TOS PROTOCOL AND PROCEDURE: MAM – SMALL MAMMAL SAMPLING

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See configuration management system for approval history.

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A_DRAFT	07/11/2012	ECO-00469	Draft release
B_DRAFT	01/24/2014	ECO-01181	Draft release. Will finalize in next rev.
C	03/31/2014	ECO-01671	Production release, template change, and other changes as detailed in Appendix C. Merged with rodent-borne pathogen sampling protocol.
D	04/10/2014	ECO-01792	Updated Appendix D with site-specific information. Updated References. Added Appendix D, Bleed Grid Designation.
E	12/05/2014	ECO-02530	Migration to new protocol template
F	03/23/2015	ECO-02644	Decreased sampling bout duration for diversity grids from three nights to one. Changed cold temperature thresholds for trapping. Removed retro-orbital bleeding technique. Removed Heteromyidae from bleeding list and added Muridae. Added prioritization of processing steps. Added equipment and protocol modifications for D04, D19, D20. Added sp codes. Removed datasheet column references due to changes in datasheet; updated datasheet quick references.
G	05/04/2015	ECO-02890	Added IACUC requested language regarding cervical dislocation training and GRSM-specific IACUC instructions. Added back in anesthesia instructions, and added euthanasia instructions per the IACUC-approved protocol.
H	01/29/2016	ECO-03660	Baseline edits. Effective starting 2016 field season: added tick monitoring to data collection, clarified priority of data collection in decision tree. Revised instructions for pathogen grid selection, added instructions for blood sample processing and intentional voucher collection. Added alternative anesthesia delivery method. Clarified trap cleaning rules and added language to discourage dumping of seed on the ground when pulling a grid. Clean up of SOPs E and H.

J	02/17/2017	ECO-04445	Clarified priorities re: trapping nights per grid when time is limited, and pathogen grid selection guidelines. Alter processing prioritization scheme, including limiting blood samples to 20 per plot. Added additional guidelines for selecting blood samples for testing (Appendix D, E), and revised blood sample limit based on current budget. Updated dominant genera and species lists in Appendix E. Clarified ear tag replaced field; added date to the untagged voucherID format; ear sample collection using scissors; use of 'X' in trap coordinate to denote uncertainty; decreased seed sterilization temperature; added 'Unknown' option to reproductive fields; updated quick reference to reflect updates to datasheet; added language to accommodate mobile data entry application; updated shipping inventory instructions; changed data entry instruction to NOT enter any data if no traps were set on a given plot. Added guidance for entering identification references info at the level of the individual – no longer being collected at the level of the plot.
K	01/30/2018	ECO-05276	Removed Hawaii, removed Tomahawks from Puerto Rico, modified sample collection instructions, added barcoding language, updated shipping instructions to reflect experience with UNM archive and new shipping application; moved species id up in the processing order, added bait missing as another indicator of trap status 3
L	03/18/2019	ECO-06065	Removed Puerto Rico trapping, increased quantity and method of hair collection, added tar paper covers to traps in Barrow, AK, with option to use at other cold, wet sites, clarified instructions for voucher specimen tagging, updated instruction for DNA barcoding prep based on K. LeVan Knowledge Base article, clarified use of trap status codes and non-target, removed Rattus from priority species for bleeding to keep only to cricetids, fixed error in priority species for JERC, reorganized processing section based on feedback
M	02/11/2020	ECO-06264	Updated to new template (NEON.DOC.050006vJ). Added total tick count binned estimates, eliminated requirement to start sampling bouts within 5 days of the original new moon window in that month, added requirement that a new bout should begin no less than 21 days after the beginning of the previous bout, added new bait sunflower-only bait option for sites with fire ant problems, allowed hair sample collection from all target species, clarified bait measurement by volume not

			weight, clarified timing of sample collection bouts, clarified instructions for missed bout reporting, updated voucher label size, updated new taxonomy for Callospermophilus and Ictidomys, added workflow diagrams for SOPs and a sampling figure, added 50 g spring scale option to equipment list, changed trap check window at TOOL site to 6-8 hours.
N	03/16/2022	ECO-06781	• Update to reflect change in terminology from relocatable to gradient sites
O	01/18/2023	ECO-06892	• Added Pesola scale calibration procedures • Included description of alternatives to dry ice for storage of samples during field collection • Adjusted training requirements to allow within-bout training • Added dropdown to formally record presence of botflies/fleas/other parasites • Updated safety information including new personal protective equipment requirements, and added safety precautions for flame sterilization • Increased trap soaking time for bleach to 5 minutes • Updated sample labeling including no longer requiring human readable labels on blood samples, and barcode/sampleID on voucher tags • Updated guidance on preferred animals for ear sampling • Increased seed baking temperature to 205°C for 10 minutes • Updated site-specific sampling details (especially alternation of diversity and pathogen grids at TOOL, BARR and HEAL) and target species at several sites • Added methoxyflurane option for anesthesia/euthanasia • Required use of liquid-nitrogen safe vials
P	05/05/2023	ECO-07005	• Added details to the equipment list and Appendix D to clarify sterile PIT tag description and removed obsolete references to AD[08] and AD[09]
Q	10/17/2024	ECO-07112	• Additional communication requirements between trap setting and collection teams. • Recommended addition of DNA/RNA shield to blood samples less than 10 microliters (those that smear on vial side) to increase utility. • Updated expected number of bouts and grids from optimization work.

			• Updated bout spacing requirement to be 21 days after end of previous bout since bouts can now span 2 weeks. • Added shorter trap check option at HEAL. • Added longer low temperature seed baking option (135-150°C for 45-60 min). • Added YELL (WY) to list of sites with required N95 respirators per NPS permit. • Updated to protocol template NEON.DOC.050006 rev L, including NEON logo.

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1 OVERVIEW

1.1 Background

Small mammals are widespread, sensitive to local environmental changes, and known to carry and transmit zoonotic agents; therefore, they have been chosen as sentinel taxa for the NEON Terrestrial Observation System (TOS). From NEON's perspective, species-specific demography and population sizes, prevalence of pathogens important to public health, species richness, and relative abundances can be monitored simultaneously and ultimately linked to land use and climate changes, and therefore provide useful metrics of responses in biodiversity to these and other drivers (Kao et al. 2012). Small mammals as primary and secondary consumers interact significantly with plants and ground invertebrates (other NEON sentinel taxa), and generally represent size classes, life histories, and home range sizes that are distinct from the other NEON taxa (Kao et al. 2012). NEON employs mark-recapture methods to assess the dynamics of small mammal diversity and disease across time and space (Ostfeld and Parmenter 2008).

