly into the final library folders. This is because more often than not, these photos will require some degree of processing before they are ready to either be used in a database or placed into the photos library. Working photos (photos that are being processed), should be stored either in a workspace within a specific project or within a user’s photo library.

Example directory:

```
\Working_Photos
  \User_A
    \Photo_SetA_Name
      \Originals
      \Edited
    \Photo_SetB_Name
      \Originals
      \Edited
```

I.3.1.3 Library Photos

Library photos are public photos readily available to be used for a variety of purposes. High quality photos are encouraged where possible, but may also include lower resolution photos. These photos have been reviewed, processed, documented and ready to be stored in a digital photo repository. All SOPN library photos will be placed on the central M: drive. These photos will be “Read-Only” to prevent unauthorized and/or accidental editing.

Library photos are organized by logical theme keywords related to the parks. The generic organization structure template is lengthy and subject to updates. A handy reference is presented in Appendix C. Each park will have it’s own directory. The structure for each park can be modified to match the themes present in each park, however it is encouraged the folder names remain the same. This is to provide a level of consistency in search functions. The full library structure can be found at the end of this document as well as in the central files at M:\Central_Files\Library\Photos\Tools\Photo_Library_Base.

Example directory:

```
M:\Library
  \Photos
    \PARK
    \Natural_History
    \Animals
    \Astronomy
    \Bogs
    \Caves
    \...
```

I.3.1.4 Data Photos

Project Data Photos:

Photos taken as part of a project's data collection protocol are project data that needs to be organized, documented and preserved in conjunction with all other project data. Project data photos should be organized and contained within the project folders and NOT the library folder. Detailed project protocols should define how and where photos are downloaded, edited and rolled up into final folder locations.

It is recommended to use a specific method of organizing data photos within project folders to maintain some consistency from project to project. For example:

```
\Project_A
  \Data
    \Photos
      \Originals
      \Miscellaneous
      \DataPhotos
```

It is not recommended to store or embedded data photos within a MS Access database. A photo linking tool should be used instead to link the photographs to the database.

Miscellaneous Project Photos:

Incidental or opportunistic photos taken by project personnel are not data photos and can be managed as miscellaneous photos. Miscellaneous photos taken as part of a project should be stored in the project miscellaneous photos directory. This allows the photos to stay with the project, but does not confuse photos that are data related. These photos may be further processed to become "Library" photos. Photos of interest to a greater audience should be made available to the parks where they were taken.

1.3.2 Image Naming Standards

Adding a description within the image file name will help make the file intuitive and easy to select. However, when dealing with a large number of photos, this can seldom be maintained and should be reserved only for small sets of photos, library photos and miscellaneous photos. The photography industry uses thumbnail browses and keywords to retrieve photos. As such, SOPN will adopt this method.

It is only practical to manually rename photos if the quantities are small. When working with more than a handful of photos, software which utilized 'batch' rename functions should be used. This will vastly improve workflow and insure consistency. In some cases, renaming photos may require a two part process. An example is when in the first step is a batch process which inserts the park code and year at the beginning of the photo name. The second step then involved

adding a descriptive component to the name as a manual edit on a photo by photo basis. Organizing photos by topic in folders can make batch renaming with descriptive names possible. See the cheat sheet on how to perform batch renaming in the Appendices.

When dealing with hundreds of photos, such as in the case of data photos, descriptive naming is neither practical nor useful and photo file names should either be retained as produced by the camera or batch renaming without descriptive components should be used.

Images that will be uploaded to NPS Focus require unique, descriptive names. This is due to the scope and quantity of images being loaded in one place. Having very specific file names insure that these images will continue to be uniquely identified through the coming decades.

In all cases, photo names should not use spaces or special characters. Try to keep file names less than 25 characters.

I.3.2.1 Digital Library Naming Standards

The Southern Plains Network Digital Library is the network's central repository. This library is currently housed on the second hard drive of data manager's computer and is mapped as M:\Central_Files\Library. Access to this folder is currently set to SOPN employees only. In a future time, the digital library may be moved off of the Data Manager's computer to a centralized server. Naming standards should be set to facilitate proper file management. To this end, SOPN has chosen to adopt the service-wide naming standards used by NPS Focus. These standards provide a simple method to generate unique file names.

The image file name should consist of:

1. Park Code
2. A brief description of the image
3. The date of the image written as YYYYMM (YY if month is not known)
4. A numeric extender (multiple image sets only)

Examples:

PECO_VascularPlants_2001.jpg
CHIC_FreshFish_200206.tif
BEOL_Tamarisk_2005_1.tif
BEOL_Tamarisk_2005_2.tif

Each part is separated by an underscore. Multi-part and multi-page items consist of:

1. Multiple images associated with one record (such as multiple angles of the same monument)
2. Multiple images that describe similar objects or scenes
3. Multiple pages of an item that has been scanned.

Note that all sections of the file name have been separated by a hyphen. When an item being digitized consists of multiple parts, the main filename should be followed by an underscore and part number beginning with _1, _2, _3, etc.

I.3.2.2 Data Photo Naming Standards

These naming guidelines are designed for projects which collect hundreds if not thousands of photos.

File names should assist in the linking of the projects data and the photograph. Project needs may be driven by site, time, specimen, or method. Projects with a limited number of photos (<50) may elect to be descriptive with file names. Projects with larger number of images (>50) may elect a sequential image naming standard. Various examples are provided here. All images should follow these guidelines:

- Document the naming standard used. This should be done in the projects Data Processing Protocol.
- No spaces in the file name; generally less than 20 characters
- Park code and year should either be included or conclusive by the directory structure.
- Use underscore to separate components

Option 1: preferred for small photo datasets (<50 photos)

Park code and year are included in the file name. The image file name should consist of four parts:

1. The park code (SOPN, ALFL, BEOL, PECO, etc...)
1. The year of the image written as YYYY
2. Project Code or description
3. Photo number ID (ideally the same number from the original file name generated by the camera)

Examples:

CAVO_2001_VPlants_2501.jpg

CAVO_2001_VPlants_251.jpg

WABA_2003_SiteA_001.jpg

WABA_2003_SiteA_002.jpg

Option 2: preferred for large photo datasets (>50 photos)

Park code is assumed conclusive by the directory structure. The image file name should consist of three parts:

1. The month and day (MMDD)
2. incremental, unique photo id (ideally the same number from the original file name generated by the camera)
3. Time in 24 hour format (HHMM)

Examples:

07292006_150_0830.jpg

07292006_151_0830.jpg

07292006_152_0838.jpg

1.3.3 Image Viewing and Editing

Thumbnails give a quick icon view of many photos so photos may be quickly selected visually. It is recommended that 1) a quick viewing software or database be used to look at thumbnails, captions, descriptions, dates and keywords, and where appropriate, 2) a contact sheet of these thumbnails be printed for quick reference.

I.3.3.1 Editing

At a minimum, photos should be edited as follows:

- Poor quality photos should be deleted, except where the subject is highly unique.
- Medium quality photos should be assessed against existing photos of the same subject in the park photo library. If the photos duplicate the subject with no enhancement of quality or perspective, the photo may not be worth saving and should be deleted.
- Photos should be rotated to portrait or landscape.
- Photos should be rotated to make the horizon level.
- Photos of people should have 'red eye' removed.
- Photos should be cropped to remove edge areas that grossly distract from the subject.

Large groups of photos acquired under sub-optimal exposure or lighting can be batch processed to enhance contrast or brightness. Batch processing can also be used to resize groups of photos for use on the web.

I.3.4 Image Documentation and Cataloging

Images should be documented and cataloged. Documentation, or metadata, provides the minimum information a user will need to appropriately use the photo. Cataloging provides a collective means for searching, finding, and retrieving photos.

I.3.4.1 Software

All software or combinations of software should meet these minimum requirements:

- Meet the minimum metadata requirements
- Ability to add additional fields, as desired
- Ability to establish a template of these fields
- Ability to create a thumbnail view
- Ability to search
- Ability to do basic functions like rotate, zoom, pan

SOPN will use a combination of software and databases to perform these functions.

- ThumbsPlus is used to document photos with keywords and attributes, produce contact sheet printouts, and allows for quick searching and viewing of photographs.
- Wherever possible, Adobe Photoshop should be used for all photo modifications. If Photoshop is not available, or if the photo only requires minor modifications, the photo editing tools in ThumbsPlus can be used instead.

I.3.4.2 Minimum Metadata Attributes

All photos should be documented with a set of minimal metadata attributes. A ThumbsPlus template has been created to insure that all these fields are captured. The template can be found in M:/Library/Photos/Database/SOPN_Photo_Library_Template.t4d. These minimal metadata attributes are documented through the photo's user fields in ThumbsPlus and include:

- File name (usually inherent)
- File location (usually inherent)
- Storage Location of the original/hardcopy/negative
- Description
- Photographer, Contributors, or Archive Institution (all that apply)

- Collection Name, if applicable (historic and archives)
- Publisher
- Date Taken
- Format/Size/Source
- Type of Media of original
- Subject
- Keywords
- Park Code
- Place
- Any necessary credits
- Distribution Restrictions, such as copyright or sensitivity

Digital photos capture some metadata and will hold this information in an EXIF file that stays with the photograph until the photograph is modified. **Only modify photos using software that preserves this information.** (An example to **avoid** is rotating images in the Windows Picture and Fax viewer). Ideally, edits should be performed using Photoshop or ThumbsPlus because these software will preserve the EXIF file. These attributes include:

- File name
- Aperture
- Date Digitized
- Date Taken
- Exposure Bias
- Exposure Time
- F-Number
- Flash (yes, no)
- Focal Length
- ISO Speed
- Light source
- Metering Mode
- Shutter Speed

If the image is processed, for example cropped or modified in Photoshop, the following attributes should be documented:

- Name of photo editor
- Software used
- Date photo is modified
- Model of printer intended (if edited for print)

Special Note for Data Photo Metadata

Projects should store metadata attributes for data photo within the appropriate relational tables of the project database. Project databases should contain at least the minimum metadata requirements listed here.

