



Protocol Implementation Plan for Bald Eagle Monitoring in Wrangell-St. Elias National Park & Preserve, Central Alaska Network

Version 1.0

Natural Resource Report NPS/CAKN/NRR—2018/1752



ON THE COVER

Adult bald eagle on the nest, Wrangell-St. Elias National Park & Preserve
Photograph courtesy of the National Park Service, Judy Putera

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Executive Summary

This document contains the Protocol Implementation Plan (PIP) for Bald Eagle Monitoring in Wrangell-St. Elias National Park & Preserve (WRST), Central Alaska Network (CAKN), version 1.0. The Monitoring Bald Eagles in Southwest Alaska Network Parks (SWAN; Wilson et al. 2017) protocol serves as the basis for this document. This PIP provides an overview of the methods for collecting, managing and reporting monitoring data for bald eagles, as described in the CAKN Monitoring Plan (MacCluskie et. al. 2005). The study design, data collection and analytical procedures are based on the SWAN protocol and have been previously published in the Journal of Wildlife Management (Wilson et al. 2014) and in two National Park Service Natural Resource Technical Report (NRTR) series publications (Thompson et al. 2009, Thompson and Phillips 2011). The methods described here also closely follow those outlined in the United States Fish and Wildlife Service's post-delisting monitoring plan (USFWS 2009).

Acknowledgments

We thank the Wrangell-St. Elias National Park and Preserve wildlife biologists and all the pilots who have been collecting and preserving bald eagle monitoring data since the early 1990's. We also thank the many SWAN biologists and data managers that conducted research to strengthen the survey methods which led to the SWAN bald eagle monitoring protocol, Standard Operating Procedures (SOPs), and database development. These documents provide the basis for the bald eagle monitoring program in WRST.

List of Acronyms

ARCN:	Arctic Network
CAKN:	Central Alaska Network
DENA:	Denali National Park & Preserve
DO:	Director's Order
ENIS:	Early Nest Initiation Survey
FOIA:	Freedom of Information Act
GAR:	Green-Amber-Red
GIS:	Geographic Information System
IRMA:	Integrated Resource Management Applications
JHA:	Job Hazard Analysis
KATM:	Katmai National Park & Preserve
KEFJ:	Kenai Fjords National Park
LACL:	Lake Clark National Park & Preserve
LPS:	Late Productivity Survey
NPS:	National Park Service
PASP:	Project Aviation Safety Plan
PIP:	Protocol Implementation Plan
PI:	Principle Investigator
PPE:	Personal Protection Equipment
SOP:	Standard Operating Procedure
SWAN:	Southwest Alaska Network
USFWS:	United States Fish and Wildlife Service
WRST:	Wrangell-St. Elias National Park & Preserve
YUCH:	Yukon-Charley National Preserve

Introduction

This protocol implementation plan (PIP) details the monitoring plan for bald eagles (*Haliaeetus leucocephalus*) in Wrangell-St. Elias National Park & Preserve (WRST), one of three park units in the Central Alaska Network (CAKN). The Monitoring Bald Eagles in Southwest Alaska Network Parks (SWAN; Wilson et al. 2017) protocol and standard operating procedures serve as the basis for this plan.

WRST will employ the SWAN protocol in its entirety, with minor modifications to the methods to account for its implementation in WRST. The SWAN protocol study design, data collection methods, and analytical protocols have been previously published (Thompson et al. 2009, Thompson and Phillips 2011, Wilson et al. 2014, Wilson et al. 2017). The methods described by SWAN are based on those outlined in the United States Fish and Wildlife Service's (USFWS) post-delisting monitoring plan (USFWS 2009). All WRST procedural modifications to SWAN SOPs are summarized below and fully described in WRST versions as identified in the SOP list (Table 7).

Within the SWAN protocol, sampling methods differ for each of the park units. Implementation of the SWAN protocol in WRST will occur with the following adoptions and modifications:

1. WRST will implement the SWAN protocol to address Measurable Objectives 2 and 3 stated in the SWAN protocol.
2. The region of interest in WRST includes shoreline habitat on Copper and Tanada Lakes, and riverine habitat along Tanada Creek, the Copper River, Chitina River, and Bremner River.
3. WRST will maintain the practice of assigning individual nests to a nest territory which may contain one or more alternate nests. Nests are identified by a territory number with each alternate nest numbered consecutively within the territory. For example, territory 10 might have 2 nests, identified as 10-1 and 10-2. This designation is termed a nest site ID. WRST maintains a list of territories and a list of individual nest sites.
4. WRST will implement the list frame sampling design as outlined for Lake Clark National Park & Preserve (LACL) in the SWAN protocol. The WRST list frame contains a list of all nest site ID's. All list frame nests are surveyed annually. New nests are added to the list frame as they are observed. The list frame contains a majority of the bald eagle nests in WRST.
5. WRST will conduct three formal nest surveys in the region of interest each year; two during nest initiation in May, and once again prior to chick fledging in late July.
6. Aerial surveys will be conducted with one observer and one pilot in a small tandem fixed-wing aircraft.
7. Data will be collected on paper data sheets specific to WRST.
8. WRST will enter data into the SWAN bald eagle database, with minor modifications, for WRST data collection.

Background

The Central Alaska Network (CAKN) has adopted a holistic view of network ecosystems and will track the major physical drivers of ecosystem change and responses of the two major components of the biota: plants and animals (MacCluskie et al. 2005). The CAKN has identified Fauna Distribution and Abundance as one of its top three Vital Signs. The Fauna Distribution and Abundance Vital Sign includes monitoring efforts for a suite of vertebrate species spanning the elevational gradient found in CAKN parks, and also includes species of specific interest within each park.

Raptors have been identified as a vital sign within this context because they are top trophic level predators that also act as indicators of bioaccumulative contaminants that persist in our ecosystems. One of three prominent raptor species will be monitored in each CAKN park unit. Golden eagles (*Aquila chrysaetus*) and peregrine falcons (*Falco peregrinus*) nest in some of the highest recorded densities in Denali National Park & Preserve (DENA) and Yukon-Charley Rivers National Preserve (YUCH), respectively and both parks have long-term datasets. In WRST, the Copper River and its major tributaries contains a high density of nesting bald eagles at the northern extent of their range and populations have been monitored there since 1987.

The USFWS began monitoring bald eagles on the Copper River in 1987 (Amaral 1988). A series of productivity flights in July covered the Copper River from the Chistochina River confluence to the delta. In 1989, nest initiation surveys were added, and two surveys per year were continued on various segments of the Copper River and some of its tributaries until 1997 (Faber 1989, Kozie 1996). In 1992, coastal surveys along the Malaspina Forelands were initiated, and continued through 1995 (Kozie 1996). No surveys were conducted in WRST from 1998 to 2003. In 2004, nest initiation and productivity surveys were conducted along the Copper River between the Chistochina and Chitina Rivers, and in 2005 the surveys were extended to Miles Lake on the lower Copper River. In 2006, the addition of Vital Signs funding allowed the expansion of surveys to include the entire Copper River from its source to Miles Lake, and nesting habitat along the Chitina and Bremner Rivers, major tributaries of the Copper River (Figure 1).