NEON small mammal sampling assesses the abundance and diversity of the nocturnal small mammal communities of North America, including the population dynamics of species that are competent reservoirs for infectious disease, at dozens of sites (depending on study design and associated logistics) throughout North America for a period of 30 years. This represents a significant increase in the number and diversity of long-term datasets involving small mammals and is also unique in the degree of standardization across studies, as well as the availability of the data and archived samples to the scientific community and the public. Data generated via this protocol allow NEON and the scientific community to address a diversity of questions, and the associated vouchering of specimens and tissue samples provides an important resource for external PI-driven research to address an even wider range of questions.

1.2 Scope

This document provides a change-controlled version of Observatory protocols and procedures. Documentation of content changes (i.e. changes in particular tasks or safety practices) will occur via this change-controlled document, not through field manuals or training materials.

1.2.1 NEON Science Requirements and Data Products

This protocol fulfills Observatory science requirements that reside in NEON's Dynamic Object-Oriented Requirements System (DOORS). Copies of approved science requirements have been exported from DOORS and are available in NEON's document repository, or upon request.

Execution of this protocol procures samples and/or generates raw data satisfying NEON Observatory scientific requirements. These data and samples are used to create NEON data products, and are documented in the NEON Scientific Data Products Catalog (RD[03]).

1.3 Acknowledgments

Many thanks to Jesse Dulberger, who wrote the first version of this protocol. Best practices are based on recommendations in Wilson et al. 1996, as well as the first small mammal abundance and diversity working group established in 2012 (*Guy Cameron, Bob McCleery, Bill McShea, Rebecca Rowe, Rob Swihart, Beatrice Van Horne).*

All procedures described in this document have been reviewed and approved by Battelle's Institutional Animal Care and Use Committee (IACUC).

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain higher-level information that is implemented in the current document. Examples include designs, plans, or standards.

AD[01]	NEON.DOC.004300	EHS Safety Policy and Program Manual
AD[02]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD[03]	NEON.DOC.000724	Domain Chemical Hygiene Plan and Biosafety Manual
AD[04]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD[05]	NEON.DOC.000915	TOS Science Design for Small Mammal Abundance and Diversity
AD[06]	NEON.DOC.004104	NEON Science Data Quality Plan
AD[07]	NEON.DOC.000911	TOS Science Design for Vectors and Pathogens

2.2 Reference Documents

Reference documents contain information that supports or complements the current document. Examples include related protocols, datasheets, or general-information references.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.002652	NEON Data Products Catalog
RD[04]	NEON.DOC.001271	AOS/TOS Protocol and Procedure: DPM – Data Management
RD[05]	NEON.DOC.001585	Datasheets for TOS Protocol and Procedure: Small Mammal Sampling
RD[06]	NEON.DOC.003282	NEON Protocol and Procedure: SIM – Site Management and Disturbance Data Collection
RD[07]	NEON.DOC.005247	AOS/TOS Standard Operating Procedure: NEON Aquatic and Terrestrial Site Navigation
RD[08]	NEON.DOC.001025	TOS Protocol and Procedure: PLT – Plot Establishment and Maintenance
RD[09]	NEON.DOC.005346	OS Standard Operating Procedure: FRZ – Preparation and Use of Dry Ice Alternative Freezing Materials
RD[10]	NEON.DOC.001717	TOS Standard Operating Procedure: TruPulse Rangefinder Use and Calibration
RD[11]	NEON.DOC.005224	NEON Protocol and Procedure: Shipping Ecological Samples and Equipment
RD[12]	NEON.DOC.001907	Field Key to the Small Mammals in NEON Domain 01
RD[13]	NEON.DOC.001908	Field Key to the Small Mammals in NEON Domain 02
RD[14]	NEON.DOC.002167	Field Key to the Small Mammals in NEON Domain 03
RD[15]	NEON.DOC.001909	Field Key to the Small Mammals in NEON Domain 05
RD[16]	NEON.DOC.003136	Field Key to the Small Mammals in NEON Domain 06
RD[17]	NEON.DOC.001910	Field Key to the Small Mammals in NEON Domain 07
RD[18]	NEON.DOC.001911	Field Key to the Small Mammals in NEON Domain 08
RD[19]	NEON.DOC.001912	Field Key to the Small Mammals in NEON Domain 09

RD[20]	NEON.DOC.001913	Field Key to the Small Mammals in NEON Domain 10
RD[21]	NEON.DOC.003137	Field Key to the Small Mammals in NEON Domain 11
RD[22]	NEON.DOC.003138	Field Key to the Small Mammals in NEON Domain 12
RD[23]	NEON.DOC.003139	Field Key to the Small Mammals in NEON Domain 13
RD[24]	NEON.DOC.003140	Field Key to the Small Mammals in NEON Domain 14
RD[25]	NEON.DOC.001914	Field Key to the Small Mammals in NEON Domain 15
RD[26]	NEON.DOC.003143	Field Key to the Small Mammals in NEON Domain 16
RD[27]	NEON.DOC.003141	Field Key to the Small Mammals in NEON Domain 17
RD[28]	NEON.DOC.003142	Field Key to the Small Mammals in NEON Domains 18 & 19

2.3 Acronyms

Acronym	Definition
CDC	Centers for Disease Control and Prevention
NIOSH	National Institute for Occupational Safety and Health
PIT	Passive Implant Transponder
PPE	Personal Protective Equipment
HEPA	High-efficiency particulate air
IACUC	Institutional Animal Care and Use Committee
LN	Liquid Nitrogen

2.4 Definitions

Fulcrum: Software tool used to create NEON electronic data entry applications.

Non-target species: Any non-study animals directly or indirectly affected by the research. Examples include the potential to live-capture or kill non-target individuals (e.g., loss of offspring due to taking of one or both parents) or disturb/harass other species during the research activity (e.g., during sampling that employs airplanes and/or boats).

Opportunistic species*:* Any animal whose capture is accidental or incidental, but whose capture can lead to valuable information. Examples include non-target species of small mammals which, if captured, will be marked and released.

Opportunistic vs. Non-target Species (terms and definitions modified from the National Park Service)

Plot-night: A single night of sampling at one small mammal plot (e.g., one night of sampling at either a pathogen or diversity grid).

Sampling bout: The three consecutive (or nearly so) nights of trapping per pathogen and the one night of trapping per abundance/diversity grid intended to occur monthly or every other month around the new moon and includes all trapping grids.

ServiceNow: Software tool used for problem/incident tracking and resolution.

Small mammal: Any mammal that is (1) nonvolant; (2) nocturnally active; (3) forages predominantly aboveground; and (4) is greater than 5 grams but less than approximately 600 g. In North America, the **target** species include cricetids, heteromyids, small sciurids, and introduced murids. It does not include shrews, large squirrels, pocket gophers, rabbits, or weasels, despite the fact that individuals of these species may be incidentally captured.

