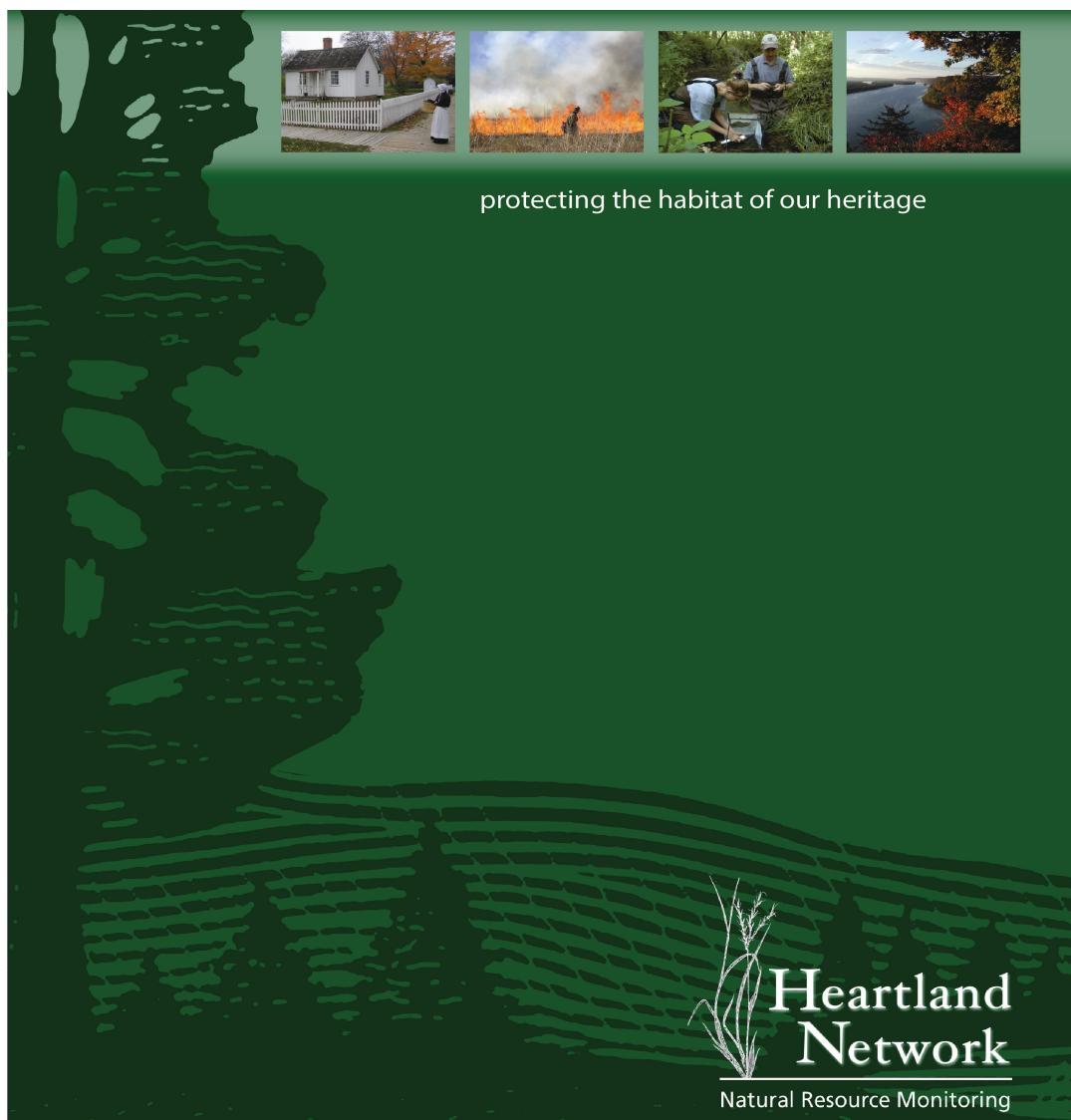




Quality Assurance Plan for Monitoring White-tailed Deer in the Heartland Inventory and Monitoring Network

Natural Resource Report NPS/HTLN/NRR—2018/1802



ON THE COVER

Herbert Hoover birthplace cottage at Herbert Hoover National Historic Site, prescribed fire at Tallgrass Prairie National Preserve, aquatic invertebrate monitoring at George Washington Carver National Monument, the Mississippi River at Effigy Mounds National Monument.