Annual aerial surveys were conducted using slow fixed-winged tandem aircraft with one biologist observer. All known nests were checked during a nest initiation survey conducted in May. Location, nest tree species, nest tree condition, nest integrity, and the presence and behavior of adult eagles were recorded for each nest site, including new nests. Nests having an incubating adult were revisited prior to chick fledging to determine nest success and chick productivity.

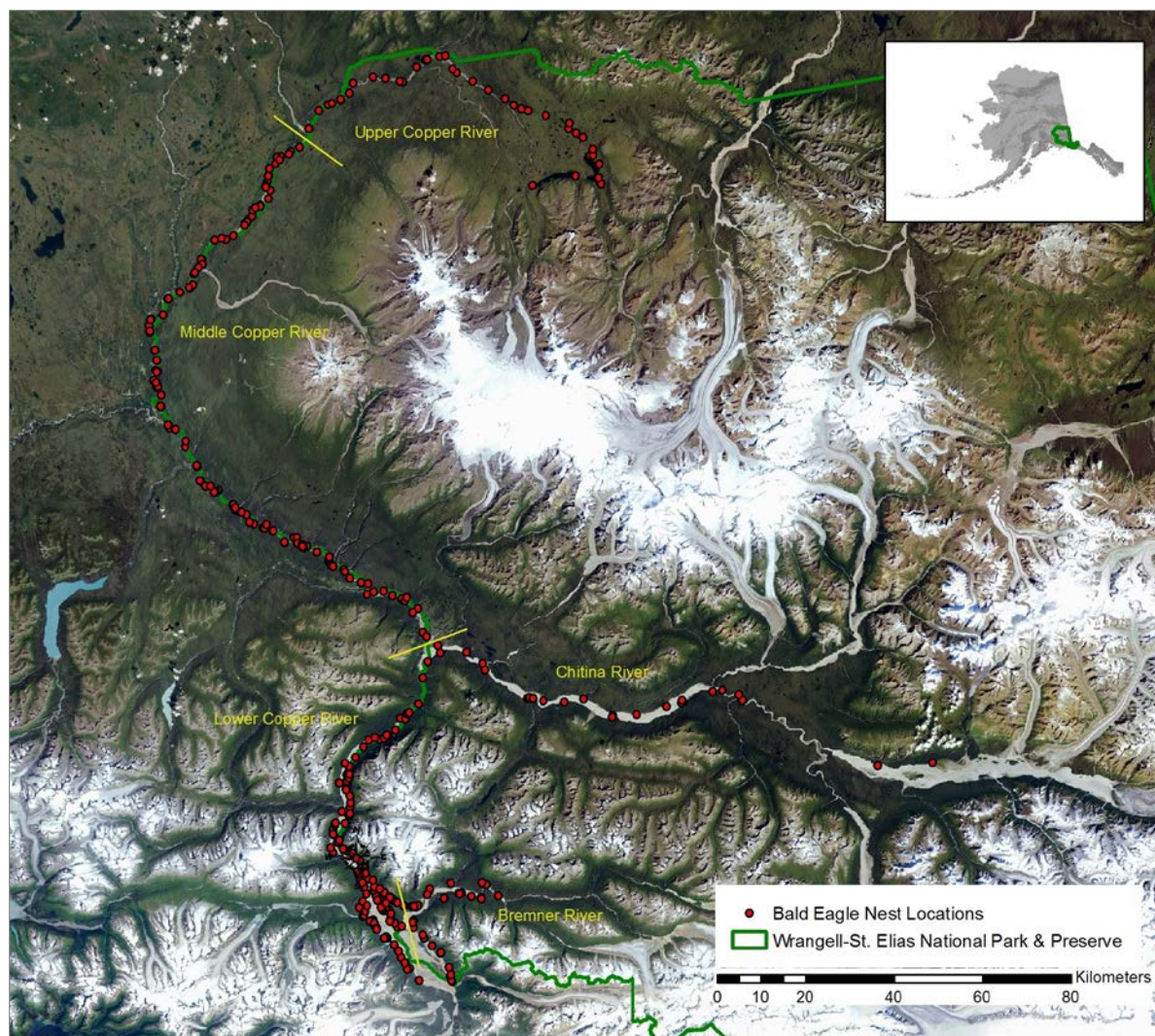


Figure 1. Sample area, including bald eagle nest sites, in Wrangell-St. Elias National Park & Preserve.

Conceptual Framework for Monitoring

As in the SWAN protocol, bald eagle reproductive performance is expected to be sensitive to current and long-term changes in terrestrial, freshwater, and marine systems, environmental contaminants, climate change, human disturbance, and catastrophic events such as oil spills (Table 1). We anticipate that CAKN climate related vital signs such as climate, glaciers, snowpack, and permafrost, as well as vital signs that measure plant phenology and vegetation structure and composition will be important for understanding how long-term ecosystem changes may affect bald eagle nesting and prey abundance. Of equal importance are non CAKN related monitoring efforts including salmon escapement and fish contaminants monitoring.

Table 1. Factors affecting bald eagles in WRST and potential measures for Vital Signs monitoring.

Category	Management Issue(s) informed by monitoring	Potential Measures
Freshwater and Marine Ecosystems	Commercial, recreation, and subsistence harvest of salmon and other fish species.	Annual salmon abundance and timing of the run at Tanada Creek and Long Lake weirs operated by WRST. Annual salmon abundance and timing of the run at Miles Lake Sonar on the lower Copper River operated by ADF&G. Harvest data from Federal Subsistence Fishery and State sport, personal use and subsistence fisheries.
Climate Change	Anticipated long-term climate change is predicted to alter bald eagle nesting phenology and prey abundance. Anticipated changes in vegetation structure and composition and hydrology of major rivers may affect the availability of large trees suitable for nesting.	CAKN and partner agencies Glacier monitoring of long-term changes and resulting hydrologic flow to major river systems. CAKN and partner agencies Climate monitoring using a system of high and low elevation climate stations. CAKN Vegetation Structure and Composition, Plant Phenology, Snow Pack, Permafrost, and Shallow Lakes monitoring.
Land Use and Recreation	Timber harvest and development on private land within park boundary and increased visitation may lead to increased disturbance to nesting bald eagles.	WRST front country and backcountry visitor use monitoring.
Contaminant Levels	Toxin contamination in resident freshwater fish that may be consumed by bald eagles.	Baseline sampling under the NPS Western Airborne Contaminants Assessment Project. USGS project to determine mercury levels in fish sampled from WRST Lakes. WRST, USGS, and USFWS project to determine mercury and semi-volatile organic compound levels in subsistence food fish.
Catastrophic Events	Oil transportation pipeline and highway cross watersheds that feed into the Copper River.	Catastrophic events can be monitored through news media

Measurable Objectives

The main objective of this PIP is to measure changes in the bald eagle breeding population in a region of interest in WRST. The SWAN protocol uses dual-frame (list and area frame) sampling to estimate bald eagle abundance within the area of interest in Katmai National Park & Preserve (KATM) and Kenai Fjords National Park (KEFJ) (Haines and Pollock 1998; U.S. Fish and Wildlife Service 2009). KATM and KEFJ also use double observer (Nichols et al. 2000) sampling to correct for missed nests during surveys, and modified occupancy sampling (Wilson et al. 2017) to correct the proportion of initiated nests if the peak nesting period is missed. LACL employs only list frame and modified occupancy sampling. In this case, abundance is not monitored in LACL.