3 METHOD

Standard Operating Procedures (SOPs), in Section 7 of this document, provide detailed step-by-step directions, contingency plans, sampling tips, and best practices for implementing this sampling procedure. To properly collect and process samples, field technicians **must** follow the protocol and associated SOPs. Use NEON's problem reporting system to resolve any field issues associated with implementing this protocol.

The value of NEON data hinges on consistent implementation of this protocol across all NEON domains, for the life of the project. It is therefore essential that field personnel carry out this protocol as outlined in this document. In the event that local conditions create uncertainty about carrying out these steps, it is critical that technicians document the problem and enter it in NEON's problem tracking system.

Quality assurance is performed on data collected via these procedures according to the NEON Science Data Quality Plan (AD[06]).

The plan includes:

- Hot checks in the field by HQ staff or contractor, if funding is made available.
- DNA barcoding of a subset of samples to quantify error rates in taxonomic IDs.

3.1 Sampling Goals

NEON requires the study of live organisms in their natural setting to document the diversity, population sizes, and pathogen prevalence of small mammals through time, in relation to such critical drivers as climate change and land-use change. These parameters will be assessed through a mark-recapture live trapping study and associated tissue collection. The NEON sampling design allows for robust estimation of (1) population sizes and species diversity using standard mark-recapture techniques (AD[05]), and (2) inter- and intra-annual changes in pathogen prevalence (AD[07]). All methods conform to standard methods used in the study of wild small mammals (see Wilson et al. 1996, Sikes et al. 2016).

3.2 Trapping design

Sherman live traps (H. B. Sherman, Inc., Tallahassee, FL, folding or non-folding, 3" x 3.5" x 9" or, if kangaroo rats (*Dipodomys spp.*) or rats (*Rattus spp.*) are common, 3" x 3.75" x 12") are used to capture animals via this protocol. Trapping grids are established with 100 Sherman live traps (10 m spacing – 10 rows – 10 columns; see **Figure 1**), except at the SRER site where 49 traps are set due to very high capture rates (10 m spacing - 7 rows - 7 columns). Six grids are trapped during each sampling period, depending on the area of the site and associated logistics. The grids are distributed proportionally across the dominant vegetation types, collocated with a subset of the TOS Distributed Plots (see TOS Science Design for Small Mammal Abundance and Diversity (AD[05]) for additional details).

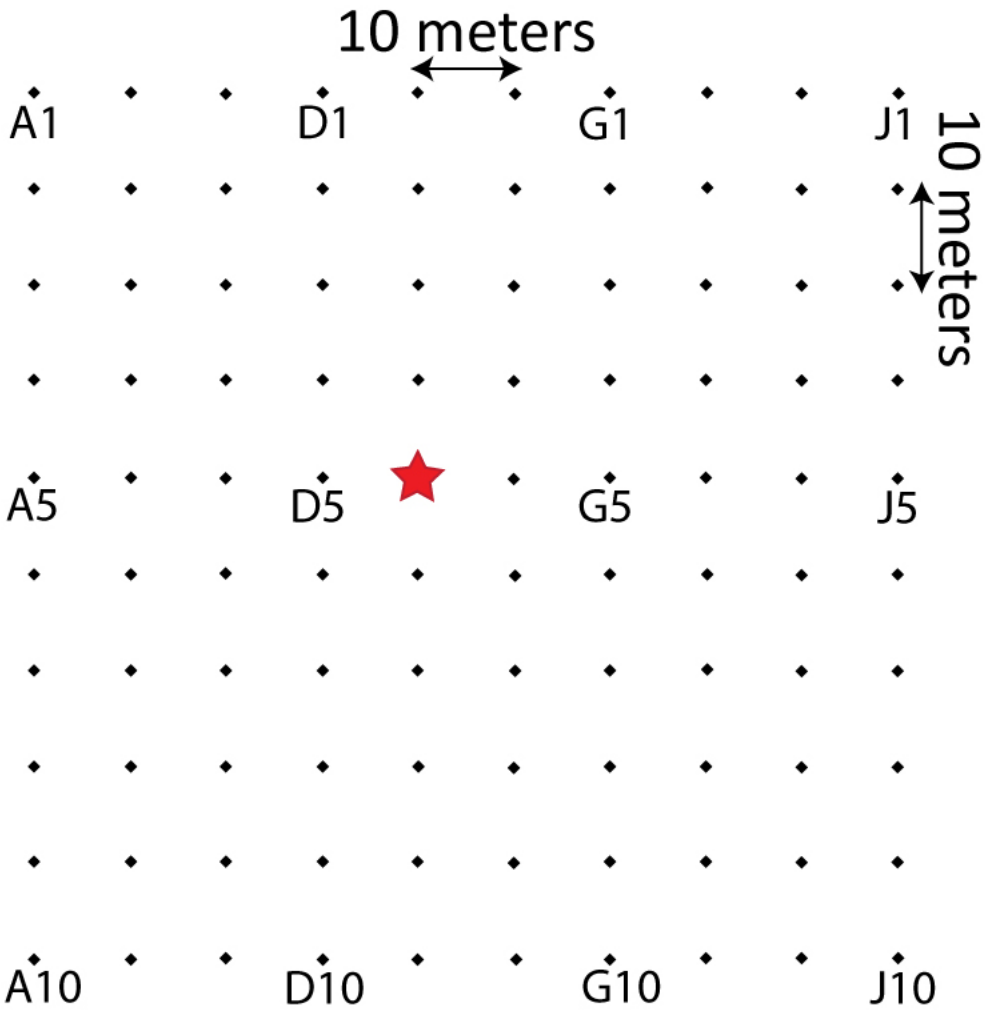


Figure 1. Schematic of trapping grids. One Sherman trap is placed at each point in the grid. Where permitted, a permanent marker is placed at coordinate E5, indicated by the red star.

3.3 Grid types

Three grids at each site that occur within any or all of the dominant vegetation type(s) are designated by domain staff as pathogen grids (see Appendix D). The remaining grids are designated as diversity grids. NEON staff use the 'mamType' column in the Fulcrum TOS Spatial Data application to determine whether a grid is designated as pathogen or diversity. This information is also publicly available in the portal downloaded data from the mam_perplotnight table via the mammalGridSamplingMethod field.

Guidelines for selecting pathogen grids:

Pathogen grids have already been selected at all sites and should remain consistent across years except in cases described lower in this section. The primary goals in selecting pathogen grids are: 1) long-term

sampling of target and opportunistic species, which requires moderate to high **average** capture rates, and 2) representation of the site's dominant vegetation type.