Photography by NPS.

Quality Assurance Plan for Monitoring White-tailed Deer in the Heartland Inventory and Monitoring Network

Natural Resource Report NPS/HTLN/NRR—2018/1802

Heartland Inventory and Monitoring Network (HTLN)

National Park Service
Heartland I&M Network
Wilson's Creek National Battlefield
6424 West Farm Road 182
Republic, MO 65738

November 2018

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from [Heartland Inventory and Monitoring Network website](#) and the [Natural Resource Publications Management website](#). If you have difficulty accessing information in this publication, particularly if using assistive technology, please mail irma@nps.gov.

Please cite this publication as:

Heartland Inventory and Monitoring Network (HTLN). 2018. Quality assurance plan for monitoring white-tailed deer in the Heartland Inventory and Monitoring Network. Natural Resource Report NPS/HTLN/NRR—2018/1802. National Park Service, Fort Collins, Colorado.

Contents

	Page
Tables	iv
Abstract	v
List of Terms	vi
Introduction	1
Protocol Overview	1
Detectability of deer	1
Important considerations	2
Measurable Objectives	2
Protocol Activities and Modules	3
Sampling Design	3
Data Quality Objectives	5
Data Quality Standards	6
Taxonomic Standards	6
Protected Data	6
Quality Assurance Procedures	7
Training Requirements	8
Quality Control Procedures	9
Project Quality Assessment	10
Routine Data Quality Evaluations	10
Documentation	11
Records	11
Metadata	11
Data Certification	11
Literature Cited	12

Tables

	Page
Table 1. Protocol activity matrix for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.	3
Table 2. Temporal sampling design for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network	4
Table 3. Activity-level sample design matrix for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network	4
Table 4. Data quality values for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.	5
Table 5. Measurement quality objectives for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network	6
Table 6. Quality assurance procedures for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network	7
Table 7. Training and professional certification requirements for IMD scientific staff to achieve Division-wide data quality goals.	8
Table 8. Quality control procedures for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.	9
Table 9. Routine data quality evaluation reports and checklists produced as a part of implementing the Heartland Network white-tailed deer monitoring protocol.....	10
Table 10. Required records to be maintained as a part of implementing the Heartland Network white-tailed deer monitoring protocol.....	11

Abstract

In accordance with guidelines set forth by the National Park Service Inventory and Monitoring Division, a quality-assurance plan has been created for use by the Heartland Inventory and Monitoring Network in the implementation of the White-tailed Deer Monitoring Protocol (HTLN 2018). This quality-assurance plan documents the standards, policies, and procedures used by the Heartland Network for activities related to the collection, processing, storage, analysis, and publication of monitoring data. The policies and procedures documented in this quality-assurance plan complement the quality-assurance plans for other monitoring activities conducted by the Heartland Network and supplement the National Inventory and Monitoring Division Quality Management Plan (DeVivo 2016).

List of Terms

Definitions are based on a combination of USGS (1995)¹ and EPA (1997)².

Accepted Data. Data that have undergone all QA and QC procedures as defined in a published protocol and associated SOPs. Used in cases where a Quality Assurance Plan has not been developed and approved.

Accreditation. A formal recognition that an individual or organization (e.g., laboratory) is competent to carry out specific tasks or specific types of tests, and/or meets predetermined qualifications or standards. For labs, this is typically done on an analyte basis for a limited/specific period of time (EPA 1997).

Accuracy. A measure of the degree of conformance of the values generated by a specific method or procedure with the true value. The concept of accuracy includes both bias (systematic error) and precision (random error). EPA recommends that this term *not* be used and that precision and bias be used to convey the information usually associated with accuracy. See Precision and Bias (USGS 1995; EPA 1997).