A deviation in the measurable objective for this PIP compared to the source protocol is that the CAKN protocol will retain all the nest-level objectives and metrics of the SWAN protocol.

1. Estimate annual and long-term trends in the annual proportion of individual nests in which eagles attempt to reproduce (nest initiation). Nest initiation is not directly observable, and will be modelled using data obtained during two nest initiation surveys conducted in May.
2. Estimate annual and long-term trends in nest initiation success, expressed as the percentage of initiated nests that produced at least one young to near fledging for individual nests as well as nest territories.
3. Estimate annual and long-term trends in nest productivity, expressed as the number of young produced per initiated nest.

What's Being Measured and How

Bald eagle monitoring in WRST will closely follow sampling in the SWAN source protocol for LACL (Table 2). List frame surveys will be conducted in WRST based on a list of nests maintained by the park since 2006. The list frame contains a list of all known individual nests (nest sites). New nests are added to the list frame as they are found each year. Nests not found after 2 consecutive years are assumed to have been destroyed and are dropped from the active list frame each year. Two aerial early nest initiation surveys (ENIS) will be conducted in May to determine nest initiation. One late productivity survey (LPS) of all initiated nests will be conducted just prior to chick fledging. The number of chicks and chick age will be determined.

Table 2. Monitoring objectives, sampling methods, and variables measured at WRST as part of the protocol for monitoring bald eagles in CAKN.

Objective	Sampling Method	Data Collected	Analysis Tool	Derived Data
Nest Initiation	Replicate aerial survey	Eagle behavior and number of eggs.	WinBUGS script	Probability of nest initiation Probability of cue availability
Nest initiation	Resource-grade GPS	Spatial location of nest	ArcMAP	Known nest list maintenance
Nest Initiation	Aerial survey	Ancillary nest data	WinBUGS or R	Covariate data to be used for modeling state parameters or ecological questions
Chick Productivity	Aerial survey	Chick count	WinBUGS script	Mean number of chicks per initiated nest
Chick Productivity	Aerial survey	Chick age	NA	Used to estimate nest initiation date and for advanced analyses of nest success. Can also be used to monitor changes in nesting phenology

Sampling Design and Monitoring Schedule

The sample area in WRST extends along the Copper River from Copper and Tanada Lakes near the headwaters south to Miles Lake, 53 km upstream from the Gulf of Alaska (Figure 1). The Copper River tributaries to be surveyed include the Chitina River from the Copper River confluence to about 6 km upstream of the Tana River, and the Bremner River from the Copper River confluence to Three Mile Canyon. This sample area was selected because the Copper River is the dominant river in south-central Alaska, draining a basin of 68,600km², is under Federal management, and all or part of the area has been included in bald eagle surveys since 1987. The sample area also contains the majority of bald eagle nests within WRST. Bald eagles are known to nest along the 201 km coastline of WRST, however it would be a logistical challenge to include the coast habitat in the sampling scheme.

Table 3. Monitoring objectives, sampling frame, and scale of analyses at WRST as part of the protocol for monitoring bald eagles in CAKN.

Objective	Area Sampled	Spatial Design	Temporal Design	Scale of Analysis
Nest initiation	Copper Lake, Tanada Lake, Tanada Creek, Copper River, Chitina River, Bremner River	Visit all known nests (list frame) within the sample area	Two annual spring surveys	Region of interest.
Productivity	Copper Lake, Tanada Lake, Tanada Creek, Copper River, Chitina River, Bremner River	Visit all initiated nests	One annual summer survey prior to fledging	Region of interest.

Overview of Methods

Two early nest initiation surveys (ENIS) will be conducted during peak nest initiation in early to mid- May. All known, existing nest locations (list frame) are loaded into the aircraft and observer Global Positioning Systems (GPS). The surveys are conducted using a small tandem fixed-wing aircraft with 1 biologist/observer and 1 pilot. These aircraft are recommended because of the double-sided view provided to the observer, high maneuverability, and slow flight speed. Surveys are flown 46 – 91 meters (150 – 300 ft) above ground level at speeds sufficient to safely locate and determine nest contents. Each nest in the list frame is checked for initiation by the presence of an incubating adult. Behavior for each adult eagle is recorded. Empty nests are checked during the second nest initiation survey. The crew also searches for new nests in suitable habitat along the river corridors. Locations of new nests are recorded with the aircraft GPS and nest initiation status and ancillary data is recorded. A late productivity survey (LPS) is conducted just prior to chick fledging in late July. All initiated nests are checked to determine the number of young produced. The number of chicks and their developmental stage will be recorded. Nests with young will be classified as successful, and empty nests, without fledglings nearby, will be classified as unsuccessful. Data is recorded on paper data entry forms during each survey.

Data Management

Data Management Life Cycle

Data management for the bald eagle monitoring program will proceed through an ongoing life cycle as shown in Figure 2 (NPS 2008). Major stages of the life cycle include data collection, data entry and import, quality control, data product documentation and archival, seasonal closeout, dataset certification, and data analysis and reporting (Wilder 2005).