I.4 Long-term Storage

I.4.1 Originals and Interim Photo Storage

Once the photos have been processed and placed into their appropriate libraries, original photos should be archived onto a CD-ROM and labeled as originals. Other project interim photos may be backed-up using normal project back-up procedures and deleted. Any working photos, such as those in Photoshop, may be maintained at the user's discretion. Users should be considerate of disk space, however, and should use CDs or DVDs to backup files not frequently used.

1.4.2 Library Photo Storage

Once documented, photos should be catalogued and moved into the photo library. Library photographs will be stored in the photo directory within SOPN's master digital library located at M:/Library/Photos. The folder template is designed to capture all photos from all SOPN parks in the NPS. Thus, this template contains many folders that may not be relevant to all SOPN parks. This template should be used as a starting point for a park's photo library. Before using this folder structure, it should be reviewed and edited so as to remove folders which are irrelevant to the park.

SOPN will designate one individual as a low-key, low-time commitment 'Photo Manager'. In most cases, this will be the data manager. The photo manager's principal duties include insuring that all photos are processed to set standards and to encourage network personnel to perform good photo management. The photo manager could also act as a liaison with park photo managers (if available).

1.4.3 Data Photos Storage

Data photos are always to be stored with the rest of the project's data files. As the project reaches a milestone, such as when a report is written, photos should be reviewed for samples of interest to a greater audience. This may include scenic views, animals, activities, methods, equipment, or facilities. If the project includes multiple pictures of essentially the same method or item, select a few that are representative. These photos should be copied and processed into library photos. It should be noted which project the photo originated from within the photo's metadata attributes.

1.5 Photograph Property and Use

All photos collected with National Park Service funds and staff time are property of NPS. Contractors using photographs as part of their project should provide copies, preferably high resolution digital copies, to the NPS project leader.

When using a photograph, provide credit to the photographer. This is usually written on the right side of the photograph or at the bottom in a smaller font size (sans serif) than the text in the document.

1.6 Photos of People and Rights to Privacy

When taking a photo of a person, the subject's right to privacy may come into play. Photos with the following criteria should seek a model waiver form:

- The person is recognizable, AND
- The person is not a government employee (on-duty), AND
- The photo will be used for profit to the photographer.

OR

- Any photos of a minor, where the minor is recognizable.

Photos with the following criteria do not need a model waiver form:

- Photos are public domain (unless protected by law)
- Photos are not for profit
- If photos are used for profit, such as in a magazine, it is not NPS who profits

In the case of NPS, it is rarely the case where a model waiver form is needed. Typically these photos are used for education and editorial purposes, where photos of subjects are acceptable.

Other violations of privacy may include:

- The photographer intruded on the person's seclusion to take the photo

OR

- Private information about the person is now made public

OR

- When the photo causes the average, reasonable person to believe something about them that isn't true.

None of these instances should occur within the scope of government work.

NPS and contracting photographers should exercise the following guidelines when photographing people:

- Generally avoid photos of minors for public distribution.
- Intentionally do not identify the non-government people pictured, providing one less invasion of privacy.

I.7 Roles and Responsibilities

Data Manager

The SOPN data manager is responsible for ensuring that network staff adhere to the directory structure and tagging guidelines. Additionally, the data manager will provide oversight for the photo library directory structure.

SOPN Staff

All network staff are responsible for ensuring that all photos collected meet the standards listed above and are stored in the appropriate locations on the shared drive.

I.8 References

Evans, Kass. 2003. National Park Service NPS Focus Image Creation and Management Guide. Draft Rev January 23, 2003. Retrieved January 7, 2004 from the World Wide Web: <http://focus.nps.gov/doc/techdoc/ImagingGuide.html>

Duboff, Leonard D. 1989. The photographer's business and legal handbook. Images Press, New York, NY. ISBN 0-929667-02-6.

Appendix J. Project Data Life Cycle Guidance

Update Frequency

As needed; Minimum Annually

Adapted From

Project Data Life Cycle Guidance Document – Northern Colorado Plateau Network.

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

J.1 Introduction

The following guidelines were developed for the Southern Plains Network (SOPN) of the National Park Service (NPS) Inventory & Monitoring (I&M) Program for ensuring that all SOPN project data are acquired, processed, and made available for distribution in accordance with I&M program requirements and NPS policies.

J.2 Scope and Applicability

These guidelines apply to all SOPN projects, whether they are short-term projects, which may include individual park research projects, inventories, or pilot work done in preparation for long-term monitoring, or long-term projects, which includes monitoring or other multi-year research projects. The guidelines apply only to projects that have passed the planning and approval stage and that have a record established in the SOPN project tracking system (see Project Tracking System SOP – currently under development as of September 2008). If the project in question does not yet have a record in the SOPN project tracking system, contact the SOPN data manager to have such a record created.

J.3 Project Data Life Cycle

During the various phases of a project, project data take on different forms and are maintained in different places as they are acquired, processed, documented, and archived. This document presents an overview of the typical life cycle of SOPN project data and includes a checklist (Appendix A) to ensure that all life cycle steps are completed for each project. Although the data life cycle may vary depending on specific project needs and objectives, the typical life cycle for SOPN projects proceeds as follows (Figure J-1):

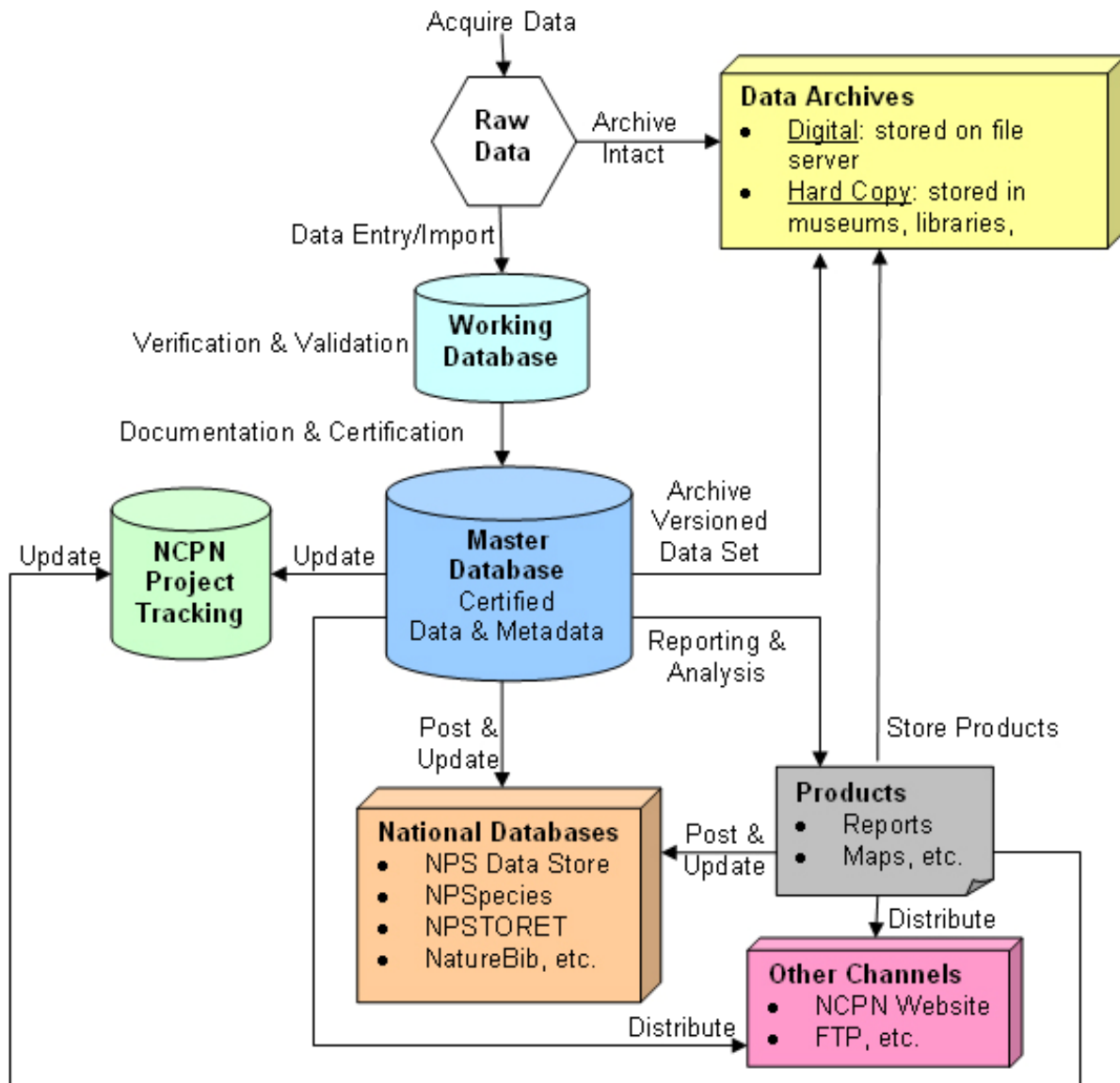


Figure J-1. SOPN Project Data Life Cycle

Acquire data – For data recorded by hand in the field, data forms should be reviewed regularly (preferably daily) for completeness and validity in order to capture errors as close to their origin as possible. Digital data are downloaded from field data collection devices as often as field schedules permit.

1. **Data entry / import** – Data are entered manually from hard-copy forms, and digital data files are uploaded to the working database.
2. **Verification and validation** – The accurate transcription of raw data is verified; data are validated by the project leader or subject-matter expert to detect missing data, out-of-range values, and logical errors. Much of this verification and validation is performed via quality assurance/quality control (QA/QC) routines that are developed and run on the working databases. This is a critical step that requires careful oversight by the project

lead. Errors discovered later in the project life cycle are much more costly to correct. It is also important to document the verification and validation process (e.g., types of errors checked for and results). This documentation is required for documentation and certification (see step 3). Contact the data manager to see examples of such documentation.