Bias. Systematic error that is manifested as a consistent positive or negative deviation from the known or true value. It differs from random error which shows no such deviation (EPA 1997).

Calibration. Determination, by measurement or comparison with a standard, the correct value of each measure on a meter or other device, or the correct value for each setting of a control knob. The levels of the calibration standards should bracket the range of planned measurements (EPA 1997).

Certified Data. Certified data are those data that a) have been through all QA/QC procedures as outlined in the Quality Assurance Plan, b) meet expected quality standards, or are appropriately identified and annotated at the record level in cases where they do not meet those standards, c) have documented procedures for data collection, processing, and transformation in appropriate metadata formats, and d) are suitable for use.

Commercial Laboratory. Any laboratory, wherever located, that performs analyses or tests for third parties for a fee or other compensation and provides chemical analyses, analytical results, or other test data to IMD, by contract or agreement.

¹ U.S. Geological Survey (USGS). 1995. Quality Assurance / Quality Control Manual: National Water Quality Laboratory. Open-File Report 95-443. U.S. Geological Survey, Denver, Colorado.

² Environmental Protection Agency (EPA). 1997. Glossary of quality assurance terms and related acronyms. U.S. Environmental Protection Agency.

Comparability. The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (EPA 1997).

Data Quality Objectives (DQOs). Qualitative and quantitative statements that clarify the objectives of observations, define the appropriate type of data, and specify levels of uncertainty that are acceptable to managers when using data. DQOs provide the statistical framework for planning data collection and management, and are used as the basis for establishing the quality and quantity of data needed to support decisions. Includes Qualitative Data Quality Values (DQVs), and informs development of Measurement Standards (or Measurement Quality Objectives; MQOs), Performance Standards, Accreditation Standards, and Policy Standards (EPA 1997).

Data Quality Values (DQVs). Desired qualitative characteristics of data and datasets related to intrinsic data quality (reasonability, accuracy, objectivity, credibility), contextual data quality (relevance, timeliness, completeness, comparability), representational data quality (interpretability, understandability, consistency), and data accessibility (security, discoverability, utility).

Data Validation. Quality Control tools or processes designed to evaluate legitimacy of data as they proceed through the data management life cycle. Typically data that do not pass validation procedures are either corrected using prescribed methods or flagged/graded to inform data users as to their appropriate use.

Data Verification. Quality Assurance tools or processes where data are checked for accuracy and inconsistencies as they migrate through the data management life cycle. Data Verification helps to ensure that data are complete, properly formatted so that they can be processed, and accurately translated when transferred from one source to another.

Data Flagging/Data Qualification. A code or annotation that signals that data do not meet specified data quality standards so as to inform appropriate use.

Minimum Detection Limit (MDL). The minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero (EPA 1997).

Minimum Quantification Limit (MQL). The concentration of analyte in a specific matrix for which the probability of producing analytical values above the method detection limit is 99 percent.

NELAC. National Environmental Laboratory Accreditation Conference. A voluntary organization of state and federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP (EPA 1997).

NELAP. The overall National Environmental Laboratory Accreditation Program of which NELAC is a part (EPA 1997).

Pre-Certified Data. Provisional data that have undergone minimum levels of QC as defined in the QAP, rendering the data suitable for use for a limited set of designated or defined purposes only. The QC procedures that have been performed are communicated clearly to the end user. In general, this status should only be used in cases where data are routinely used to support park management decisions before certification can be completed.

Precision. The degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms (EPA 1997).

Proficiency Testing. A means of evaluating a laboratory or testing organization's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Provenance. The lineage of inputs, entities, systems, and processes that influence data, in effect providing a historical record of the data and its origins, such that the results of scientific efforts are fully reproducible.

Provisional Data. Provisional data are those data that have undergone incomplete QA/QC procedures as defined in the QAP and are not suitable for general use. Provisional data may be used in some cases, however, depending on the amount of QA/QC completed, and the intended use.

Quality Assurance (QA). The set of activities designed to ensure that data, products, or services meet defined standards of quality with a stated level of confidence. Quality Assurance focuses on ensuring that data are collected and managed to the highest practicable quality, at or above stated data quality standards (USGS 1995).