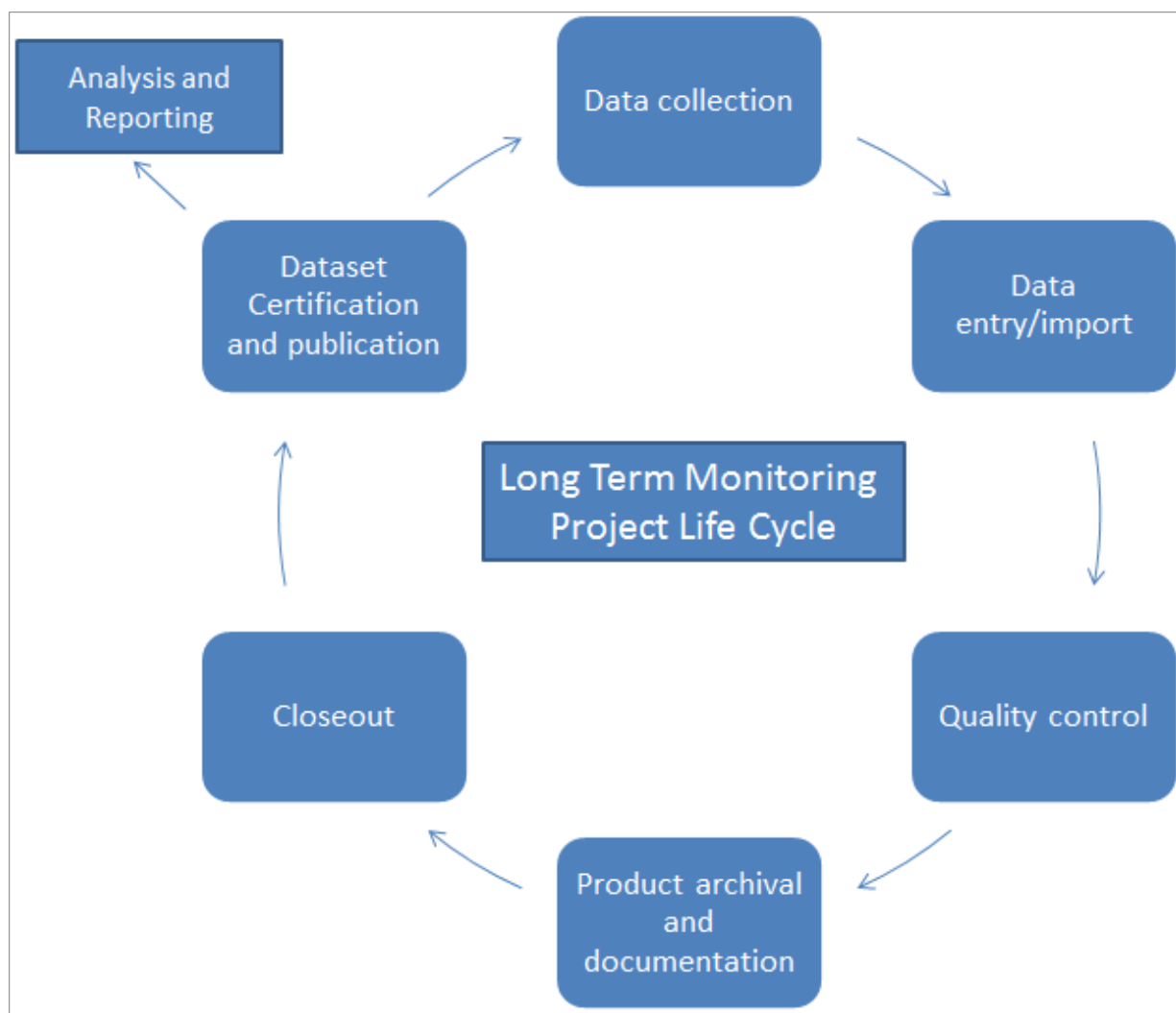


Figure 2. Long term monitoring project data management life cycle.

NPS Standards

Data Quality

Director's Order #11B mandates a high level of information quality from the service's scientific programs:

The National Park Service will ensure that information it releases will be developed from reliable data sources and will otherwise ensure information quality at each stage of information development. The NPS's methods for producing quality information will be made transparent, to the maximum extent practicable, through accurate documentation, use of appropriate internal and external review procedures, consultation with experts and users, and verification of the quality of the information disseminated to the public. The NPS will also keep users informed about corrections and revisions.

Information will be developed only from reliable data sources based on accepted practices and policies utilizing accepted methods for information collection and verification. It will be reproducible to the extent possible. Influential information will be produced with a high degree of transparency about data and methods. The information should include all pertinent information to allow the public to understand the park's legislative authorities, mission, activities, organization, strategic plan, performance plan, and performance accomplishments.

Director's Order #11A section 5.8: Data Integrity Standards outlines the NPS policy for accuracy, completeness and review:

All information owners will maintain all official NPS records and data in a manner which meets the highest data integrity standards, including timeliness, accuracy and completeness (also see DO #11D). Each information owner will take whatever steps necessary to ensure that NPS systems have sufficient data quality reviews and audits from both an internal system perspective, as well as externally thorough control reviews.

Adherence to the data management procedures in this monitoring protocol will ensure compliance with DO#11.

Freedom of Information Act

The Network will comply with all FOIA restrictions regarding the release of data and information as instructed in NPS Director's Order #66B.

Records Management

Direction for managing physical and digital materials is provided in NPS Director's Order 11D.

The NPS has a strong business need for excellent records management, in that the Service's mission is to care for natural and cultural resources so that they are left "unimpaired" for future generations. This requirement for managing resources in perpetuity sets a high standard for record keeping. No resources can be managed well in the future without complete records of how they were managed in the past. Because the NPS manages some of America's most significant cultural and natural resources, the public also has a significant interest in our records. Section 1.9.2 of NPS Management Policies 2006 (NPS, 2006) states that the future of the Service depends on the availability, management, dissemination, and preservation of information, and directs the agency to implement professional quality programs to manage information resources.

Core Functional Model

Data generated by the bald eagle monitoring program are managed according to the Core Functional Model described in Figure 3.