3. Documentation and certification – Data certification is a benchmark in the project data life cycle that indicates that: a) the data are complete for the period of record; b) they have undergone and passed the quality assurance checks; and c) that they are appropriately documented and in a condition for archiving, posting and distribution as appropriate. Certification is not intended to imply that the data are completely free of errors or inconsistencies which may or may not have been detected during quality assurance reviews. Refer to Appendix G – Metadata Guidance for data documentation procedures. A project data certification form is provided at the end of this appendix. This form must be completed by the project lead before any project data or data products can be posted, distributed, or archived.
4. Reporting and analysis – Certified data are used for analysis and reporting, including annual summary reports for monitoring projects. Depending on project needs, data might be exported for analysis or summarized within the database.
5. Post data and data products, and update national databases – To make data and data products available to others, certified datasets and metadata are posted to national repositories such as the NPS Data Store, while reports and other publications are cataloged in and posted to NatureBib. National databases such as NPSpecies and NPSTORET are also updated. Datasets and data products may not be posted if they contain protected information about the nature or location of sensitive, threatened or endangered species, or other natural resources of management concern. However, this position will be revisited once these systems are prepared to handle such datasets/data products. In addition, the SOPN project tracking system is updated to record important attributes about datasets and data products, such as cataloging information and storage locations (see Project Tracking System SOP – currently under development as of September 2008).
6. Archive raw data, versioned dataset, and data products – Raw digital data are archived intact following SOPN digital data archiving procedures, while field data forms and other hard copy data are archived according to SOPN hard copy data archiving procedures. Archiving of hard copy field forms may occur at the end of a season as a means of retaining all marks and edits made during the verification and validation steps. Certified data (in both native database format and ASCII format) and metadata are archived according to SOPN digital data archiving procedures. Reports and other data products, both digital and hard copy formats, are also archived. Refer to the Appendix F - Library Strategy for digital and hard copy archiving procedures..
7. Distribute data and data products – Data, metadata, reports and products can be shared and distributed in a variety of ways – especially via the SOPN website and the web-based national databases and repositories – as well as by FTP or mailing in response to specific requests, or by providing direct access to project records to cooperators. In all cases,

distribution will follow legal requirements under the Freedom of Information Act, with limitations established to protect information about sensitive resources.

8. Track changes – All subsequent changes to certified data are documented in an edit log, which accompanies project data and metadata upon distribution. Significant edits will trigger reposting of the data and products to national databases and repositories.

A checklist is provided at the end of this appendix for documenting these project data life cycle steps. For long-term projects such as monitoring projects, this checklist must be completed on an annual basis. For short-term projects such as inventory projects, the checklist must be completed upon project closure.

J.4 Roles and Responsibilities

Project Lead (NPS)

The project lead owns the project and the project data, and therefore, is responsible for ensuring that all project data life cycle steps are completed.

Data Manager (NPS)

The data manager is responsible for ensuring that all data management-related steps in the project data life cycle are completed. The data manager will also assist the project lead with completing project life cycle steps involving GIS data.

Project Data Certification Form

Data certification is a benchmark in the project data life cycle that indicates that: a) the data are complete for the period of record; b) they have undergone and passed the quality assurance checks; and c) that they are appropriately documented and in a condition for archiving, posting and distribution as appropriate. Certification is not intended to imply that the data are completely free of errors or inconsistencies which may or may not have been detected during quality assurance reviews.

1) Certification date: _____

2) Certified by: _____

Title: _____

Affiliation: _____

3) Project code: _____

Project title: _____

4) Range of dates for certified data: _____

5) Description and scope of data being certified: _____

6) List the parks covered in the certified data set, and provide any park-specific details about this certification.

Park	Details

7) ____ This certification refers to data in accompanying files. Check all that apply, and indicate file names to the right:

____ Database file(s): _____

____ Spatial data theme(s): _____

____ Geodatabase file(s): _____

____ Other (specify): _____

____ Certified data are already in the master version of a park, SOPN, or NPS databases (e.g., NPSpecies, NPSTORET).

Please indicate the database system(s): _____

8) Is there any sensitive information in the certified data which may put resources at greater risk if released to the public (e.g., spotted owl nest sites, cave locations, rare plant locations)?

____ No ____ Yes Details: _____

9) Description of data processing, quality assurance measures, and results and summary of quality assurance reviews, including details on steps taken to rectify problems encountered during data processing and quality reviews. (Note: Can be a reference to appropriate sections of the protocol or a separate document.)

Project Data Life Cycle Checklist

Project Name:

Project ID:

Project Lead:

Year:

1. ☐ Data acquired.
2. ☐ Data entered/imported.
3. ☐ Data verified and validated.
4. ☐ Data documented and certified.
5. ☐ Reporting and analysis completed.
6. ☐ Data and data products posted and national databases updated.
7. ☐ Versioned dataset, data products, and raw data archived.
8. ☐ Data and data products distributed.
9. ☐ Changes tracked.

Appendix K. Quality Assurance/Quality Control Guidance

Update Frequency

As needed; Minimum Annually

Adapted From

Quality Assurance/Quality Control - Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

K.1 Introduction

This SOP provides quality assurance/quality control (QA/QC) guidance when working with Network information. QA/QC is integral to all steps of managing information, so it is difficult to provide one set of procedures that fulfill all needs. However, the general QA/QC steps do depend on whether the information originates from external sources, where the Network has minimal control, or is created by the Network, where the Network has both full control and the obligation to produce quality information. Thus, this document is split into two sections. The first section covers QA/QC recommendations for all stages of a network project – from initiation to close-out. The second section discusses the procedures for handling externally generated information that is to be incorporated into one of the network operations.

K.2 Internally-Generated Information: Project

Most of the information generated by the Network will originate from work under vital signs monitoring protocols. Each protocol will contain its own individual data management section. However, the QA/QC requirements have the same general structure. While monitoring is an ongoing operation, each year's effort is distinct and may be viewed as a specific project. Therefore, the QA/QC requirements may be viewed within the framework of the project life cycle. This section is primarily written for data collection in the field, although a subset of the guidance will apply to any type of project, whether or not field work is involved. Figure K-1 provides the general steps for project QA/QC.

K.2.1 Initiate

During the project initiation phase, the important step for quality assurance is to clearly define the data and information needs. It will be impossible to generate the information without a clear

definition,. This includes review of the protocols and ensuring that all sample techniques are clear, complete, and fully recorded.

K.2.2 Plan

The planning stage is where quality assurance (QA) is initially implemented. There are a number of areas where quality can be assured, most importantly in planning for field work, in database design, and in staff training.

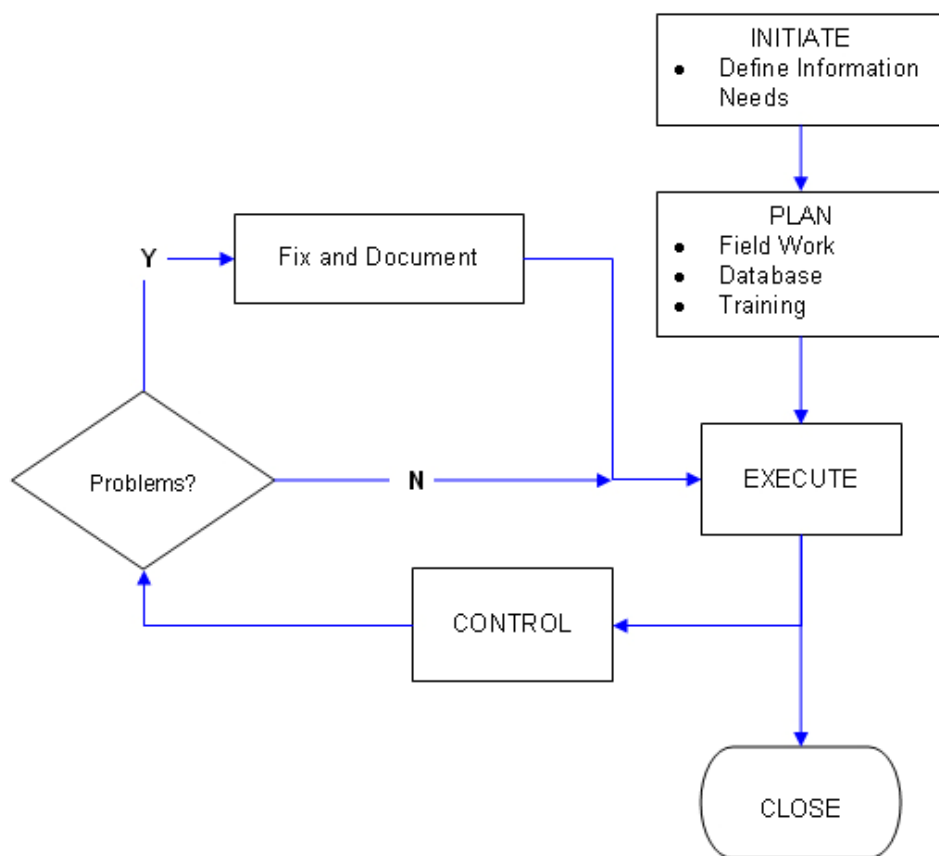


Figure K-1. Quality Assurance and Control Steps During the Project Life Cycle

K.2.2.1 Field Work

Planning for the field work is planning for the media that collect, record, and store the information. Common types of media include field sheets, personal digital assistants (PDAs), global positioning system units (GPS), digital cameras, and field personal computers.

Field forms generally exist only on paper field sheets or electronic field forms on PDA's or field personal computers. Field forms of any type should be developed by the Principle Investigator working with the data management staff and field personnel input whenever practical. They should not only accommodate the requirements of the protocol or study plan but maximize the ease of use in the field and reflect the structure of the data being recorded.