Quality Assurance Plan (QAP). Documentation of Quality Assurance and Quality Control procedures for a protocol, program (inventory and overall I&M), or national database application (i.e., Data Store).

Quality Control (QC). Operational techniques and activities that are used to ensure that data or products meet designated requirements for quality. Quality Control procedures focus on testing data for quality and can include both an evaluation of whether data quality meets data quality objectives and/or procedures to correct data (USGS 1995).

Raw Data. Data in their state of original collection, either in the form of paper or electronic field forms, electronic sensor files, or digital media (photo, video, or audio). These data generally have been collected following some QA procedures, but have not undergone any QC procedures.

Round Robin Testing. A method of proficiency testing, whereby a blind sample is split and sent to other laboratories for analysis. Laboratories participating in round robin testing must not pass test samples from one laboratory to another.

Sensitivity. The ability of a method or instrument to discriminate between minimally different levels of a variable of interest by producing a noticeably different measurement response (EPA 1997).

Standards, Measurement (also Measurement Quality Objectives). Data quality requirements specifying the level of precision, bias, sensitivity, resolution, etc. that data must meet to be accepted for use in analysis.

Standards, Performance. Data quality requirements specifying the detection ability, sensitivity, variability, etc., of equipment, sensors, or observers to reliably measure characteristics within target populations.

Standards, Accreditation. Data quality requirements related to individuals or organizations involved with data collection, analysis or processing to ensure desired data credibility and defensibility. Examples include professional accreditation/certificates, required training, chain-of-custody requirements and others.

Standards, Policy. Data quality requirements related to ensuring appropriate management, use, dissemination, qualification, and documentation of data.

Introduction

The purpose of this report is to document the standards used by the Heartland Inventory and Monitoring Network (HTLN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the White-tailed Deer Monitoring Protocol for the Heartland Inventory and Monitoring Network (HTLN 2018). The policies and procedures documented in this quality-assurance plan complement the quality-assurance plans for other monitoring activities conducted by the HTLN and supplement the National Inventory and Monitoring Division Quality Management Plan (DeVivo 2016).

A quality assurance plan (QAP) is the written document that outlines the procedures a monitoring project will use to ensure that the data it collects and analyzes meet project requirements. Quality assurance (QA) refers to the overall management process which includes organization, planning, data collection, documentation, evaluation, and reporting. QA provides the information needed to ascertain the quality of data and whether it meets the requirements of the program. QA ensures that data will meet defined standards of quality with a stated level of confidence. Quality control (QC) refers to procedures used to assess data quality and ensure that defined standards are met.

Protocol Overview

Managers are interested in trends in deer population size with regards to the impact of deer on vegetation, disease transmission, concern over vehicle-deer collisions in and around parks, and the impacts of deer on neighboring private lands. Furthermore, deer have a tremendous following among the public and many parks provide information on the status of deer through their interpretive programs.

Monitoring white-tailed deer is accomplished using night-time spotlight surveys conducted weekly during the winter months of January and/or February. Two or three replicate counts are conducted each survey evening. Two replicate visible area estimates are conducted annually. Field observations produce an adjusted count of deer, which is an index of actual deer abundance.

Two main sources of observer error can occur during the field surveys: (1) failure to detect deer that are present (i.e., imperfect detectability), and (2) mis-estimation of distance to deer. Whipple et al. (1994) conducted a study to assess the accuracy of spotlight deer surveys using a protocol very similar to this one. Thus, their published method can be used with slight modifications to assess accuracy in this protocol.

Detectability of deer

Imperfect detectability is a common feature of ecological studies. Deer may exist in the visible area during surveys but not be observed, and quantifying detectability in deer monitoring studies is difficult (e.g., Collier et al. 2013). Two important sources of variability in detectability are changes in habitat over time and inter-observer error (i.e., detection probabilities may vary greatly among observers; Collier et al. 2013). Conducting annual estimates of the visible area attempts to correct for changes in habitat over time. To reduce inter-observer error, it will be important to train all

observers, regularly test detectability of deer surrogates such as reflectors for all observers, and include the results of such tests in monitoring reports.