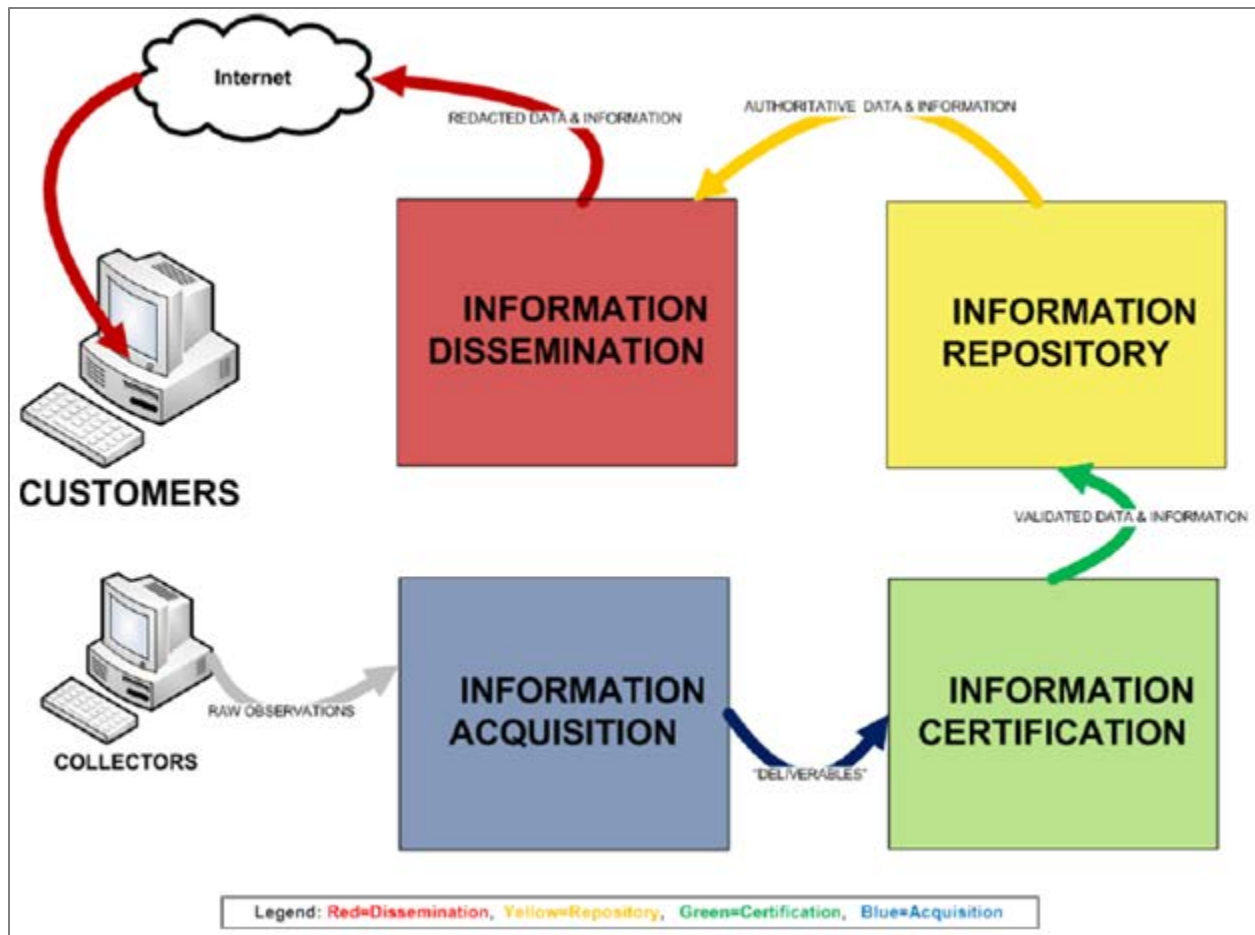


Figure 3. The ARC/CAKN Core Functional Model overview.

Dissemination services (red, Figure 3) provide all deliverables to all customers using internet web sites and web services through the NPS Integrated Resource Management Applications (IRMA) Data Store. Repositories (yellow) store the certified inventory and monitoring products called for in the protocols. Certification processes (green) assure repositories have the highest quality data and that sensitive items are restricted to authorized users. Data acquisition processes (blue) led by park staff and cooperators include a wide array of tasks, ranging from collecting raw data to composing reports on long-term trends.

Data Sensitivity Statement

The CAKN bald eagle monitoring protocol does not define the collection of sensitive data and requires no special handling procedures.

Roles and Responsibilities

Project Leader

- Ensures that the bald eagle monitoring protocol and all of its standard operating procedures are current and up to date. If methods must be changed the project leader ensures that the standard operating procedures remain synchronized with actual data management operations.

The project leader ensures data is collected, processed and integrated with the master database consistently and strictly according to the specifications and methods described in the standard operating procedures. Performs an annual closeout with the Network program manager and data manager.

- Certifies the monitoring dataset for analysis and publication and assures that the standard operating procedures are current and up to date.
- Performs analytical procedures and reports on findings
- Arranges technicians and budgets for data management costs, such as data entry and processing.

Data Manager

- Provides for the security, longevity and accessibility of the moose monitoring dataset.
- Maintains software and hardware for file backups and security, databases, custom and proprietary applications and GIS tools.
- Guides personnel in data processing techniques, metadata generation and product archival in NPS data stores and enterprise databases.
- The data manager is not responsible for data entry, processing, metadata generation or archiving data deliverables.

Quality Assurance

The bald eagle monitoring program plans for high data quality assurance by proactively deploying a system of administrative procedures and technological safeguards including:

- WRST and SWAN bald eagle monitoring standard operating procedures (Putera 2017, Wilson et al. 2017) designed to minimize the introduction of errors during data collection and processing.
- Field crew training.
- Standard database security and integrity functions and data integrity constraints (Frakes et al., 2015) to enforce compliance with the Vital Sign's logical data model.
- Application level data entry checks and business rule enforcement.
- Periodic data quality audits and reports.

Data Collection

The bald eagle monitoring program creates and maintains specific data deliverables. Each deliverable is disseminated directly from the IRMA Data Store, the single authoritative source for Network products. In the event that a data product ever diverges from that in the IRMA Data Store the latter version should be considered authoritative. Deliverables follow a Builder-Validator-Certifier task chain to assure products are produced to a standard of high quality and archived for posterity.

The WRST bald eagle monitoring will use SWAN's bald eagle data management standard operating procedure #3 (Wilson et al. 2017), hereafter referred to as SWAN SOP#3, but SOPs specific to WRST take priority where procedures conflict.

Deliverables Schedule

The bald eagle monitoring program will create and maintain the data products shown in Table 4.

Table 4. Bald eagle monitoring deliverables schedule.

Identifier	Deliverable	Schedule
BE-01	Paper data collection forms	Sample date +1 year
BE-02	Scans of field data collection forms	Sample date +1 year
BE-03	Aerial survey images	Sample date +1 year
BE-04	Waypoint files	Sample date +1 year
BE-05	Tracklog files	Sample date +1 year
BE-06	Transcribed electronic data deliverable	Sample date +1 year
BE-07	Early Nest initiation flight database import file	Sample date +1 year
BE-08	Early nest initiation survey database import file	Sample date +1 year
BE-09	Late productivity flight database import file	Sample date +1 year
BE-10	Late productivity survey database import file	Sample date +1 year

Database

The WRST bald eagle monitoring program has a single, authoritative Microsoft SQL Server database built according to I&M standards (NPS, 2015) and hosted by the Inventory and Monitoring Division in Denver, CO.

Data Entry/Import

The WRST bald eagle monitoring program will use the database and data management application developed by the Southwest Alaska Network. Personnel will integrate the data collection deliverables with the SWAN_BaldEagles database following the standard operating procedures in SWAN SOP#3 and the database application help files. Certified records will be published through the IRMA Data Store using standard CAKN product integration processes (Figure 4) (Miller 2017).

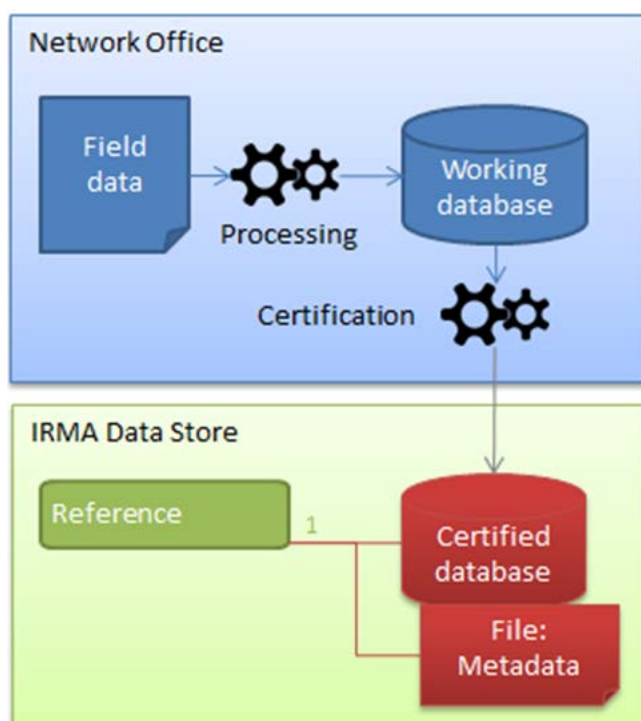


Figure 4. Overview of database architecture and system data flow.

Processing and Workflow

The types and requisite processing steps for data to be collected as a part of the CAKN bald eagle monitoring protocol have been documented (Table 4, Table 5, SWAN SOP#3).

Table 5. Data processing and certification matrix for the CAKN bald eagle monitoring protocol. Procedures for processing and certifying datasets are outlined in SOP 4.