If there are more or fewer than 3 trapping grids that occur within the dominant vegetation type(s) and trapping data from previous years are available, the selected grids should be those with the highest combined abundances of target and opportunistic species. Otherwise, pathogen grids will be chosen at random or based on an educated assessment of habitat quality. Once a grid has been designated as a pathogen grid (after an initial assessment period of two years), that classification will apply for all subsequent trapping seasons for consistent, long-term data collection.

Exceptions: if the majority of captures in the dominant vegetation type at a site are heteromyids, then an alternate habitat type may be preferred (e.g., Moab, UT – see Appendix D). Abundance will vary by season and year, so pathogen grids will not always have the highest abundance relative to the other grids– consistent long-term sampling is more important than always being the grid with the highest number of captures. However, if unusually low numbers of individuals of target and opportunistic species combined are captured on a pathogen grid for two years or more, a problem ticket should be issued. A general guideline for "low numbers of individuals" is 20 (total) per plot per year. High levels of disturbance may also be cause for changing a pathogen grid – when reporting disturbed sites, be sure to specify if the affected grid is a pathogen or diversity grid. In these cases, or if sampling on the grid poses a significant safety hazard, the Field Science staff should create a Service Now ticket documenting the change and requesting that the Science team review the grid status.

Extended sampling: When capture rates are low and resources permit, collecting blood samples from additional individuals from diversity grids is encouraged. Check Appendix D to ensure the number of animals used does not exceed the number of animals from which you will collect blood.

3.4 Personnel

It is expected that typically two or four (2 teams of 2) personnel conduct the trap checking at each site, depending on the number of grids at a particular site and the capture rates per grid. Additional personnel can be used as needed. Each team must be comprised of at least one well-trained field ecologist or lead technician who is responsible for all the handling procedures. The other technician assists with trap setting and checking, data recording, and may assist with handling only if experienced in handling small mammals and fully trained according to established NEON training requirements. Best practices in trapping include having the same person set and check specific traps, to decrease the odds of missing any traps during the check. That said, logistics often dictate the use of distinct teams to perform these temporally disjunct tasks. Under these circumstances, traps must be counted and re-counted each morning to prevent traps from being missed.

When the team collecting traps at grids in the morning is different from the team that set traps the previous evening, a formalized method of communication and confirmation is required to ensure that all of the grids that have traps set are visited the next morning during collection activities. Options for

formal communication between crews should be discussed with your manager agreed to ahead of the field season. This could include the following examples:

- A digital (group text) communication between trap setters and checkers to communicate which grids were set and then confirm which grids were collected.
- The use of a logging mechanism (whiteboard or hard-copy write-in-the-rain log) that is created by trap setters and checked off by trap collectors.

Whatever communication methodology is chosen, it must be accessible to everyone involved in trap setting and checking, and the team collecting traps must check the previous night's log before finishing for the day and confirm in writing or text that all set grids were collected.

3.5 Timing of trapping

Each pathogen grid is trapped for 3 consecutive nights within a sampling period, while the remaining grids (i.e., diversity grids) are sampled for only one night within a sampling period. Sampling occurs four times per year at the majority of sites if resources are available and winter weather conditions permit (see **Table 1** for further details). A few low intensity sites (BARR, DSNY, and LENO) are sampled for only one bout per year. Sites are designated as low intensity if they have low capture success (<5% per year), low diversity (>80% of captures from 3 or fewer species), and low pathogen prevalence (<5% of samples positive for tick-borne pathogens each year). When possible, trapping is scheduled as close as possible to the new moon, as small mammal activity is thought to be restricted under high light conditions when predation risk is presumed higher (but see Prugh and Brashares 2010).

Within a sampling period, timing of trap setting is generally managed so that the last trap is set as the sun is setting and the first trap is checked the following morning, as soon as it is light enough to process animals (i.e., within 30 minutes of civil twilight). Local conditions can necessitate deviations from this general plan; these deviations are specified in the site-specific appendices for this document, if necessary. The animals trapped according to this protocol are nocturnal, and this routine ensures that traps are not set longer than necessary – particularly during the hottest parts of the year. Where possible, between consecutive nights of trapping, traps remain *in situ* but closed during the day to prevent diurnal animals entering and becoming heat-stressed. Furthermore, when temperatures are extremely high even in the early morning (i.e., 27°C (80°F) by 10:00 am) and all traps are not shaded, one team focuses solely on checking traps and placing traps with captured individuals under the protection of shade and a heat shield, until they can be processed by the second team. This procedure reduces the amount of time animals spend in direct sunlight, which can result in lethal heat stress.

3.6 Bait

Sherman traps should be set and baited with a seed mixture (sunflower seeds – 35% and millet – 65%) that has either been sterilized by baking at 205°C for 10 minutes or 135-150°C for 45-60 minutes to prevent germination of these introduced species at NEON sites. If seeds begin turning brown or start

smoking at the lower temperatures after 45 minutes they can be removed, but otherwise baking for the full 60 minutes is preferred. The longer baking time at lower temperature is likely to be particularly helpful for those domains with the Grieve type ovens, but any domain can use either baking option. For the longer baking option, the highest temperature setting within the range that allows baking for at least 45 minutes without smoke or browned seeds should be used. Seeds are high quality resources utilized by most target small mammal species.

In cold weather conditions, polyester or wool batting for nesting should be placed in the traps, except at sites dominated by rodents in the family Heteromyidae (e.g., Central Plains Experimental Range (CPER), Jornada Experimental Range (JORN)). These are burrowing rodents which are known to urinate on batting rather than building nests, thereby reducing its insulating properties, and these species will not consume peanut butter (see below).

At sites where shrews (*Soricomorpha: Soricidae*) comprise more than 20% of the captured individuals on average (e.g., Harvard Forest), a teaspoon of freeze-dried mealworms should also be added to the trap. For sites with high variability of shrew capture rates across trapping grids, mealworms can be added only to grids of particular concern.

High-calorie bait, such as peanut butter can also be added in the event of extremely cold conditions at many sites. However, peanut butter may not be used where not permitted (see site-specific appendices), where medium- to large- mammal disturbance of traps has occurred (e.g., raccoons or bear disturbance), or where fire ants occur (e.g., Jones Ecological Research Center (JERC), Ordway-Swisher Biological Station (OSBS)).

Starting in 2019, sites with high fire or harvest ant activity can use 100% sunflower seeds as bait to eliminate the spillage of the smaller millet seeds which can attract ants to the trapping area.