In general effective planning in field sheet (paper) development will ensure that the forms:

- Fit a common and accepted format (e.g., 8.5x11 inch)

- Provide space for the observer to record the name, version and date of the monitoring protocol (or study plan) used for data collection and processing
- Are protected from inclement weather or other damages (e.g., “write-in-rain” paper)
- Utilize checkboxes, selection lists, and other data formats that are quickly and easily entered in the field with a minimum of writing (e.g. allows for wearing of gloves in inclement weather)
- Have font sizes and formats that are legible in the field (e.g., not smaller than 8 points)
- Include sufficient space (i.e. empty rows/columns) to enter all data from a site on one form (e.g., don’t provide too little space so data often ends up on the back of a sheet)
- Have strict ‘penmanship’ rules (e.g., all text must be printed instead of cursive, sevens with slashes, zeros with lines, All/no caps, acronyms and codes) that optimize the use of space and time and minimize confusion in the forms

In some cases a Personal Digital Assistant (PDA) can be used to replace a paper field form. This should be done whenever possible since it removes a separate data entry step at the end of the field season. However, the limited size of PDA screens, memory, and battery can be limiting – the Project Leader must carefully evaluate the advantages and disadvantages. PDA utilization requires:

- Form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, intuitive codes, and error checking
- Clear directions for use based on the data collection needs
- Provisions for data backups battery replacement and recharging
- Plans for how and when backup field sheets are to be used, should the PDA fail
- Directions for data transfer and backup when in the field and/or upon returning to the lab/office.

A ruggedized field PC can provide the flexibility of paper with the efficiency of a PDA (at a greater financial expense). Properly designed field forms on this media should be able to completely replace paper as long as adequate steps are taken to protect the media and the field data collected on it. Field PC utilization requires:

- Form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, and intuitive codes, and error checking
- Provisions for data backups and battery replacement and recharging
- Functional forms developing using the Microsoft Access application
- Plans for data transfer and backup in the field and upon returning to the lab/office
- Plans for how and when backup field sheets are to be used, should the computer fail, or when carrying the computer into the backcountry is impractical.

When a GPS is used, there will be:

- Clear directions for use of the GPS unit based on the data collection needs
- Provisions for battery replacement and recharging
- Specified and consistent datums and projections
- Provisions to determine and record the accuracy and precision of the GPS during data collection
- Directions for data downloads and connecting GPS data with other tabular or database formats (when the GPS isn’t integrated with a field computer)
- See also the Network’s GPS SOP (NPS-SOPN 2007b)]

When a digital camera is used there will be:

- Provisions for battery replacement and recharging;
- Plans for data transfer and backup when in the field and/or upon returning to the lab/office;
- Plans for how and when backup cameras are to be used, should the primary camera fail.

K.2.2.2 Database

A good relational database is important to effectively store, preserve, and present all of the data. While database design is complex the aspects that are related to QA/QC are straight forward.

- Have record-level tracking of who entered the information, when the information was entered, and what protocol, study plan, or method was used to collect the data;
- Contain built-in automated error checking features;
- Have controlled access and defined security levels (i.e., forms are set for data entry only, which prevents accidental deletion or alteration of existing data) and can control the sequence of data entry (i.e., certain fields require an entry before more information can be entered);
- Utilize lookup tables whenever possible to minimize data entry errors;
- Share common lookup tables with other Network databases;
- Have full-screen forms that resemble the field sheets (this greatly facilitates quality control checking);
- Distinguish between newly-entered and previously validated data;
- Utilize form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, intuitive codes, and error checking;
- Prevent duplicate records entry;
- Contain a mechanism for a random audit for errors of commission. In cases where errors are greater than 2%, a complete review (i.e., 100% re-evaluation) will occur;
- Contain complete descriptions of all data fields to minimize errors of omission.

K.2.2.3 Training

The project leader must thoroughly know and understand the protocols, SOPs, and field techniques guiding a project. All field staff will be aware of the key points, although it is not imperative they have the protocols memorized, as long as they have immediate reference to the necessary information. Training will include:

- Use of graphical (e.g., flowcharts) and text information;
- An overview of the protocols and SOPs ;
- A complete walk-through of the field techniques and SOPs with staff assistance;
- A test to confirm they are able to conduct the SOPs without assistance;
- Open scenario of possible field problems and how the staff would respond

K.2.3 Execute

The execution phase of a project is when the sampling is occurring and measurements are being recorded. Quality Control (QC) begins with this phase and QA continues throughout the phase. QA requirements outlined for the planning phase are carried out during this phase. QC requirements for data recording during this phase differ slightly depending on the media that is being utilized to record field data.

During the execution phase, paper field sheet QC requires:

- If corrections to the data are necessary, the original information will be crossed out with a single line and the new information written next to the original entry. Information will never be erased and old information will never be overwritten.
- Upon return from the field, copies of all original data sheets will be made (backup for paper field sheets). The copies of the data sheets will be stored as specified in the protocol SOP, and the original data sheets will be used for data entry.
- Data will be entered as soon as reasonably possible after collection. Data entry will not be delayed until all the project data have been collected.
- Data entry will be done by someone familiar with data collection. Data entry staff will be familiar with the database software, database structure, and any standard codes. At a minimum, data entry technicians will know how to open a data entry form, create a new record, and exit the database properly.
- If feasible, data will be entered by two qualified persons; one person will read the observations and the other will enter the data
- All data entries will have a quick visual review during the time of data entry where the data entry technician verifies each record after input.
- At the end of each data entry session, the records will be printed to hardcopy forms and visually compared

Digital data QC requires:

- Completed field forms will be reviewed for errors each day and data that were not entered in the field will be recorded on the digital media;
- All digital files will be backed up to recording media (thumb drive, external hard drive, etc) at the end of the day;
- When extended field work is carried out periodic backups must be done to a permanent media such as writing a CD in addition to the backup above;

K.2.4 Control

This phase is shown as a separate step from the execution phase but actually occurs both during the execution phase and after it is completed. In fact, throughout the project life cycle it is important to evaluate shortcomings in information collection. Where possible, these errors must be corrected during the project life cycle, in every case they must be recorded to inform proceeding projects (the next seasons monitoring effort). Important QA/QC measures involved with this phase include:

- A broad requirement for both QA and QC for periodic random ‘spot checks’ to ensure compliance with protocol SOPs and QA/QC procedures. Deficiencies should be noted, corrected, and reported to the project leader.
- A review of QA/QC and SOP procedures for shortcomings noted during the execution stage;
- An exploratory data analysis, including normal probability plots, Grubb’s test, and simple and multiple linear regression techniques that provide insight into potential logical errors;

When errors are detected, corrections or deletions will require notation in the original field records about how and why the data were changed, the date of change, and who approved the edits.

K.2.5 Close

During the closure of a project:

- There will be a means to track data errors reported after dissemination
- QA/QC and SOP procedures will be reviewed by the project leader and recommendations for change will be included in a report.
- A statement of data quality will be composed by the project leader and incorporated into formal metadata
- Following closure, and assuming that all of the QA/QC steps were followed during the project life cycle, final project data will be incorporated into the correct operation databases and the appropriate metadata will be updated

K.3 External Information

Unlike information generated by the network, externally-generated information can be much more difficult to evaluate for quality. Figure K-2 indicates the general steps when dealing with external information. Quality assurance is impossible, while quality control is limited to ensuring the information is decipherable and valid.

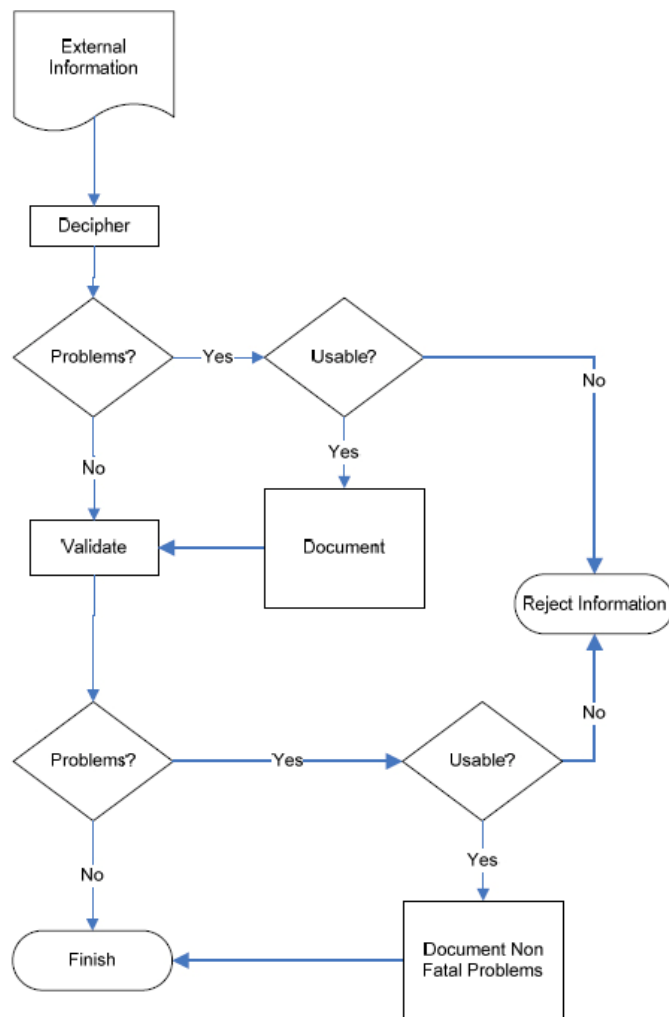


Figure K-2. General Quality Control Steps for External Information

K.3.1 Decipher

The first stage of evaluating externally generated information that is being reviewed by the Network for use is to make sure that it can be read and understood (deciphered). This process answers such questions as:

- Is there adequate metadata? (Complete, Clear, Contact Persons, etc).
- Are the protocols and SOPs that governed the collection of the data available?

K.3.2 Validate

Once the information has been deciphered and can be read and understood it must be reviewed for completeness and accuracy. This can include any or all of the following quality control reviews:

- Are there errors of omission? (Have important measures been left out?)
- Are there errors of logical consistency?