Data Processing Level	Activities Performed
Level 0 (Unprocessed)	Data sheets (BE-01) Data sheet scans (BE-02) Photographs (BE-03) GPS locations of new nests (BE-04) Tracklogs (BE-05)
Level 1 (Entered/Validated)	GPS projected into Alaska Albers Equal Area Conic projection. Photos downloaded. Datasheets checked for completeness and errors and scanned. New nests assigned a nest number. Datasheets entered into transferable digital format (BE-06)
Level 0 (Unprocessed)	Data imported into provisional database. Queries run on database to locate possible errors.
Level 1 (Entered/Validated)	Deliverables archived. Data imported into master database. Data published to NPS Data Store
Level 0 (Unprocessed)	List of known nests. Custom queries for analysis.

The ENIS and LPS data collected during the survey are recorded on data sheets (BE-01). Digital photos (BE-03) of nests, habitat, snow extent, and tree phenology are collected. Observers record GPS waypoints (BE-04) of latitude and longitude coordinates of nest trees. As soon as the survey is finished, the data are reviewed by the observer. The data are reviewed to ensure that all known nests are visited and the data is recorded, and that the codes for behavior, numbers, chick age, etc. are correct and/or reasonable (e.g., 4 adults at one nest would seem high for number of adults and would be flagged as a potential error). The coordinates collected for new nests are displayed on a map immediately after the survey to see whether they occur where expected (e.g., over land and not in water, and in relation to previously known nests). The assigned nest identifiers for new nests are double checked to make sure that the next available number (consecutive identifier) has been used. For previously known nests, observers will check that the survey coordinates are near the assigned coordinates for the nest, if new coordinates were collected. Note that there is some horizontal error expected when collecting nest coordinates in a moving aircraft.

For data collected on data sheets, the data should be transcribed into an electronic format (BE-06). Cross-reference all records with the physical field forms to make sure transcription errors are corrected. Fix all errors at this sure all records are complete and error free. If data were not recorded in the field, make sure appropriate null data values are included. Please reference SWAN SOP#3 and SOP 4 for more detail about data management. Once data are converted to an electronic format, the data file is uploaded into the bald eagle monitoring database, which is in development and will be managed by SWAN. Data uploading will fail if required fields are left blank or contain invalid entries. Therefore, it is very important to ensure proper quality assurance procedures are used, and codes followed at every data entry step. The data will be incorporated into a master database with the data published to the NPS Data Store once certified for quality and completeness of the data, following IMD standards.

Quality Control

Ensuring high data quality as a high priority for the bald eagle Vital Sign. Quality control procedures focus on verifying data as well as identifying and correcting errors in final data products. Quality control safeguards are described in SWAN SOP#3 and also include:

- Data verification and/or double data entry procedures
- Spot checking
- Automated programmatic range, domain or impossible value checking
- Graphical and visual exploratory data analysis
- Statistical error or outlier identification
- Data quality audits and reporting.
- Dataset certification

Product Archival and Documentation

Director's Order 11D states that all records of natural and cultural resources and their management are considered mission-critical records (necessary for fulfillment of the NPS mission) and must be

permanently archived. Mission critical deliverables are considered to be archived when they are uploaded to the IRMA Data Store. With few exceptions IRMA is the only authoritative repository for mission critical I&M products. Product archival, seasonal closeout and certification procedures that will be used by the CAKN bald eagle monitoring program are broadly described in CAKN DMSOP#1 titled “*Product Archival, Seasonal Closeout and Dataset Certification Procedures for the Arctic and Central Alaska Inventory and Monitoring Networks*” (Miller 2017).

Data archiving is done in concert with seasonal close out and data certification. All data are archived in the following ways:

- IRMA Data Store. Formats may include:
 - o Raw and processed data files described in this protocol’s deliverables schedule.
 - o Human readable text file of all bald eagle monitoring databases. A SQL script is built that can recreate the entire database and all the data within it.
- Network file server
- SQL Server database
- SQL Server snapshot backup packages that can be restored to a server with low latency.
- Within ARCN/CAKN’s database backup files

Bald eagle monitoring program data are maintained on a network file share and SQL Server database located in the Fairbanks Administrative Center (FAC) in Fairbanks, Alaska. The certified database content is backed up to off-site storage and also copied to an I&M authorized data center. The I&M program and FAC use enterprise-level business continuity processes to maintain their version of the bald eagle database. In the event of catastrophe at one site, the original data may be restored from the other.

IRMA Data Store

The NPS IRMA Data Store is the primary organizational repository and publication platform for information related to the bald eagle monitoring program. The bald eagle Vital Sign has a single master IRMA project reference (<https://irma.nps.gov/DataStore/Reference/Profile/2216071>) to which all products are related (Figure 2, Figure 5; Miller 2017).

The public Vital Sign web page covering bald eagle monitoring will publish the releasable contents of this reference and its related references via web services. It is the joint responsibility of the PI and the data manager to keep the system of related IRMA Data Store references up to date.

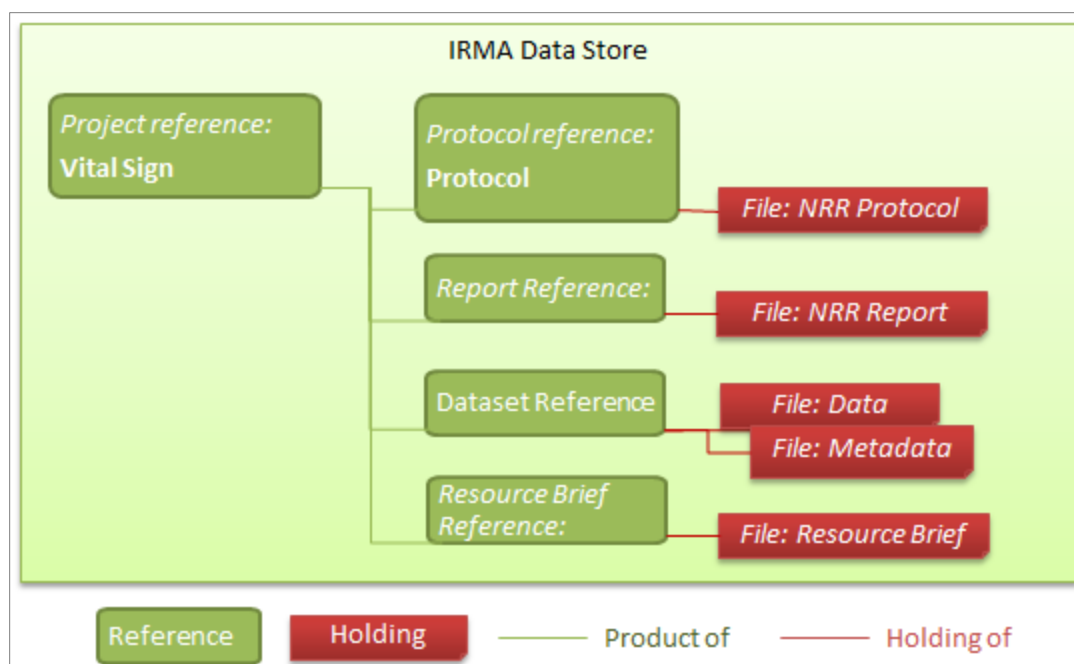


Figure 5. Standard ARCN/CAKN Vital Sign Project reference architecture in the IRMA Data Store.