3.7 Processing

All processing will take place in the field, to allow for quick release of captured individuals at the point of capture and to provide adequate ventilation for the field staff. Upon capture, individual small mammals will be processed according to their classification as target, opportunistic, or non-target species (see Appendix D for detailed species lists). Processing includes:

- Marking with a unique tag (target and opportunistic species).
- Assessing age, sex, and reproductive condition, and taking standard measurements (i.e., hind foot length and weight; target and opportunistic species).
- Identification to species where possible (all captures). Additional measurements (e.g., ear length, tail length, and/or total length) shall be taken when relevant to species identification (target and opportunistic species).
- Presence of ticks by life stage (target and opportunistic species).

- Total number of ticks present on the head and neck within bins (1-5, 6-20, >20) at pathogen grids.
- Presence of botflies, fleas and/or other parasites (target and opportunistic species).
- Blood collection for pathogen analyses (target species in appropriate condition).
- Fecal sample collection for physiological analyses (target and opportunistic species).
- Ear tissue for genetic analyses (target and opportunistic species).
- Clipped whiskers and hair for potential isotopic analyses (target species in appropriate condition).

Some of these data may be omitted in cases of high capture rates posing time constraints. These are outlined in SOP C.4

3.7.1 Marking

Individuals are marked to allow for the study of population dynamics, reproductive condition, timing of colonization of new individuals, longevity and movement, and a variety of other aspects of life history that require permanent individual marking.

3.7.2 Animal Care

This protocol has been reviewed and approved by NEON's Institutional Animal Care and Use Committee (IACUC). Any deviations from this protocol that may impact the well-being of a capture are not permitted.

During the trapping period, it is important to do everything possible to ensure the well-being of all potential captures. This includes providing adequate bait and batting under cold conditions (outlined below) and keeping traps in the shade under hot conditions. In addition, animals should not be kept in the traps for excessive periods of time, not to exceed 16-18 hours. If capture rates are high and there is a risk of approaching this threshold, perform only the highest priority tasks during handling (see SOP C.4 for further details).

PIT tags from individual, pre-loaded, gas sterilized, sealed pouches are injected under the skin on the back of the animal and do not impede movement. Ear tags are small, metal, and do not cause unnecessary pain when applied quickly and with sharp and correct application (using provided tool and placed in cartilage at base of external pinnae). In rare cases, if tagging is deemed undesirable considering the condition of an animal (e.g., highly stressed, female that gave birth in the trap), an animal may be released without tagging.

Handling time per individual should be 15 minutes or less, using techniques to reduce injury, stress, and pain. While handling, the condition of all captured individuals must be monitored closely. Specifically, the rodent's rate of respiration, spontaneous movements, responses to tactile stimulation, and ability to retain sternal recumbency should be monitored to gauge both the state of anesthetization (when relevant) and general condition of the animal. A small vial of 10% sugar water must always be available

to revitalize stressed, dehydrated, hypothermic or heat-stressed captures; this solution should be replaced regularly (e.g., monthly) to inhibit the growth of mold.

Stressed individuals should be placed in a secure container containing bait, and in the case of hypothermia, a disposable hand warmer and batting. If conditions are particularly cold (< 65° F/ 18° C) overnight and into the morning, a hand warmer can be started while driving to the site and placed on the defroster vents of the work vehicle so that it is warm by the time of arrival. Individuals monitored for hypothermia should be checked every 15 minutes and released only when the animal exhibits normal behavior. If no signs of recovery are observed by the time processing a grid is complete, the animal should be euthanized with a lethal dose of isoflurane or methoxyflurane. Death must be confirmed via cervical dislocation (see Vertebrate Euthanasia tile in online Training Center). The specimen should then be tagged on the foot, bagged, and placed on dry ice as soon as possible, with ultimate disposition in a curated collection (see SOP C.8 for additional details).

4 SAMPLING SCHEDULE

4.1 Sampling Frequency and Timing

Small mammal sampling is scheduled in bouts, with a bout comprised of three consecutive (or nearly) nights of trapping on pathogen grids and one night of trapping on diversity grids. A single bout can span up to 14 days, if necessary, to ensure adequate time for processing all captures. Sampling frequency, or the number of bouts per year, is determined by whether the site is assigned "standard" or "low intensity" status (**Table 1**). Sampling shall occur year-round, where personnel resources and weather conditions permit, with one bout per year at low intensity sites and a minimum of four bouts per year at standard intensity sites (**Table 1**). Current low intensity sites include BARR, LENO and DSNY because they have low capture success (<5% per year), low diversity (>80% of captures from 3 or fewer species), and low pathogen prevalence (<5% of samples positive for tick-borne pathogens each year). Any expected deviations from this schedule are indicated in the site-specific appendices (Appendix D).

If the sampling schedule must be altered, the OS Prioritization Matrix located on the front page of the Field Science Sampling Support Library should be consulted. Minimum sampling at standard intensity sites requires at least three bouts per site per season spread across early-, mid- and late-season collections to ensure that species with differing seasonal patterns are well-represented in the data. The late-season collection is the highest priority of these bouts with additional details available from the Prioritization Matrix. If site conditions (e.g., flooding) or resource availability prevent trapping of all grids in a bout, a minimum of 3 plot-nights is needed to constitute a bout (e.g., a bout can be canceled if this minimum cannot be achieved, but data and samples should be retained if already collected). A minimum of 75 traps per plot (36 traps at SRER) is needed to constitute a plot-night. Canceled or incomplete bouts need to be communicated to Science with a ServiceNow incident (see Missed or Incomplete Sampling section below).

Table 1. Sampling frequency for Small Mammal Sampling procedures on a per SOP per plot type basis.

SOP	Site Type	Plot Type	Bout Duration	Bouts Per Year	Bout Interval	Remarks
SOP C	Standard intensity	Pathogen	3 nights	4	At least 21 days after end of previous bout	Sampling within 10 days of new moon at weather-appropriate times (Section 4.2)
		Diversity	1 night			
	Low intensity	Pathogen	3 nights	1	Schedule late summer or fall	
		Diversity	1 night			

* Some sites will likely not be able to adhere to these guidelines given limited snow-free windows for sampling. These deviations are captured in the site-specific appendices

Scheduling Considerations

1. **Field Work:** Bouts should be scheduled to occur within 10 days before or after the new moon Traps should be set in the evening no more than 3 hours before sunset and collected at dawn. Traps should not be set if there is any doubt that they can be accessed the following morning.

Avoid scheduling bouts during times of the year when the weather criteria described in Section 4.2 below are not likely to be met.

a. Blood samples should be collected during every bout.

b. Ear, fecal, hair and whisker samples are collected at 3 bouts per year per site. These should be collected only when capture rates are likely to be high enough to yield at least 5 samples per grid per day.