Detectability is often divided into two components: availability and the probability of being detected. In the case of spotlight surveys for deer, to be “available” the animal would need to be present within the visible area, not obscured by vegetation, and looking in the vicinity of the observer so that the spotlight could reflect from the tapetum lucidum of the eye. Given that an animal is available, the probability of detection refers to whether an observer actually sees it and recognizes it as such. Thus deer that are present within the visible area but are not “available” are not able to be detected. For example, a deer within the visible area that was lying down at some distance from the road looking away from the observer would not be available. When we quantify detectability, this will refer to the proportion of *available* deer that observers detect, rather than the proportion of *all* deer present within the visible area.

Important considerations

Detectability in wildlife studies can vary with many factors, including variables related to the observer, the environment, and the target species (Anderson 2001). This protocol attempts to control for a number of these variables, for example through training of observers and only conducting surveys during non-inclement weather. However, many variables still exist that could affect detectability. Since both detectability and estimation of visible area have been found to vary with habitat type and observer in multiple published studies (Whipple et al. 1994; Collier et al. 2007; Collier et al. 2013), assessment of accuracy as described above should be done for all observers involved and include the major habitat types encountered along the tour roads.

Finally, it should be noted that high detectability per se is not necessarily important since the final product of the monitoring is an adjusted count of deer, rather than actual abundance. The important indicator of quality for this protocol is the degree of precision both among and within observers over time. In other words, consistently low detectability will not bias the adjusted counts; inconsistent detectability among or within observers will. The same is true for estimates of visibility. Consistent under- or over-estimates introduce less error than inconsistency among or within observers (e.g., one observer’s estimates are too high while another’s estimates are too low).

Measurable Objectives

1. Document annual changes in the number of white-tailed deer.

Justification: Significant annual changes in the number of deer may signal the presence of illegal deer harvest, disease, or other acute factors of concern for park management.

2. Determine long-term trends in the number of white-tailed deer.

Justification: Understanding decadal trends in the number of deer will help park management determine if measures need to be taken to maintain herd health, minimize vegetation damage within a park, or alleviate visitor health concerns.

- Annually map locations of white-tailed deer observed.

Justification: Mapping deer locations allows park management to assess the influences of management actions on deer usage of an area, habitat type, etc.

Protocol Activities and Modules

Data are collected or derived as a part of the White-tailed Deer Monitoring Protocol for the Heartland Inventory and Monitoring Network (HTLN 2018) in nine different activities or modules (Table 1).

Table 1. Protocol activity matrix for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.

Category	Activity #	Activity Type	Description
Site Establishment and Pre-sampling Activities	1	Sampling location "route" establishment & documentation	For safety reasons, hard surface roads are used as sampling transects. Survey routes are mapped in a GIS.
Field Observations	2	General sampling event	Estimate cloud cover, and using a Kestrel 3000 or 4000 (pocket weather meter) measure temperature, wind speed and relative humidity at the beginning and end of each repeated count.
	3	Count deer (detection)	Count all available deer during the repeated count.
	4	Deer location - vehicle location, distance from vehicle, and bearing (quadrat, angle)	The location of the survey vehicle is recorded in a GNSS each time a distance and bearing is recorded for a deer or group of deer. The distance from the vehicle to the deer or to the center of a group of deer is measured with a rangefinder. The bearing from the center-line of the vehicle to the deer or to the center of a group of deer is measured using a land compass.
	5	Visible area measurements	The area in which deer are visible is measured every 1/10 mile perpendicular to the survey route.
Derived Data	6	Total visible area	Derived from activity #5 as described in SOP 7
	7	Adjusted count	Derived from activity #4 and derived data (#6) as described in SOP #7

Sampling Design

Sampling is conducted once per week during the winter months of January and/or February on a maximum of four evenings. Two to three replicate counts are conducted each survey evening. Two replicate visible area estimates are conducted annually (Table 2). Information regarding the sampling design is provided in Table 3.