Reports

Reports are published in the NPS Natural Resource Report publication series (<https://www.nps.gov/im/publication-series.htm>) or professional journals. Reports and journal articles reporting analytical results will be published in tandem with the dataset that was used.

Natural Resource Reports are automatically tracked and announced to Network program managers and data managers but journal articles are not. The PI will create Data Store references for journal articles related to monitoring, link them to the Vital Sign's IRMA Project reference (Figure 5) and notify Network staff of their presence.

Data

All reports providing statistical results will also publish the data on which they were based. Metadata will be provided as well as a link to the certified original dataset (NPS 2005). Data are made available through IRMA in machine readable formats according to Director's Order #11A and as mandated by the Federal Open Data Initiative (Executive Order No. 13642).

The bald eagle Vital Sign will have a single public dataset reference in the IRMA Data Store to which certified data will be published (Figure 5). This reference will be the only authoritative data source available to the public.

Resource Brief

The I&M resource brief is the primary outreach document for the bald eagle monitoring program. The principal investigator will revise any existing resource brief after new findings to reflect current understanding of the resource's trend and implications for park management. Resource briefs are

made available on the Network web site through an IRMA Data Store Resource Brief product reference that is attached as a product of the main Vital Sign Project reference (Figure 5).

Products Publication

Reports, datasets and other monitoring products are published through NPS websites using the Vital Sign's master Data Store Project reference via web services exposed by the IRMA Data Store. Authoritative products will only be distributed through the IRMA Data Store (Figure 5).

Metadata

All project datasets, including spatial and non-spatial data, are archived in the IRMA data store with metadata (NPS 2005; Figure 5). The mandate for adequate metadata comes from Director's Order #11A:

All NPS data systems will develop data dictionaries and conform to available NPS organization-wide dictionaries. Geographic Information and Metadata must meet all Federal standards, DOI standards and NPS standards.

Preferred metadata formats include [Federal Geographic Data Committee](#) (FGDC 1998) and [Ecological Metadata Language](#) (KNB 2017).

Line of Sight

Line of Sight is the informal name given to the I&M program's philosophy that every datum should be inextricably linked in a traversable way to the standard operating procedure and protocol version that guided its collection. This custodial chain is maintained through metadata columns in the main monitoring database coupled with metadata maintained in each protocol and standard operating procedure's IRMA reference. A data consumer will be reliably able to access a data record and discover the standard operating procedure version that defined its collection and processing (Figure 6).

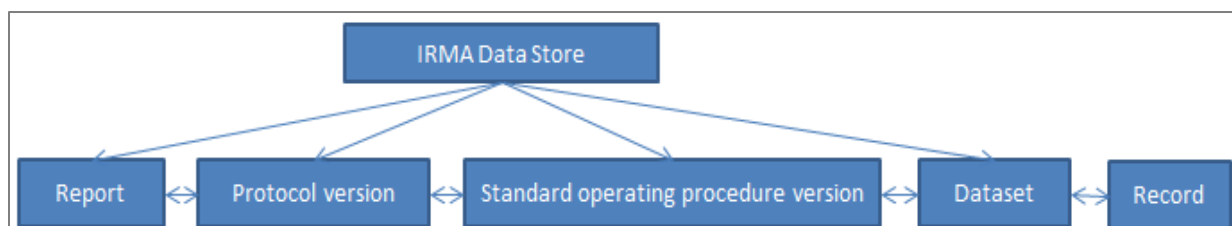


Figure 6. Each informational component informs and is informed by other components. Discovery of one component leads to discovery of all other components in a formalized data management chain of custody.

Data and Information Security

Digital products produced by the bald eagle monitoring program will be stored in the IRMA Data Store, databases on I&M and/or local servers, and the Network file server in descending order of preference. Under no circumstances will any mission-critical information reside on individual I&M staff computers whether they are assigned to monitoring personnel by the NPS or not. Project

materials will be secured and available on I&M servers at all times. The data manager, in conjunction with IT staff at FAC and with the Network support office in Ft. Collins, CO is responsible for backups, security and longevity of monitoring data.

Closeout

Closeout is the part of the bald eagle monitoring data management life cycle through which seasonal data collection files (deliverables, Table 4) are archived in the IRMA Data Store. Specific closeout procedures are found in ARCN/CAKN Data Management Standard Operating Procedure #1 (CAKN DMSOP#1; Miller 2017). Closeout happens after a re-measurement cycle when data files have been collected, processed and integrated into the main monitoring database. After field data are integrated with the master monitoring database they are archived as holdings of private IRMA Dataset References (Figure 5). Closeout is complete when the IRMA Dataset's holdings match the deliverables schedule (Figure 7). After closeout all permissions are removed from the season's IRMA Dataset reference except for the project leader and data manager. The dataset reference will then be linked to the main bald eagle monitoring IRMA Project reference so that it becomes discoverable within the NPS.