2. **Laboratory Processing:** The evening after samples are collected:

a. Sort all samples according to SOP D. Store ear, fecal, and blood samples in an ultralow (-80°C) freezer upon return from the field.

b. Store voucher specimens in an individual labeled plastic bag in an ultralow (-80°C) freezer.

c. Store coin envelopes containing hair and whisker samples in labeled small plastic bags at ambient temperature and low humidity.

d. At the end of the field season, a subset of ear samples will be sent for DNA barcoding according to SOP F.

4.2 Criteria for Determining Onset and Cessation of Sampling

Sampling bouts should occur as close as possible to the new moon and trapping at all sites should occur within a 21-day window centered on the new moon (i.e., 10 days before the new moon – 10 days after). When possible, the timing of sampling at each site should remain consistent with respect to the new moon over the course of NEON operations, and it is preferable to sample the same month each year. Sampling bouts can span up to two weeks; however, sampling bouts are required to be scheduled at least 21 days after the end of the previous bout. Often sites are scheduled assuming a logistical constraint of trapping 3-4 grids at one site in one evening. However, there is no scientific requirement to schedule the trapping in this way if sufficient personnel are available to sample more grids simultaneously. Fewer grids can also be trapped in a night when capture rates are high or personnel are limited, and bouts can span 14 days for completion. Priority should be given to ensuring that all grids set can be checked in a timely manner the next morning without needing to release animals without processing. These details are left to the discretion of the Field Operations Manager to be approved annually by Science Operations.

Small mammal sampling can be performed under a variety of weather conditions. Weather conditions are recommended to be sourced from weather.gov. However, care must be taken to prevent conditions such that trapped individuals cannot thermoregulate properly, either in hot or cold conditions. Such conditions will result in the death of the trapped individuals. Important permitting requirements include:

- **Each mortality must be reported to the Field Operations Manager within 24 hours** of processing to help ensure that all state- and site-specific permit requirements are followed.

- Be aware that there are state- and site-specific permitting requirements detailed on permits provided by NEON Permitting for reporting both live captures, as well as mortalities of vertebrates captured, including either all species or, in some cases, just the species with state status.
- It is imperative that the staff conducting the small mammal trapping are familiar with the guidelines detailed in the permits for the sites and states in their jurisdiction.
- **If, for any reason ≥ 5 individuals (regardless of species) on any given trapping grid during a single night die,** either in the trap or in hand**, the trapping on that grid should be discontinued** until the next scheduled sampling bout, and a problem ticket should be issued within 24 hours of the event detailing the locations, species, sex, and ages of the mortalities**.** Additional speculation as to mortality causes can also be reported in the problem ticket for assistance with developing mitigation strategies.
    - Note that the samplingImpractical reason for the missed nights of sampling should be reported as 'Disturbance' and no additional remarks in the data are necessary.

If weather or any other circumstances cause one night of trapping within the sampling bout to be missed, consult Section 4.4. Given acclimation and regional variation in the conditions that threaten the survival of trapped rodents, guidelines for preventing mass mortality in cold and hot conditions are provided in the site-specific appendices, as necessary. The following guidelines are generally applicable across sites and can also be found as a Quick Reference in Appendix A.

Cold conditions

- Bedding (i.e., polyester or wool batting) should be used when low temperatures are expected to be < 18°C (65°F), except at sites where heteromyids dominate. In areas that heat up quickly, bedding may be removed prior to processing.
- Extra bait should be added to traps on nights when temperatures are expected to be < 7°C (45°F).
- Trapping should not occur on nights when **both** very cold temperatures (< 5.5°C (42°F)) and (a) precipitation in the form of rain are expected (>20% chance at sites with bedding; >5% chance at sites that cannot use bedding) or (b) dew is expected (i.e., if humidity is >75% and the projected minimum temperature is below the dew point).
- At sites that are cold and wet either consistently or in the shoulder seasons (but still meet the above criteria) and have a history of high mortality during these conditions, traps can be covered with tar paper, as described for the Barrow, AK, site in Domain 18.
- Due to the added logistical burden, trapping should not occur when snow cover exceeds 15 cm (6 inches) at the time of trap setting. Snowfall is not inherently problematic for trapping; therefore, a few inches (<=6 inches) of snow already fallen or predicted to fall during the trapping bout should not prevent trapping. Do not set traps if >6 inches of snow are predicted to fall overnight, as this will significantly increase the effort required to locate and check traps.

- If there are smaller individuals (as detected from the weight of the trap), process these first, as they will typically have a harder time thermoregulating under cold conditions.

Hot conditions

When ambient temperatures are expected to exceed 80 degrees Fahrenheit by 10 a.m.:

- Extra effort must be made to ensure that all traps containing captured individuals are processed or placed in the shade as soon as possible. Work can continue past 10 a.m. or when temperatures exceed 80 degrees Fahrenheit, but care should be taken to ensure the well-being of the captures. Ice packs can be placed with the shaded traps in exceptionally hot conditions.
- If you are unable to arrive at a site due to unforeseen circumstances prior to 8 - 9 am, field technicians should open all traps to release animals and avoid heat-induced mortality. The trap night should be repeated the subsequent night by resetting the traps.
- Heat-stressed individuals can be cooled by wetting them down, particularly around their head and inguinal regions.
- If there are larger individuals (as detected from the weight of the trap), process these first, as they will typically have a harder time thermoregulating under hot conditions.

All conditions

If there is any chance (i.e., >0%) that traps cannot be checked the following morning at dawn, traps shall not be set. For example, if trap locations are accessed via dirt roads that become impassable when wet, do not set traps if there is a possibility of rain overnight.

Windy conditions

If winds are very strong (> 35 mph) – either consistently or gustily – and there is little vegetation to protect the traps, trapping is not recommended. A mechanism to secure traps could prove useful for moderately windy conditions. For example, bending wire to fit snuggly over traps has proven effective at some sites (Denise Stetson, pers. comm.).

Predators

If predators destroy (i.e., damage beyond repair) >15 traps on a single grid on any given night, traps should be removed from the grid and that sampling bout terminated prematurely for that grid. The Field Operations Manager shall be informed as soon as possible, and a problem ticket should be issued.

If predators disturb (i.e., not damaging but closing trap doors, moving traps, etc.) > 30 traps on a single grid on any given night (or the combination of destroyed and disturbed traps > 30), traps should be removed from the grid and that sampling bout terminated prematurely for that grid. The Field Operations Manager shall be informed as soon as possible, and a problem ticket issued.

Cattle

If cattle disturbance is significant, issue a problem ticket. A mechanism to secure traps could prove useful (see Windy Conditions above). If steps to secure traps are unsuccessful at minimizing cattle disturbance, guidance for grid closure due to cattle disturbance should follow that listed above for predator disturbance.