Upon review of the metadata, protocols, and SOPs:

- Do inconsistencies in the documentation cast doubt on the validity of the dataset?
- Do inadequacies in the SOPs cast doubt on the validity of measures?
- Is the study design documented in the protocols flawed?
- Was the field staff sufficiently trained to carry out the SOPs correctly?

K.3.3 Problems

If there are problems with either of the above steps the nature of the problems must be carefully evaluated and a decision must be made about the information's usability. If the metadata is inadequate or nonexistent it must either be corrected by reference to the author of the dataset or the dataset must be judged unusable.

In other cases the specific problem must be judged as to how seriously it jeopardizes the usability of the information by the appropriate members of the Network staff. The Data Manager is finally responsible for deciding on the usability of questionable data, although Network Staff will need to provide guidance based on their area of expertise.

K.4 Roles and Responsibilities

Project Leader

- Ensuring the appropriate QA/QC procedures are integrated throughout the project life cycle
- Ensuring the field staff are adequately trained

Data Manager

- Assisting the Project leader in integrating QA/QC procedures throughout the project life cycle
- Assisting the Project Leader in training the field crew
- Approving externally-generated information as being of adequate quality

Appendix L. Voucher Specimen Collection Management Guidelines

Update Frequency

As needed; Minimum Annually

Adapted From

Natural History Specimen Collection, Cataloging, and Deposition for Multiple Park Projects – National Capitol Region

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

L.1 Introduction

The collection of biological specimens is necessary to properly document species occurrences and to provide an important educational, scientific and research resource. Given the importance of biological collections it is imperative that the specimens are properly collected, cataloged and stored. The purpose of this document is to provide NPS staff (both regional and park based), cooperators and contractors with guidance on how to collect and process voucher specimens collected as part of regional (multi-park) projects.

L.2 Scope and Applicability

The standards described in this procedure pertain to all multi-park projects involving biological specimen collecting activities within the National Capital Region; however, parks are encouraged to apply the standards described herein to all projects taking place in a single park unit. Any individual (regional and park NPS staff, contractors or cooperators) who might be collecting biological voucher specimens for a project taking place in the National Capital Region must follow these standards and procedures. This guidance should be used in conjunction with the NPS Museum Handbook and all other NPS regulations and policies.

This document does not describe the procedure for preparation or curation of voucher specimens. Voucher preparation and curation are activities that require great skill and professional knowledge that varies by taxa and even by species. Curation should be addressed in detail through the scope of work and budget for each project. Researchers can review NPS guidance on preparing specimens in the NPS Museum Handbook Part I, Appendix T (<http://www.cr.nps.gov/museum/publications/MHI/AppendixT.pdf>).

L.3 Procedures and General Requirements

L.3.1 Research Permit and Reporting System

Principle investigators must obtain a research permit from NPS prior to beginning any scientific study on a national park. The National Park Service has developed the Research Permit and Reporting System (RPRS: <http://science.nature.nps.gov/research/ac/ResearchIndex>) to help streamline this process.

The purpose of the RPRS system is to help investigators: (1) apply for permission to conduct natural resource, cultural resource, or social science field work within a specific unit of the National Park System, (2) review permit application requirements and field work restrictions before applying for permission to conduct a study, (3) review the objectives and findings of previously conducted scientific studies before formulating plans for new studies, (4) grant permission to conduct studies within parks (5) provide an avenue for submitting annual accomplishment reports, and (6) search and review the types of research activities park managers are most interested in attracting. The RPRS system also provides links (Admin. Docs.) to information on the general conditions, guidelines and procedures granted and expected of the permittee under the permit.

It is imperative that investigators (including NPS staff and non-NPS personnel) provide detailed information regarding the project when requesting a permit through the RPRS system. This is especially true when describing specimen collection. Park staff (especially natural resource managers and park curators) must review these requests carefully to ensure that the collection procedures indicated by the investigator are adequate and acceptable to the park.

The permit application must specify:

- what kinds of specimens will be collected and whether those specimens will be exhausted during the investigation or permanently retained.
- the maximum number of a single species they plan to collect.
- the overall number of specimens they expect to collect.
- funding available to catalog and label specimens according to NPS procedures.
- the proposed repository must be identified for specimens that will be retained (e.g. listing “other institution” is not acceptable). If a non-NPS institution is chosen as the repository for the specimens, it must be confirmed in advance that the proposed institution will accept the specimens on long-term loan and that they meet NPS museum standards for housing museum collections.
 - This information should be confirmed by forwarding the non-NPS repository the research permit application. An authorized representative for that repository must sign the permit application thereby confirming that their institution meets NPS standards.

To facilitate the permit approval process, it is required that the applicant contact the park resource manager (Table L-1) and discuss the details of specimen retention, what data will be collected from specimens, how specimens or records will be submitted, and the proposed repository for biological collections. It is also very important that the park natural resource managers and park curators communicate with each other throughout this process to ensure that the proposed collections fall within the park’s Scope of Collections and that the investigators understand the collections guidelines. Specimen Collections and Guidelines

Table L-1: Contact information for Resource Manager/Curators at each SOPN park

Park	Resource Manager/Curator	Work Phone	E-mail
BEOL/SAND	Fran Pannebaker	719-383-5016	fran_pannebaker@nps.gov
CAVO	Brian Quigley	505-278-2201	brian_quigley@nps.gov
CHIC	Steve Burrough	580-622-3161 ext.601	steve_burrough@nps.gov
FOLS	Felix Revello	620-285-6911	felix_revello@nps.gov
FOUN	vacant		
LAMR/ALFL	Arlene Wimer	361-949-8173 ext.224	arlene_wimer@nps.gov
LYJO	Virginia Kilby	830-868-7128 ext.239	virginia_kilby@nps.gov
PECO	Daniel Jacobs	541-594-3053	daniel_j_jacobs@nps.gov
WABA	Dave Shafer	580-497-2742	dave_schafer@nps.gov

Upon successful completion of the RPRS application process and approval of the research permit, investigators commence with their research activities and begin specimen collection. To the extent that specimen collection may impact a population, it is important to weigh the destructiveness of sampling against the value of the information gained, especially when collecting rare species. Photographs, sound recordings, or specimen fragments should be considered as alternatives to collecting biological specimens.

The preparation and cataloging of specimens to NPS standards is the responsibility of the principle investigator (permittee) and must follow the guidelines outlined in 36 CFR and the Museum Handbook, Part I (Appendix T) and Part II (Chapters 3 & 4 and Appendix H), NPS Management Policies, RM77, Natural Resource Reference Manual #77, and Director's Order 24 for Museum Collections. This includes:

- Proper specimen preparation
- Proper specimen storage until specimens are transferred to NPS
- Proper labeling of the specimen in accordance with Director's Order #77 which states that NPS specimen labels:
 - Become a permanent record and identify the specimen as belonging to the NPS irrespective of where it is being stored.
 - Provide data that are essential to the identification of the specimen.
 - Must be completed by the collector before cataloging the specimen (this includes adding the NPS Catalog and Accession numbers to the label).
 - A list of the appropriate NPS labels can be found in Table L-2.
- Researchers/principle investigators should enter all specimen information into the project database (if one has been prepared for the project) or into an Excel spreadsheet specifically formatted for specimen information. Entering the specimen data in this manner will help facilitate the transfer of specimen information into the NPS Cataloging Database (ANCS+). Both the database and spreadsheet will be accompanied by documentation to assist the research when entering data.

Table L-2. List of NPS specimen labels and their associated NPS Form Number.

NPS Forms #	Label Title
500	Vertebrate Wet Specimen Label
501	Vertebrate Specimen Label
502	Skull Vial or Box Label
503	Invertebrate Specimen Label
504	Geology Collection
505	Paleontology Label
506	Wet Plant Specimen Label
507	Invertebrate Label
508	Egg Box Label
509	Insect Label
510	Annotation Label
511	Mineral Collection Label
512	Herbarium Collection Label

L.3.2 Cataloging Specimens

Park curators are responsible for providing the numbers (accession and catalog numbers) required by the NPS Automated National Catalog System (ANCS+) for the voucher specimens collected in their parks as well as the documentation. Four catalog numbers are usually set aside for 1) field notes 2) lab notes 3) photographs (other than specimen photographs) 4) final report. If a park does not have a curator then the data manager will assist the park with providing the numbers.

- Studies that require multiple specimens will be assigned one accession number for each park (ANCS+) and will have individual catalog numbers assigned to each specimen.
- Upon completion of the field work, but prior to the completion of the project or delivery of the collected specimens, researchers must provide the project leader with the number of specimens that were collected in each of the parks included in the project.
- The project leader must then request an accession number and the proper number of catalog numbers from each of the parks.
- Curators are expected to provide the requested numbers to the project leader within five to seven days of the request. It is imperative that the numbers are received in a timely manner to ensure that the specimens are processed quickly and can be transferred and archived appropriately.

Researchers/cooperators must enter all of the specimen information including the NPS accession and catalog numbers into the project database (if one has been provided) or the ANCS Excel spreadsheet. Either the ANCS spreadsheet or a project database will be provided to the investigator(s) at the onset of the project.

All documents relating to the accession must contain the accession number(s) i.e. reports, maps, databases, photographs, etc. In cases where multiple specimens of the same species or object are

collected at a single site on the same date, accessioning the group as a lot is an option. The lot would receive a single catalog number that covers all of the items in the grouping. The investigator must consult with park personnel to ensure that accessioning multiple specimens as lots is acceptable. If approved, the investigator will be required to provide detailed documentation for the specimens accessioned in the lot.