Table 2. Temporal sampling design for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network. X = occurrence of a repeated deer count; VA = visible area is assessed rather than a third repeated deer count.

Repeated Counts	Weekly Replicates			
	Week 1	Week 2	Week 3	Week 4
1	X	X	X	X
2	X	X	X	X
3	VA	X	VA	X

Table 3. Activity-level sample design matrix for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network. Activity numbers match those in the Protocol Activity Matrix (Table 1).

Category	Activity #		Sampling Design	Revisit Design
Field Observations	3,4	Observer proficiency training and testing	–	Annual prior to first surveys
	3,4	Weekly replicate surveys	Four, one-evening surveys conducted weekly in January/February.	Annual
	3,4	Repeated counts	Two or three consecutive, repeated counts on each survey evening, starting one hour after official sunset.	Weekly
	5	Visible area measurements	Measurements of the visible area conducted every 1/10 mile along the survey route.	Bi-weekly
	2	Weather conditions	Measure weather conditions at the beginning and end of each repeated count.	Prior to each repeated count

Data Quality Objectives

Data quality values (Table 4) are qualitative characteristics of data and datasets related to intrinsic data quality (reasonability, accuracy, objectivity, credibility), contextual data quality (relevance, timeliness, completeness, comparability), representational data quality (interpretability, understandability, consistency), and data accessibility (security, discoverability, utility).

Table 4. Data quality values for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.

Type	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	All visible deer are detected and their location measured.
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Trends in the index of deer density reflect underlying changes in true deer density, and are estimated consistently over time. However, tour roads do not constitute a random transect, and the distribution of deer is influenced by the presence of the road. Therefore, the protocol does not attempt to calculate true density.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Surveys are weekly to account for different moon phases. Acceptable environmental conditions (e.g. wind speed, precipitation) for surveys are defined. The protocol is intended to provide data that are comparable over time at the park scale only.
	Completeness	All data/ measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Weekly surveys begin in January. In the event of bad weather, surveys may be postponed to February/early March prior to leaf out. Goal is to complete four weekly replicates per year.

Table 4 (continued). Data quality values for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.

Type	Data Quality Value	Definition	Protocol Considerations
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Trends in the index of deer density reflect underlying changes in true deer density, and are estimated consistently over time. However, four roads do not constitute a random transect, and the distribution of deer is influenced by the presence of the road. Therefore, our index of deer density is not directly comparable to some published standards for carrying capacity.
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	No protected data are collected as a part of this protocol.

Data Quality Standards

The Measurement Quality Objectives (MQOs) for quantitative measurements taken in the field are defined in Table 5.

Table 5. Measurement quality objectives for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network. Activity numbers match those in the Protocol Activity Matrix (Table 1).

Activity #	Measure / Quality Indicator	Quality Objective
2	Weather – relative humidity	+/- 2% of true value
3	Deer count (detection)	100% of available deer are detected and counted.
4	Deer location - vehicle location	+/- 0.5 meter for differentially corrected data
4	Deer location - distance from vehicle.	Estimated distance is +/- 10 meters of true distance.
4	Deer location - bearing (quadrat, angle)	Estimated bearing is +/- 5 degrees of true bearing.
5	Visible area measurements	Estimated distance is +/- 10 meters of true distance.

Taxonomic Standards

White tailed deer is the only taxon being recorded, and data are reported as described by

Wilson, D. E., and D. M. Reeder, eds. (2015) Mammal species of the world: A Taxonomic and geographic reference (3rd ed). John Hopkins University Press. ISBN 978-0-8018-8221-0. OCLC 62265494.

Protected Data

No protected data are collected as a part of this protocol.

Quality Assurance Procedures

Quality assurance procedures are the set of activities designed to ensure that data, products, or services meet defined standards of quality with a stated level of confidence (Table 6). Quality Assurance focuses on ensuring that data are collected and managed to the highest practicable quality, at or above stated data quality standards.

Table 6. Quality assurance procedures for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network. See individual SOPs for details.