Documentation of Issues

1. Data from animals that die during the course of handling or trapping should be recorded, with a 'D' marked on the datasheet or 'dead' selected in the mobile application in the appropriate field (fate). The 'D' supersedes the 'not processed' option for the fate field.
2. If traps are not set on a particular grid as scheduled AND the trap night cannot be rescheduled, a samplingImpractical entry should be made in the trap setting app for each grid and night for which a sampling event is missed. The user should select the best explanation for why the night was missed from the drop-down menu. The intent is to generate records for all intended grid-nights of trapping per bout, with remarks explaining why a given trap-night was missed and unable to be rescheduled. Even if the bout would technically (e.g. per protocol) be considered "complete" without that grid-night of sampling, samplingImpractical should still be used to assist the end user in assessing data completeness. In the case where the minimum number of bouts will still be completed (1 for low intensity or 4 for standard intensity sites), but an 'extra' scheduled bout will be missed, samplingImpractical need not be completed for this missed "extra" bout.
3. When large-scale disturbances such as a hurricane, flood or fire happen at a site, these should be reported in the Site Management app, regardless of whether they disrupted sampling or not.
4. If no individuals are captured, this should also be noted on the datasheet. Electronic data devices (e.g., Fulcrum) automatically default to set and empty (trapStatus=6).
5. If traps are damaged or disturbed overnight, note trap locations and record the nature of the disturbance in the trapStatus field (**Table 2**), with any other known details described in the remarks field.
6. If a trap is discovered to have been set too tightly to successfully capture an animal overnight, a trap status of 2 should be used.

Table 2. Descriptions and prescriptions of codes used in Notes field of small mammal datasheet and Trap Status field of mobile data entry application.

Definitions	Application Rules
1 – traps not set	Used at the level of the entire trapping grid, or, if some traps on a grid were set and others were not, can be used to indicate which ones were not set. This can also be used in the extremely rare event that a set trap goes missing due to predator disturbance.

Definitions	Application Rules
2 – trap disturbed/door closed but empty – no animal sign	Used per trap coordinate, when necessary. Also used if a trap is discovered to have been set too tightly to successfully capture an animal overnight or for the capture of a non-mammal species (e.g., bird or reptile).
3 – trap door open or closed with feces left behind or bait missing	Used per trap coordinate, when necessary.
4 – >1 capture per trap	Used per trap coordinate; in the rare event of multiple captures per trap; enter this note code for each individual
5 – single capture in trap	Used per trap coordinate, when necessary
6 — trap set and empty	Used at the level of the entire trapping grid (paper datasheets), or, if some traps on a grid were set and empty.

Bout Completion Criteria

- A minimum of 3 plot-nights sampled is needed to constitute a bout
- A minimum of 75 traps per plot is needed to constitute a plot-night

4.3 Timing for Laboratory Processing and Analysis

Process all frozen samples immediately upon returning to the lab according to SOP D: Post-Field Sampling Tasks. Once samples are frozen, they must remain frozen; plan accordingly. A subset of the ear tissue samples will be used in SOP F.

4.4 Sampling Timing Contingencies

If weather or any other circumstances cause a night of trapping within the sampling bout to be missed, trapping may be resumed and continued as normal within 5 days of the latest night of trapping (even if trapping extends outside of the new moon window). If this is not possible, sampling should be resumed as soon as possible, while maintaining the timing of trapping relative to the new moon for the sites.

Table 3. Contingency decision for small mammal sampling protocol.

Delay	Action	Outcome for Data Products
Hours	If traps are set, the traps must be checked and any captured individuals processed or released without processing AS SOON AS POSSIBLE. Do whatever it takes (within safety limitations) to prevent mortality of study animals.	Trapping-induced mortality violates the assumptions of the mark-recapture models that are used to estimate density. In addition, high mortality rates from trapping threaten the scientific and ethical integrity of the study.

1-10 days	Add additional days of sampling as soon as possible to sample all points. Submit an incident ticket to document delayed sampling.	Fewer sampling points could result in less precise estimation of richness, diversity, or density. Capture-recapture models require recapture data from >1 night of sampling per bout to estimate densities. If additional time is not available, fewer samples will be collected. Although densities cannot be calculated if recapture data are insufficient, any night of trapping produces valuable data regarding relative abundances of species, reproduction and persistence of local populations, and species presence/absence.
11 or more days	Do not sample. Resume sampling as scheduled during the next month. If resources are available, missed nights of sampling may be rescheduled to occur during an additional bout later in the year. Submit an incident ticket to document missed sampling	1. Species richness or demography due to changes in seasonal phenology could be influenced by significant changes in temporal sampling window. 2. Not completing sampling on all plots impacts diversity metrics and target sample size.

4.5 Missed or Incomplete Sampling

Sampling according to the schedule is not always possible, and multiple factors may impede work in the field at one or more plots or sampling locations in a given bout. For example:

- Logistics – e.g., insufficient staff or equipment
- Environment – e.g., deep snow, flooding, inclement weather, or
- Management activities – e.g., controlled burns, pesticide application

Instances such as those listed above must be documented for scheduling, tracking long-term plot suitability, and informing end users of NEON data availability. Some types of missed sampling are due to events that should be recorded in the Site Management App; refer to the Site Management and Event Reporting Protocol for more detail (RD[06]).

Missed or Incomplete Sampling Terms

Terms that inform Missed or Incomplete Sampling include:

- **Protocol Sampling Dates**: Bout-specific sampling dates.
- **Scheduled Sampling Dates**: Bout-specific sampling dates scheduled by Field Science and approved by Science. These dates coincide with or are a subset of the Protocol Sampling Dates.

- **Missed Sampling**: Incidence of *scheduled sampling* that did not occur. Missed Sampling is recorded at the same resolution as data that are ordinarily recorded.
- **Sampling Impractical**: The field name associated with a controlled list of values that is included in the data product to explain a Missed Sampling event – i.e., why sampling did not occur.
- **Rescheduled**: Missed Sampling is rescheduled for another time within the *protocol sampling dates*, resulting in no change to the total number of sampling events per year.

The documentation that must accompany missed sampling depends on the timing, subsequent action, and the audience appropriate for numerous scenarios (**Figure 2**).