The principal investigator must provide each park with a project database/Excel spreadsheet upon project completion containing detailed information related to each voucher specimen collected. The information should describe whole or partial specimens, audio recordings, photographs and must include (at least) the following fields of information for each specimen:

- Park Code
- Scientific Name (following Integrated Taxonomic Information System convention)
- Taxonomic Serial Number (TSN, according to ITIS)
- Common Name
- Specimen Description (e.g. complete specimen or skull)
- Locality
- Latitude/Longitude or UTM X/UTM Y, Zone (for UTM coordinates)
- Geographic Datum
- Habitat Description
- Collected By
- NPS Accession Number
- NPS Catalog Number
- Collector's Specimen Number
- Collection Date
- Item Count
- Specimen Condition
- Preservation method
- Indicate if specimen is rare, threatened or endangered
- Identified by and date if identified by someone other than collector
- Formation (for paleo/geo specimens)
- Period/System (for paleo/geo specimens)
- Other supporting information may be required as determined by the individual needs or each project.

All voucher collections should be accessioned along with a copy of the final project report as well as other project documentation such as copies of the research/collecting permits and the research/project proposal. The park curators are responsible for uploading/entering the catalog information into the ANCS+ system. The preformatted database/Excel files should expedite this process by allowing the curators to import the information directly into the ANCS+ database.

L.3.3 Voucher Repositories

Ideally, specimens should be stored at the park where they have been collected. In order to increase the efficiency of processing and tracking voucher specimens, the park where the specimens should be the primary repository for ALL biological specimens. Accessioning the collection within the park it was collected will greatly increase the efficiency of voucher processing, simplify collection management and the accountability of collections and enable researchers to access specimens from multiple parks at a single location.

When depositing specimens, the NPS project leader must

1. Call the park and make an appointment to drop off the specimens.
2. Indicate what exactly is being deposited and the number of specimens.
3. Indicate the condition of the specimens (e.g. are they stored in solution, are photographs or are the study skins.).
4. Indicate that the specimens have been cataloged (i.e. have the appropriate information been entered into ANCS+ for each specimen).
5. The park should provide the depositor with a receipt of property form (Form DI-105) documenting the transaction. A copy of that form will be sent to the park curator.
6. Indicate how many linear feet of documentation will accompany the accession.

In cases where the park does not have adequate facilities to store and maintain specimens, the selection of another repository is appropriate: It should be noted that all voucher specimens collected on NPS lands are the property of the National Park Service, regardless of the final repository and as such any non-NPS institution must agree that any NPS specimens in their possession will remain NPS property. It is highly recommended, although not mandated, that when a non-NPS institution is identified as the most appropriate repository, the multi-park specimen collection be maintained as a single unit and not split into smaller collections with some located at parks and other at the alternate repository.

Any time NPS collections are loaned to other agencies or institutions, NPS Form 10-127 (NPS Outgoing Loan Agreement) must be completed and 10-127a (which describes the terms and conditions of the loan agreement) must be attached. All long-term loan agreements will be processed and tracked by park curators. Refer to Chapter 5 of the NPS Museum Handbook, Part II for additional information regarding loan agreements.

NOTE: Please refer to the permitting section of this document for additional requirements involved with the permitting process when a non-NPS institution is designated as the specimen repository.

L.4 Roles and Responsibilities

Principle Investigator:

Submit applications for research or collecting permits as soon as possible to ensure that processing does not delay the start of field work. Work with the park research coordinator or resource management staff – keeping them apprised of all park visits and research activities. The PI is also responsible for ensuring that all of their staff have copies of this SOP and of the research/collection permit and are aware of the specifics of these documents. Follow all rules and regulations applicable to voucher specimen collection on NPS property as outlined above. This includes making sure that all specimens are properly prepared including mounting, labeling, cataloging, and storage until they are turned over to the NPS. If questions arise, project staff should contact the NPS project leader with questions regarding permitting or specimen

collection. Any deviations from the guidelines described above (or in the contract/cooperative agreement) must be approved in advance by the project leader and in conjunction with park research coordinators and/or curators.

Park Resource Manager and Park Curator:

Work with the principle investigator to issue research or collecting permits and to stay informed about all park visits and research activities. It is imperative that park personnel in charge of permitting and curation ensure that all research and collecting permits are completed properly. This includes making sure that the permit meets the requirements of 36 CFR 2.5:

36 CFR 2.5: Field data, objects, specimens, and features obtained for preservation during inventory, monitoring, research, and study projects, together with associated records and reports, will be managed over the long term within the museum collection. Specimens that are not authorized for consumptive analysis will be labeled and cataloged into an appropriate cataloging system in accordance with applicable regulations.

- Accomplishing this requires that the natural resource management staff and park curatorial staff communicate with each other to ensure that both are in agreement on how specimens will be collected and processed. The importance of this cannot be understated.
- Park curators will be expected to provide numbers within five (5) to seven (7) days of the request. This is vital in order to ensure that biological specimens are processed and stored properly prior to them degrading.

Park personnel are expected to communicate all problems relating to the project to the project leader. Park curators are responsible for ensuring that all of the specimen information submitted by investigator is entered into ANCS+ upon completion of the project. This will involve importing the specimen information stored in the project database or specimen spreadsheet into ANCS+. The investigator and the project leader are responsible for ensuring that this information is accurate.

NPS Project Leader:

Provide all applicable project requirements and product specifications to the principle investigator at the beginning of all contracts or cooperative agreements (prior to the start of fieldwork). These materials include SOPs, databases, etc. The project leader is also responsible for ensuring that the PI receives training or orientation on any project materials. They must work with the project scientist, park resource management, and curatorial staff to ensure good communication and coordination throughout each project. The project leader is responsible for ensuring that all voucher specimens collected during a project are properly deposited at the appropriate facility and that the associated data is accurate and properly formatted for importing into ANCS+.

Outside Storage Facility (If applicable):

Receive and maintain all voucher specimens collected. In conjunction with park curators, coordinate and track all outgoing loan agreements involving vouchers specimens with other agencies or institutions. Arrange for the transfer of voucher specimens to the park in which the specimens were collected if the park desires to house the specimens and has the proper facilities to do so.

L.5 References

Code of Federal Regulations (2003), Title 3: (<http://www.access.gpo.gov/nara/cfr/page1>)
National Park Service (2000) Director's Order 24, NPS Museum Collections Management: (<http://www.nps.gov/policy/DOrders/DOrder24.html>)

National Park Service (2003) Museum Handbook
(<http://www.cr.nps.gov/museum/publications/handbook.html>)

National Park Service Natural Resource Management Reference Manual #77 (draft):
<http://www.nature.nps.gov/RM77/>)

Research Permit and Reporting System Frequently Asked Questions (2004):
<http://science.nature.nps.gov/research/ac/html/RPRSFAQ>).

DOI Departmental Manual, Park 411

National Park Service Management Policies (Chapter 4)

Appendix M. Web Page Development and Maintenance

Update Frequency

As needed; Minimum Annually

Adapted From

Web Page - Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

M.1 Introduction

The Network's web page is primary tool for Network communication. It will be a site for distributing reports, analyses, datasets, and other materials to its staff, member parks, the National Park Service, other government agencies, and the public. The web page is partitioned in two sites that are nearly identical structure, but differ in content. The first is the public internet-based web site with non-sensitive and non-proprietary materials. The second web site contains proprietary and sensitive materials considered of use and interest to the network staff, member parks, and other NPS personnel. The general format of the pages is guided by the standards set by the NPS and the I&M administration. Figure M-1 provides a conceptual model of how this operation functions.

M.2 Procedures

M.2.1 Information Sources

The web page operation receives all of its information from one of two sources. Externally, the NPS and I&M policies determine the web format and procedures while the Network's operations are responsible for content.

The web page administrator will regularly check the following regarding changes in NPS or I&M web page standards:

- Templates for I&M web pages are found at:
<http://www1.nrintra.nps.gov/im/datamgmt/webdev/networkmodel/index.cfm>
- NPS Natural Resource Web Manual (NPS 2006a)

Any links to a non-NPS site must trigger a disclaimer intercept, unless the partner's web site has been reviewed and approved by the NPS under a formal agreement. One of the following scripts will be used as an intercept:

- **General Intercept Script:** `<a href="/cgi-bin/intercept.pl?http://xxx.xxx.xxx">`
- **Partnership Script** - to be used with formal partner's websites with who there is a written agreement- `<a href="/cgi-bin/intercept2.pl?http://xxx.xxx.xxx/">`
- **Corporate Partnership Script** - to be used with links to commercial partners with which there is a written agreement- `<a href="/shell/intercept3.pl?http://xxx.xxx.xxx/">`
- **Concessions Script** - to be used with links to all official NPS concessionaire sites - `<a href="/shell/intercept4.pl?http://xxx.xxx.xxx/">`

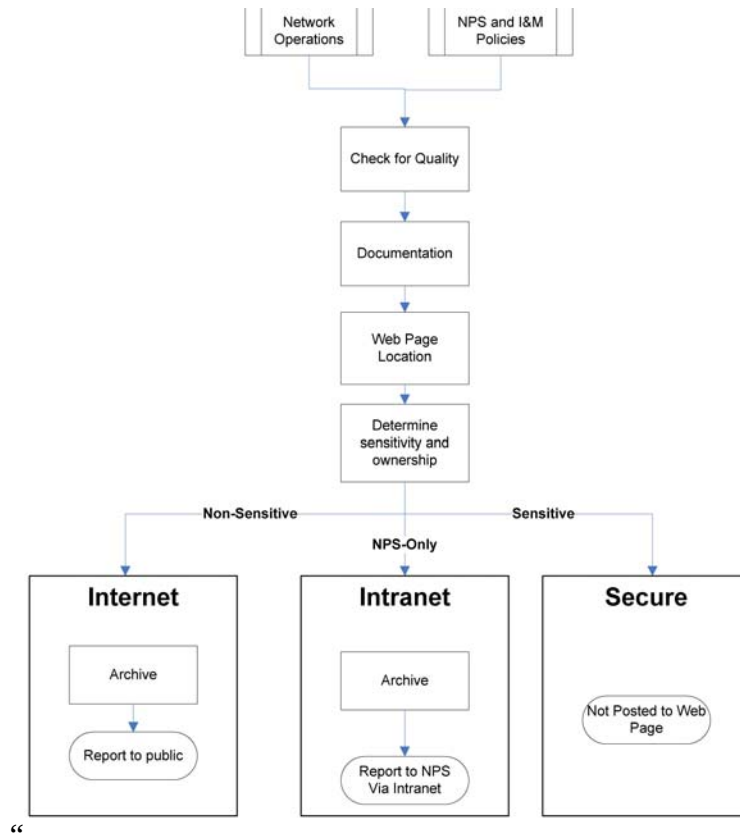


Figure M-1. Information Flow Chart for Maintaining the Network Website Content

M.2.2 Verify Quality

The web administrator will not post anything on the network web site unless it has been determined by another network operation (e.g., vital sign monitoring) to be of adequate quality. When received, it is not necessary to reevaluate the quality of information other than to verify this step was completed.