Category	Activity/Procedure	Measure	Reference(s)
Site Establishment and Pre-sampling Activities	Driver orientation and training completed	Deer Count	SOP 2 - Training and Testing Observers
	Detection training completed	Deer Count	SOP 2 - Training and Testing Observers
	Distance estimation/measurement and bearing measurement training completed	Deer Location	SOP 2 - Training and Testing Observers
	Upload data-dictionary, set pdop to < 6, attach external antenna, equipment check, training in GNSS mapping	Deer Count and Location	SOP 4 - Conducting the Spotlight Survey; SOP 5 - Measuring the Visible Area
	Equipment check, lights tested, rangefinder calibration	Deer Count and Location	SOP 1 - Before the Field Season
	Test and calibrate Kestral	Weather	SOP 1 - Before the Field Season
Field Observation	Sustained wind < 30km/hr, no snow or heavy rain	Deer Count and Location	SOP 4 - Conducting the Spotlight Survey,
	Driving speed = 16 km/hr (10 m/hr)	Deer Count and Location	SOP 4 - Conducting the Spotlight Survey
	Review data collection form and procedures for conducting spotlight surveys	Deer Count and Location	SOP 2 - Training and Testing Observers; SOP 4 - Conducting the Spotlight Survey
	Review data collection form and procedures for estimating/measuring the visible area	Adjusted Count	SOP 5 - Measuring the Visible Area
	Annual operational review - Trip report completed	Deer Count and Location	SOP 8 - Reporting
Derived Data	Count data entered through a controlled form to ensure data are within normal ranges, coded correctly, complete, of the correct data type, etc.	Deer Count	SOP 6 - Tabular and Spatial Data Management
	Data transcription 100% verified	Deer Count	SOP 6 - Tabular and Spatial Data Management
	Spatial data downloaded and processed	Deer Count and Location	SOP 6 - Tabular and Spatial Data Management
	Visible area measurements downloaded and processed	Adjusted Count	SOP 6 - Tabular and Spatial Data Management

Training Requirements

Although protocol-specific quality assurance procedures are documented above, Table 7 summarizes Division- or NPS-wide training requirements.

Table 7. Training and professional certification requirements for IMD scientific staff to achieve Division-wide data quality goals.

Training	Personnel	Purpose	Provider	Recurrence	Location of Records
DOI Scientific Integrity Training	All IMD science employees	Ensure understanding of roles and responsibilities	DOI / DOI Learn	Once per year	DOI Learn

Quality Control Procedures

The following Quality Control procedures are designed to ensure that data collected or generated meet specified requirements and/or are appropriately annotated or corrected (Table 8).

Table 8. Quality control procedures for white-tailed deer monitoring within the Heartland Inventory and Monitoring Network.

Category	Activity	Quality Objectives	Reference(s)
Derived Data or Field Data Collection	The annual operational review and report documents deviations between the protocol and the field implementation that could potentially affect data quality or utility. Update the database with affected data appropriately flagged and documented.	100% adherence to protocol	SOP 8 - Reporting

Project Quality Assessment

Routine Data Quality Evaluations

Data quality reports will be reviewed on an ongoing basis by network program managers to evaluate overall efficacy of methods and QA/QC procedures. Protocol leads and/or program managers will evaluate QA/QC data to identify procedures that need to be refined, or to identify additional procedures to be developed. Table 9 includes required data quality reports.

Table 9. Routine data quality evaluation reports and checklists produced as a part of implementing the Heartland Network white-tailed deer monitoring protocol.

Performance Measure	Description	Frequency
Annual Operational Review	Document the continuous learning and clarification of protocol details and safety issues. Evaluates field crew effectiveness in implementing the protocol. Documents data quality.	Annually.
Certification Lag-time	Measure of the proportion of data collected during the prior year that have been certified (for protocols with QAPs) and/or approved (for protocols without approved QAPs)	Annually, concurrent with administrative reporting.
Relevance	Determine the degree to which data that are collected are able to be used to meet stated monitoring objectives, support stated management goals, and associated data quality values	During technical protocol reviews.