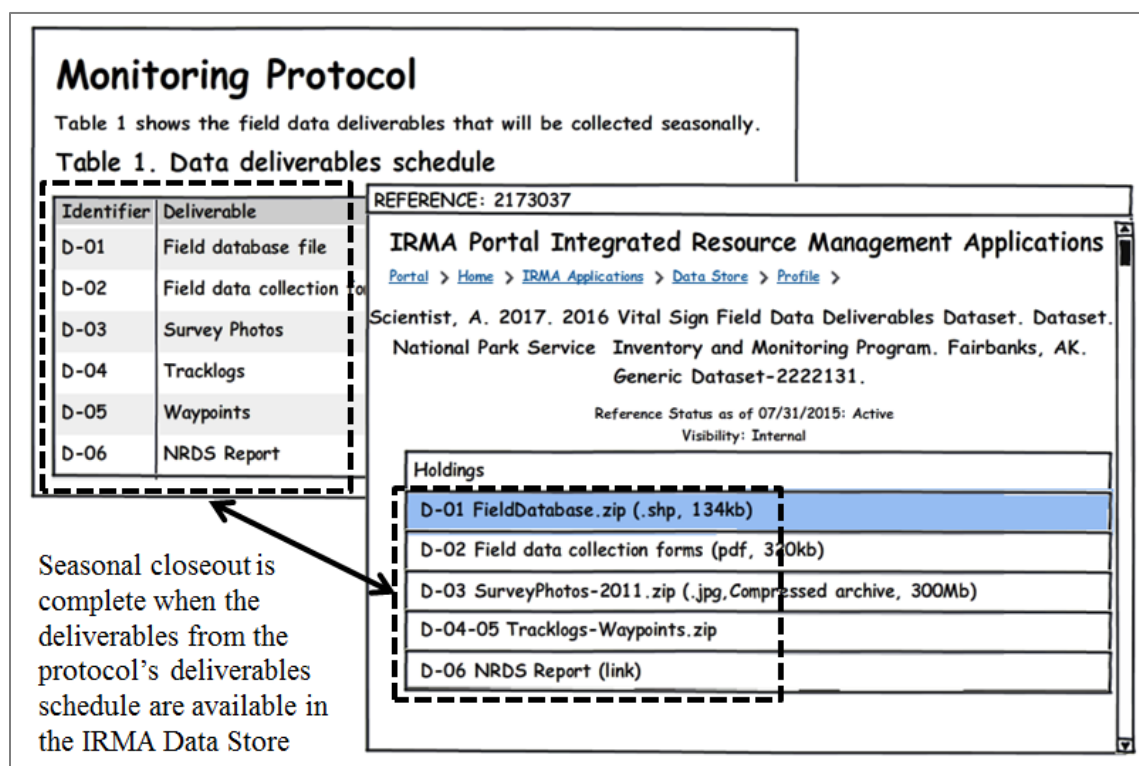


Figure 7. Data deliverables are defined in the monitoring protocol and archived in IRMA Dataset references after each remeasurement cycle. Closeout is complete when the holdings in the remeasurement Dataset reference match the deliverables in the protocol's data deliverables schedule. Note: the deliverables shown in the diagram are for illustrative purposes and do not reflect the actual WRST bald eagle monitoring deliverables shown in Table 5.

The closeout method described above will ensure that all data objects collected during a remeasurement cycle are accounted for, documented and available for perpetuity should the need arise to revisit the data.

Certification

Certification is the phase of the landbird monitoring data management life cycle where the principal investigator formally confirms that the Vital Sign's dataset is ready for analysis (NPS, 2016). Certification also affirms the scientific, administrative and technical integrity of the program including:

- The protocol and standard operating procedures are current. All technical changes are up to date and documented.
- Raw and intermediate data deliverables have been processed via quality control procedures, have been integrated with the vital sign's database or data management system and have been archived and documented appropriately for posterity.
- Each data record is traceable to the protocol version and SOP version that guided its collection.
- All closeout activities have been performed.
- The certified database or data files have been published to the Vital Sign's public Dataset reference in the IRMA Data Store.
- The Vital Sign's IRMA Data Store references and cross-links are complete.
- The dataset is of sufficient quality that analyses may be performed on it and the results published.

Budget

The estimated budget for this program is summarized in Table 6. Most of the funding for this project is used for aerial surveys and these costs range from \$5,200 to \$9,100 depending on whether a NPS or charter pilot/aircraft are used. There are no start-up costs associated with this project. WRST has several suitable GPS units, a satellite phone, and a digital camera available for the project. Other equipment such as batteries for GPS units, phone, and camera is minimal. The funding for the PI comes directly from WRST and is not a factor in the budget. The PI time commitment is as follows: approximately 24 hours with preseason logistics, 32 hours post processing data from the early and late surveys and 16 hours for data entry.

Table 6. Estimated annual operating costs (based on FY2017 dollars) for implementing bald eagle monitoring in Wrangell-St. Elias National Park and Preserve, Alaska.

Item	Estimated Cost NPS Aircraft	Estimated Costs Charter Aircraft
Aircraft + Fuel Cost: ENIS (24 hrs)	3,000	6,000
Aircraft + Fuel Cost: LPS (12 hrs)	2,100	3,000
Equipment/supplies	100	100
Total	5,200	9,100

Safety

Implementation of this protocol has multiple complex risks. Staff will continuously evaluate all risks during the surveys at the programmatic, personnel, and site level. Programmatic-level safety information is presented in SOP 7 and summarized below.

Risks associated with implementation of this protocol implementation plan are mainly associated with the low level aerial survey. Project Aviation Safety Plans (PASP) will be completed and approved prior to sampling each year. The PASP includes all important information about the flight and will be distributed to all participants involved in the project. A Green-Amber-Red (GAR) risk analysis to identify risks and abatement strategies will be included in the PASP. Flight plans are filed with flight following personnel. The pilot and observer will complete a pre-flight briefing covering safety features of the aircraft and review go-no go checklists. All flight crew personnel will obtain the requisite aviation safety training and wear the required personal protection equipment (PPE).

Standard Operating Procedures

To ensure consistent implementation of this protocol over time, the following Standard Operating Procedures (SOPs) have been adopted from SWAN SOPs or developed as needed by CAKN (Table 7). To the greatest extent possible, SOPs are adopted from procedures approved and implemented programmatically through other monitoring efforts. All approved SOPs are published in the NPS Natural Resource Report series and the latest approved versions of operational SOPs are always available for download at the NPS Integrated Resource Management Applications portal at <https://irma.nps.gov/>.

Table 7. Standard Operating Procedures required to implement the CAKN Bald Eagle Monitoring Protocol in CAKN. Table lists SWAN and CAKN SOPs by task category.*

Topic	Citation	Notes
Preparing for Bald Eagle Field Sampling	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 1 with minor revisions for use in CAKN and renamed CAKN SOP 1.
Conducting the Early Nest Initiation Survey (ENIS)	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 2 with minor revisions and renamed CAKN SOP 2: Conducting the Early Nest Initiation Survey (ENIS)
Conducting the Late Productivity Survey (LPS)	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 2 with minor revisions and renamed CAKN SOP3: Conducting the Late Productivity Survey (LPS)
Data Management for Bald Eagle Monitoring	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 3 with revisions and renamed CAKN SOP 4: Data Management for Bald Eagle Monitoring. Data Management follows CAKN procedures.
Reporting Bald Eagle Monitoring Data	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 4 with minor revisions and renamed CAKN SOP 5: Reporting Bald Eagle Monitoring Data

*All SOPs are available in the Data Store at: <https://irma.nps.gov/DataStore/Reference/Profile/2238350>.

Table 7 (continued). Standard Operating Procedures required to implement the CAKN Bald Eagle Monitoring Protocol in CAKN. Table lists SWAN and CAKN SOPs by task category.*

Topic	Citation	Notes
Revising the Bald Eagle Monitoring Protocol or SOP	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 5 with minor revisions and renamed CAKN SOP 6: Revision the Bald Eagle Monitoring Protocol or SOP
Safety Considerations for Bald Eagle Monitoring	Wilson, T.L., E.A. Weiss, T. Shepherd, L.M. Phillips, and B. Mangipane. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Standard operating procedures version 1.0. Natural Resource Report NPS/SWAN/NRR—2017/1384. National Park Service, Ft. Collins, Colorado.	Adopted from SWAN SOP 6 with minor revisions and renamed CAKN SOP 7: Safety Considerations for Bald Eagle Monitoring
Data Quality Standards	Wilson, T.L., and T. Shepherd. 2017. Monitoring bald eagles in Southwest Alaska Network parks: Data quality standards version 1.0. Natural Resource Report NPS/SWAN/NRR-2017/1385. National Park Service, Fort Collins, Colorado.	Adopted from SWAN
Archiving data with CAKN	Miller SD. 2017. Product Archival, Seasonal Closeout and Dataset Certification Procedures for the Arctic and Central Alaska Inventory and Monitoring Networks. National Park Service Arctic and Central Alaska Inventory and Monitoring Networks. Fairbanks, AK.	Adopted from ARCN and CAKN

*All SOPs are available in the Data Store at: <https://irma.nps.gov/DataStore/Reference/Profile/2238350>.

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The Department of the 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.

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