M.2.3 Verify Documentation

The web administrator will not post anything on the network web site unless it has been determined to be adequately documented. When received, it is not necessary to reevaluate the documentation other than to verify this step was completed.

M.2.4 Determine Web Page Location

All content to be posted to the web site will be posted to an appropriate page. The Network web site is divided among seven different pages.

- **Network Home** – Contains an introduction to the SOPN and shows current news and updates.
- **About Us** - Contains the name, title, address, phone number, and email address of the SOPN members and officers of the SOPN Technical Committee and Board of Directors.
- **Inventory** - Contains the latest inventory information for the member parks.
- **Monitoring** - Contains background information on development of SOPN Vital Signs and conceptual models.
- **Vital Signs Pages** - Contains specific information about SOPN Vital Signs, including protocols, sample designs, and reports
- **Data Management** - Contains the SOPN Data Management Plan, operation descriptions, the complete set of standard operating procedures.
- **Reports and Publications** - Contains completed inventory and monitoring reports, maps and administrative documents.

Both the internet and intranet sites follow a similar structure, with the main difference being the content that is available.

M.2.5 Determine Sensitivity and Ownership

A critical step is the determination of sensitivity and ownership. This specifies whether the information will be available via the inter- or intranet. All content on the public internet website must be approved as “non-sensitive”, meaning that the information is neither copyrighted nor sensitive. Content that has been classified as “Restricted – NPS Only” will be posted to the NPS Intranet website. Material designated as “Sensitive” will not be posted to either network websites. It is the responsibility of each person providing the information to specify the sensitivity.

M.2.6 Archive and Store

The Network maintains local copies of all web pages and their content in the \WEB\ folder. Under this folder are the internet (\INTERNET\) and intranet (\INTRANET\) sub-directories. Most of the folders adhere to the standard organization and naming conventions used by Cold Fusion.

M.2.7 Infrastructure

The Network uses Macromedia Dreamweaver MX to administer the inter- and intranet pages. Both sites can be access via mapped network drives. The steps needed to map to both the SOPN Internet site and the SOPN Intranet site are listed below. Figure M-2 illustrates the mapped drive dialog box.

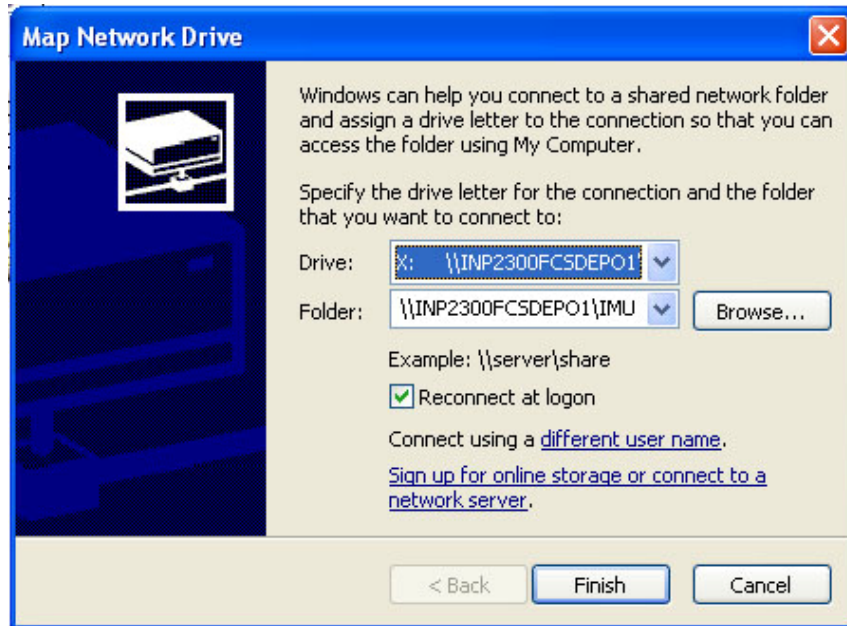


Figure M-2. Mapping a Network Drive

M.2.7.1 Connecting to the Internet Site

1. Select X: as the drive letter in the Drive: drop-down box (Another drive letter can be used, but to maintain consistency, X: should be used whenever possible)
2. In the folder box, type in either \\INP2300FCSDEPO1\IMUNITS\SOPN or \\10.147.158.138\IMUNITS\SOPN. Note: The hostname (INP2300FCSDEPO1) should be used whenever possible because IP addresses may be subject to change. However, those connecting via VPN may need to use the IP address.
3. Click the "Reconnect at logon" box.
4. Click the "Finish" button to complete mapping the drive.
5. If you're prompted for a userid and password, use your National Park Service (NPS) active directory/VPN account to authenticate (NPS\username).

M.2.7.2 Connecting to the Intranet Site

1. Select Y: as the drive letter in the Drive: drop-down box (Another drive letter can be used, but to maintain consistency, X: should be used whenever possible)
1. In the folder box, type in \\10.147.158.160\nrintra\im\units\sopn
2. Click the "Reconnect at logon" box.
3. Click the "Finish" button to complete mapping the drive.
4. If you're prompted for a userid and password, use your National Park Service (NPS) active directory/VPN account to authenticate (NPS\username).
5. If you're prompted for a user id and password, use your National Park Service (NPS) active directory/VPN account to authenticate (NPS\username).

M.3 Roles and Responsibilities

WASO I&M

- Provides the internet server facility

SOPN Web Administrator

- Manages web page updates and performs content maintenance

Network Staff

- Insure that content destined for the webpage has undergone QC before sending to the web administrator

M.4 References

NPS (2006). NPS Natural Resource Web Manual, National Park Service.

[<http://www1.nrintra.nps.gov/webnotes/NRWebManual/index.htm>], November 2006.

Appendix N. Approving Information for Distribution

Update Frequency

As needed; Minimum Annually

Adapted From

Approving Information for Distribution – Rocky Mountain Network

Revision History Log:

Old. Version #	New Version #	Revision Date	Author	Changes Made
1.0				

N.1 Introduction

This standard operating procedure outlines a strategy for approving data and information for release to the National Park Service, cooperators, and the public. This applies to all documents and datasets and their release in any form (via the web based internet or intranet, emailing electronic copies, providing printed materials, verbal descriptions, or any other form). Figure N-1 provides the decision tree network staff will follow when evaluating information for ownership (both in terms of data stewardship obligation and when handling proprietary information) and sensitivity.

N.2 Procedural Descriptions

All data and associated information from I&M activities will regularly be assessed for sensitivity and ownership prior to, during, and following field work, as specified by the field protocols and/or data management guidelines. Information types subject to review include, but are not limited to, reports, raw and manipulated data, and maps. The network lead is responsible for communicating all potentially sensitive resources to principal investigators and clarifying park and network policies related to the handling of such information. If data, reports or analyses must contain sensitive material, then the network lead will develop procedures to identify and appropriately process all potentially sensitive resources in any products that come from the project.

N.2.1 Point-of-Contacts and Classifications

For each project or protocol, the network will identify the network lead. This person, who is typically the project leader, will be responsible for communicating with PIs, cooperators and park staff.