Periodic program-level data audits and quality control inspections will be used to maintain and improve the quality of data collected, processed, and managed by IMD. Data audits should verify that staff is operating in conformance with the standards specified in this plan and program-specific QAPs. In addition, audits should track and facilitate the correction of any deficiencies. These quality checks promote a cyclic process of continuous feedback and improvement of both the data and the quality planning process. The results of quality assessments should be documented and reported to program leadership, who in turn are responsible for ensuring that nonconformities in data management practices are corrected.

Documentation

Records

NPS Director's Order 11D: Records and Electronic Records Management (NPS 2012) and its appendix, *NPS Records Schedule*, describe NPS activities and standards in maintaining and providing access to records at all levels of the Service. DO 11D states that all records of natural and cultural resources and their management are considered necessary for fulfillment of the NPS mission.

Records to be maintained under this protocol include data collection forms, training and testing certificates and reports (Table 10).

Table 10. Required records to be maintained as a part of implementing the Heartland Network white-tailed deer monitoring protocol.

Sample Collection Documents and Records	On-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Data collection field forms—both original hard copy and scanned electronic versions	Confirmation of data transcription review	Personnel training certifications and documentation	NPS manuscript submittal forms for reports published in the NPS natural resource series
Protocols, SOPs, and QAPs guiding data collection, processing, and analysis	—	—	Peer review memos and author responses for published reports and journal articles

Metadata

Metadata for all published data products are FGDC compliant. The abstract for all metadata are under the following link (<https://irma.nps.gov/DataStore/DownloadFile/541887>) and the protocol narrative can be found at (<https://irma.nps.gov/DataStore/Reference/Profile/661149>). Data can be traced to methods used for collecting and processing through these links to the latest version of the protocol, this QAP, and all associated standard operating procedures.

Data Certification

Data certification is the process, detailed in SOP 6 “Tabular and Spatial Data Management,” that confirms:

- Data have been through all QA/QC procedures
- Data either meet specified quality standards and/or are appropriately identified and communicated at the record level
- Procedures for data collection, processing, and transformation have been documented in appropriate metadata formats
- Data are suitable for use.

Literature Cited

- Anderson, D. R. 2001. The need to get the basics right in wildlife field studies. *Wildlife Society Bulletin*. 29:1294-1297.
- Collier, B. A., S. B. Ditchkoff, J. B. Baglin, and J. M. Smith. 2007. Detection probability and sources of Variation in white-tailed deer spotlight surveys. *Journal of Wildlife Management* 71:277-281.
- Collier, B. A., S. S. Ditchkoff, C. R. Ruth, and J. B. Raglin. 2013. Spotlight surveys for white-tailed deer: Monitoring panacea or exercise in futility? *Journal of Wildlife Management* 77:165-171.
- DeVivo, J. 2016. DRAFT quality management plan for the National Park Service Inventory & Monitoring Program: Guidance for vital signs monitoring protocols (distributed by K. Gallo email 8/19/2016)
- Environmental Protection Agency (EPA). 1997. Glossary of quality assurance terms and related acronyms. U.S. Environmental Protection Agency.
- Heartland Inventory and Monitoring Network (HTLN). 2018. White-tailed deer monitoring protocol for the Heartland Inventory and Monitoring Network. Natural Resource Report NPS/HTLN/NRR—2018/1801. National Park Service, Fort Collins, Colorado.
- National Park Service (NPS). 2012. Records and electronic information management. National Park Service.
- U.S. Geological Survey (USGS). 1995. Quality assurance / quality control manual: National Water Quality Laboratory. Open-File Report 95-443. U.S. Geological Survey, Denver, Colorado.
- Whipple, J. D., D. Rollins, and W. H. Schacht. 1994. A field simulation for assessing accuracy of spotlight deer surveys. *Wildlife Society Bulletin* 22:667-673.
- Wilson, D. E., and D. M. Reeder, eds. 2015. *Mammal species of the world: A taxonomic and geographic reference* (3rd ed). John Hopkins University Press. ISBN 978-0-8018-8221-0. OCLC 62265494.

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.

NPS 920/149411, November 2018

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525