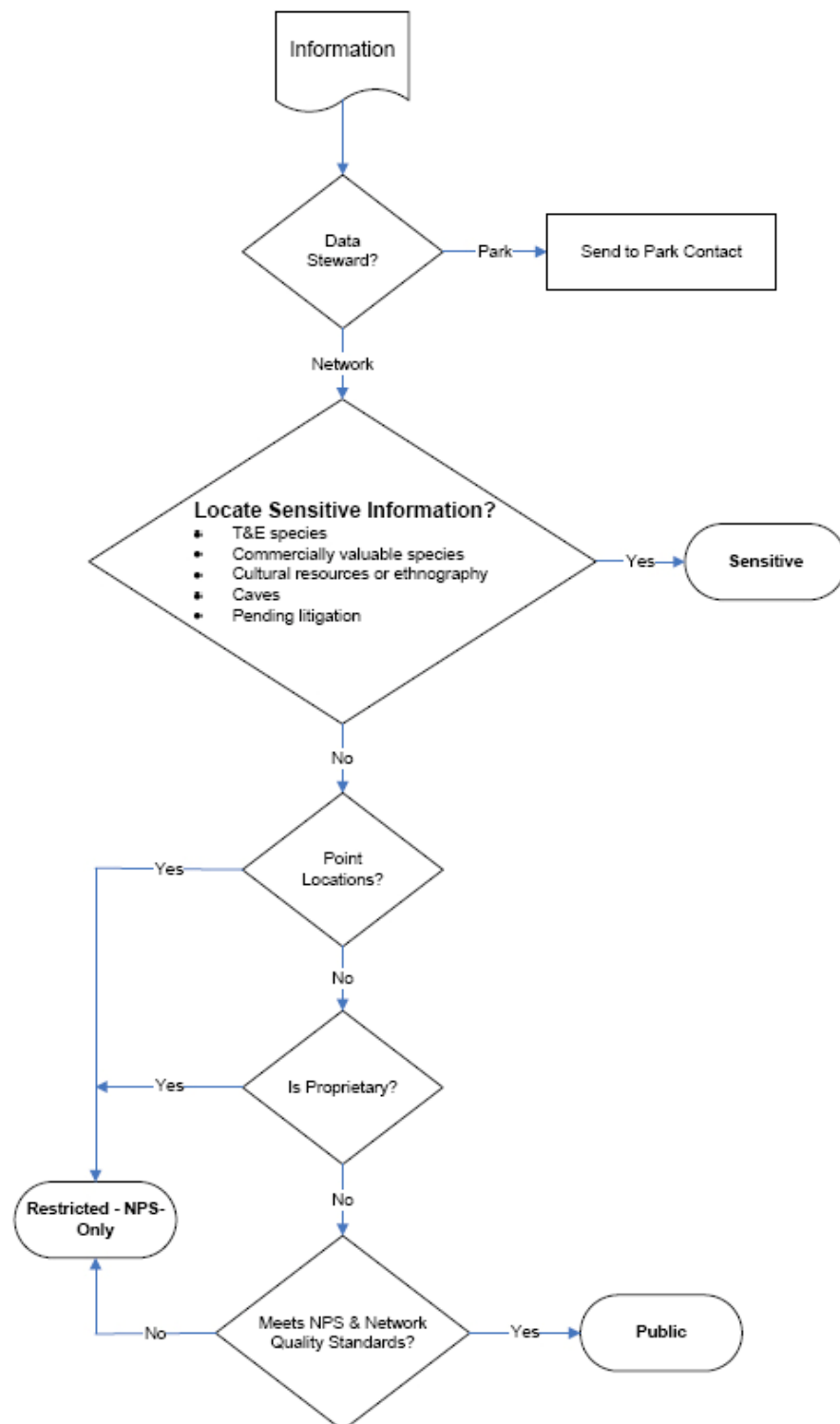


Figure N-1. Data Release Approval Process

Each park will identify one point of contact. This individual will be the one to receive all information identified as belonging to the park (see Section N2.2) and will be responsible for determining who will ultimately receive that information within and external to the park. This

person is also responsible for notifying the network if changes in park policies would affect the status of information.

For information that the network has responsibility for stewarding, information will be into one of three categories, depending on its sensitivity and ownership:

- **Public:** Approved for general release (Approved for Internet/Public posting). This information is not considered sensitive by national, network or park-level standards, is of high quality, fully documented, and non-proprietary. This information will be made available to all federal and non-federal entities and the general public.
- **Restricted, NPS-Only:** Only for release to the National Park Service (OK for Intranet posting). This information is not considered sensitive by national standards, but may reference specific point locations, be of questionable quality, proprietary, or intellectual property. All NPS staff, regardless of position and status, will have read-only access to this information. If information is requested by a federal or non-federal entity, or the public, it will only be released with the approval of the park contact.
- **Sensitive:** Not for release to the public or NPS. This information is considered sensitive by national or park level standards, and may also be of questionable quality or be proprietary. This data will not be accessible to a federal or non-federal entity, the general public, or NPS personnel unless approved by the park contact.

Data and information ultimately classified as **Sensitive** will be stored in a folder labeled /Sensitive/ on the network server, as specified in Appendix A - Central Files Directory Structure. This information will only be made available to park and network staff on an individual basis, as approved by the project manager, network coordinator, or designated park point-of-contact. Details related to management of potentially sensitive data that is collected or otherwise needed by non-NPS staff (e.g., cooperators, interns and student techs.) will be specified in the respective project or protocol. Approval for sharing this information will rest upon the network lead and the park contact.

N.2.2 Data Stewardship Responsibility

The first question to answer is who maintains the “official” copy of the data and is responsible for its upkeep. By clarifying this responsibly, confusion over versions will be minimized. In general any dataset consisting exclusively of information from a specific park will be the responsibility of that park and requests for that dataset will be routed through the park contact. Datasets which have been collected over several parks and surrounding areas to be used as the basis for vital sign monitoring activities are the responsibility of the Network and data requests will be handled by the Network.

The Network staff will evaluate information using the following questions:

- Is the dataset the result of vital sign monitoring operations?
- Does the natural resource material span multiple parks and surrounding areas?
- Has the park to which the information relates requested that the Network take responsibility for stewarding and distributing the material?

Answering “Yes” to any one of these questions places the responsibility of maintaining and distributing the data within the Network.

N.2.3 2.3. Sensitivity Evaluation

In cases where the Network has the stewardship responsibility, the Network staff will review material for sensitivity. Information is considered sensitive when it (1) describes the specific location, or (2) provides enough information to infer the specific location (e.g., a species is mentioned and there is only one location in the park where it could possibly exist) of the following:

- Wells,
- Endangered, threatened, rare, or commercially valuable species,
- Minerals,
- Paleontological objects,
- Objects of cultural patrimony,
- Archeological resources and/or artifacts,
- Ethnographic sites, and/or
- Caves.

The following questions aid in determining whether information is sensitive and should be protected (See US-DOI 2006 for further guidance):

- Has harm, theft, or destruction occurred to a similar resource on federal, state, or private lands?
- Has harm, theft, or destruction occurred to other types of resources of similar commercial value, cultural importance, rarity, or threatened or endangered status on federal, state, or private lands?
- Is information about locations of the resource in the park specific enough so that the park resource is likely to be found at these locations at predictable times now or in the future? (For example, raptor nests locations).
- Would information about the nature of the park resource, if available in conjunction with other public information, permit determining specific locations of the resource?
- Even if relatively out-dated, is there information that would reveal locations or characteristics of the park resource such that the information could be used to find the park resource as it exists now or is likely to exist in the future?
- Is the NPS unable to protect the park resource if the public knows or can infer its location?
- Is the information temporarily critical to some park's operations or negotiations (for a land purchase, water rights issue)?

An answer of “Yes” to any of these questions qualifies the information as being sensitive. If there is ambiguity as to whether information is sensitive (e.g., answers are indeterminate), it will be regarded as being sensitive.

Requests for access to all sensitive information, whether stewarded by the network or the park, will be routed to the respective park contact by the PI for approval. The park will have the ultimate say on how this information will be treated. These requests may occur when the network determines that cooperators will need this information to ensure they do not damage or interfere with sensitive resources. For instance, a cooperator may need to know the location of cultural sites during the protocol design stage to ensure that sampling points do not overlap. In other cases, a cooperator may be advised to avoid sensitive nesting locations or plants.

N.2.4 Point-Location Evaluation

Based on parks' previous experience with monitoring plots, even if they do not pertain to sensitive species or artifacts, public curiosity may jeopardize the long-term quality of such sites if they were to be visited or vandalized. Therefore, the Network will not unilaterally release information to the public that describes, with a high degree of precision and accuracy, any location within a park. Data is considered to be too location-specific if both its precision and accuracy are within +/- 100 meters. Any data record that meets both criteria will be classified as "Restricted – NPS Only." However, precise locations may be disclosed to active cooperators and contractors by the network to support specific monitoring purposes.

Meeting the +/- 100 meter accuracy and precision requirement can be addressed by one of the two following techniques:

- Round the UTM coordinates to the hundreds (e.g., 983667 to 983600 and 6689993 to 6689900)
- Add/subtract a random number between 1 and 100 to the UTM coordinates (e.g., 983667+43 and 6689900+23)

The one exception where the network will release non-sensitive point locations without first obtaining park permission is with network cooperators. However, collocation or overlap with sensitive resources (e.g., a rare species habitat, an important cultural site) would still only be disclosed with the prior approval of the park point-of-contact.

N.2.5 Proprietary/Ownership Evaluation

For this step, propriety refers to who holds, possesses or owns exclusive right to the data. Any copyrighted materials are assumed to be proprietary. Information is considered non-proprietary if it is publicly owned and distributed by any other governmental agency or if there is written permission by a private party that states that it foregoes any rights of ownership. The following questions apply when considering whether information is proprietary:

- Is it copyrighted?
- Are there other legal restrictions?
- Did the NPS or Network pay a third party for access to the data or does the third party normally sell this information?
- Has the data been collected by a non-NPS PI within the last two years and does this person plan to publish their results in a professional journal?

Answering "Yes" to any of the previous questions suggests the information is likely to be proprietary and/or intellectual property.

N.2.6 Quality Evaluation

Only information subjected to the network's quality control procedures will be made freely available to the public. Products of incomplete, poor, or questionable quality (typically legacy data) may not be appropriate for release by the Network, yet still have NPS-, Network-, or park-level value because they may be the only source of information on the natural history of a park, may have been the basis for early management decisions, and/or may still be valuable as baseline information. Information of questionable quality will always be accompanied by qualifying and explanatory documentation whenever it is published or used in reports or analyses.

N.2.7 Release

Datasets or other information will never be released before passing the classification procedure to ensure that sensitive or protected data are not made public. Investigators working on Network projects will:

- Submit all data and associated information to the network lead for the classification review process prior to release in any format.
- Ensure that any information classified other than “public” remains protected and not released to the public in any format.

When preparing or uploading information into any Network database, the Network staff will ensure that all protected information is properly identified and marked. The Network staff will work with the network lead to ensure that all references to protected information are removed or obscured in any reports, publications, maps, or other documents destined for a public forum.

Sensitive data will not be entered into any of the NPS I&M Program’s online web based applications; a metadata record, however, will be posted.

N.3 Roles and Responsibilities

Network Coordinator

- Communicate all sensitivity and ownership policies to network staff, PIs, and cooperators.
- Work with the park contact regarding any information identified as being restricted or sensitive

Park Contact

- Provide the Network Data Manager with any changes that would affect whether information is classified as being sensitive

Data Manager

- Maintain and updating this SOP

Cooperator

- Understand requirements of working with sensitive data (provided by NPS) and protect any sensitive information under their purview from unauthorized release.

N.4 References

US-DOI (2006) Freedom of Information Act Program, US Department of the Interior
[<http://www.doi.gov/foia/>], November 2006.

The Department of Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities

NPS D-93, September 2008.

National Park Service
U.S. Department of the Interior



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