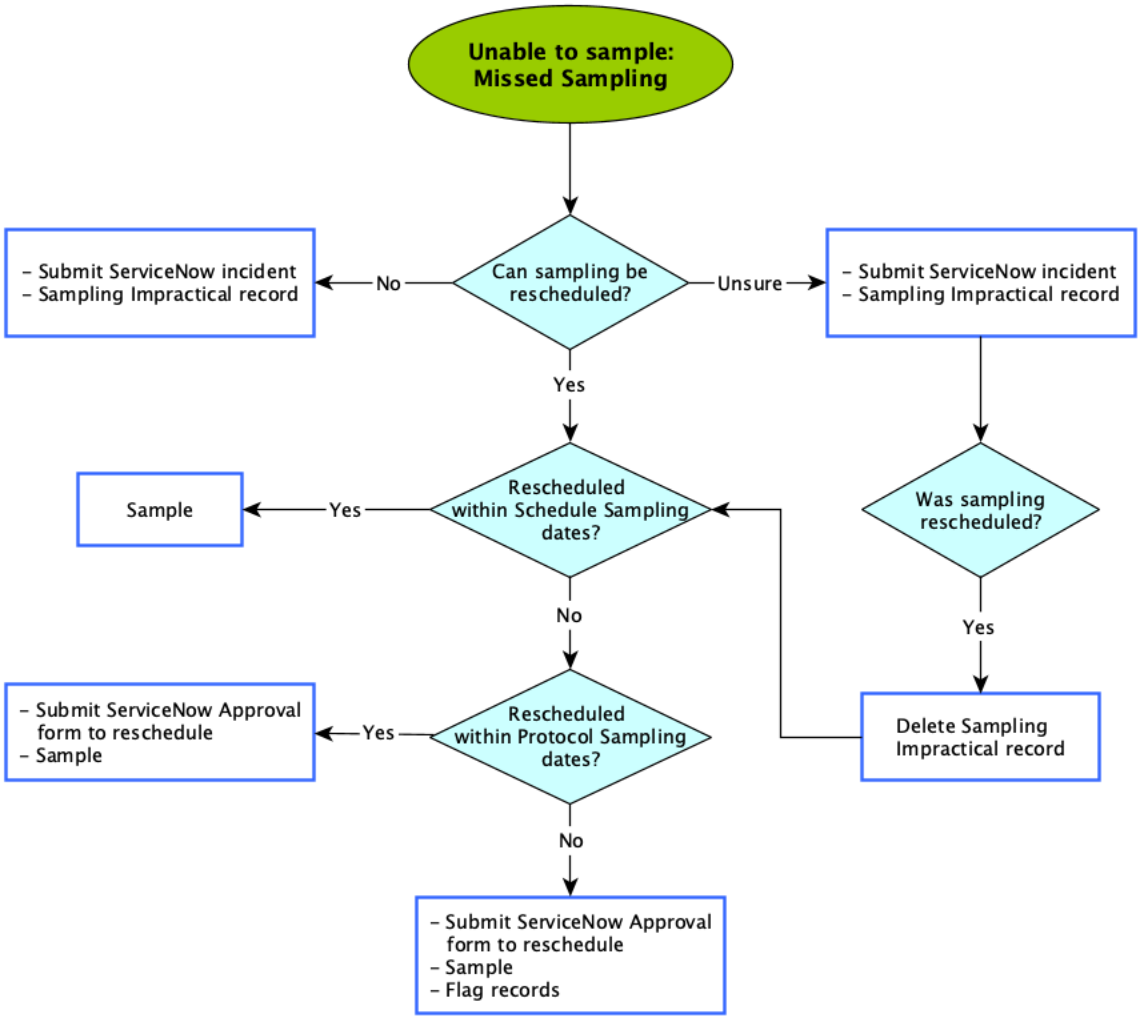


Figure 2. The documentation to account for a Missed Sampling event depends on the situation for each sampling unit not sampled per bout that is not sampled. Diamonds represent decision points and boxes describe the required action. Required actions may include: a) Submitting a ServiceNow incident, b) creating a Sampling Impractical record, c) creating a data Flag, d) creating a Site Management record, or e) some combination of (a) – (d).

To Report Missed or Incomplete Sampling

1. Missed or Incomplete Sampling must be communicated to Science by a Service Now Incident.
    a. For Missed Sampling that is Rescheduled outside the Master Schedule, there are some cases that require approval by Science and Operations (**Figure 2**, **Table 3**).
    b. If scheduled activities are delayed > 5 days past their scheduled date, a schedule change request should be submitted to Science. If a scheduled bout is canceled, it should be reported to Science using a Service Now incident. Guidance for this and other NEON protocols is summarized for ease of use in a table posted to a Field Science Sharepoint library. However, this protocol is the ultimate source of information should any discrepancy exist.
2. Create a Fulcrum record for each Missed Sampling event in the field that cannot be rescheduled. That is, because small mammal data are recorded in the field at the plot level, a record must be made for each plot missed.
    a. Use the "All Traps Not Set" button in the MAM: Trap Setting app. If you indicate that all traps were not set, you will be required to provide a reason in the "Sampling Impractical" field.
    b. Note that this ***must*** be done ***while*** connected to wi-fi. If a setting record is created off-line the collection records will not be created even after the tablet is synced. In most cases, this means that the record of missed sampling must be made after returning to the lab.
    c. Example app usage: if a grid-night of sampling could not be completed or rescheduled on a pathogen grid, the MAM: Trap Setting application should be used to create a Traps Not Set entry for all 100 traps on that grid. In the Sampling Impractical field choose a reason why sampling was impractical from the drop-down menu of choices **Table 4**.
    d. Missing data in downstream applications (e.g., Lab apps) are not recorded. For example, it is not necessary to record missing data in downstream applications (e.g., the MAM: Trap Collection or Lab apps).
3. For each Missed Sampling record, the **Sampling Impractical** field must be populated in the mobile collection device (**Table 4**).
4. For Rescheduled sampling events that occur outside of the defined Protocol Sampling Dates, a protocol-specific Flag must also be recorded (**Figure 2**)
    a. In the MAM: Trap Setting application mark "yes" if rescheduled sampling events occur outside of the 21 day new moon window. This will auto-generate the remark "Sampling outside 21 day new moon sampling window".

Table 4. Protocol- specific reasons for Sampling Impractical being entered in the Fulcrum application. In the event that more than one is applicable, choose the dominant reason sampling was missed.

Sampling Impractical reason	Description
Other	Sampling location inaccessible due to other ecological reason described in the remarks
Location flooded	Standing or flowing water too deep to complete sampling
Temperature high	Ambient temperature exceeds sampling requirements specified in protocol
Temperature low	Ambient temperature lower than requirements specified in protocol
Logistical	Site or plot access compromised, staffing issues, errors (e.g., equipment not available in the field)
Disturbance	Used when a grid must be closed early due to predators, bears, or mortality events.
Management	Management activities such as controlled burn, pesticide applications, etc.
Too windy	Used when high winds would make trapping impossible.
Extreme weather	Events (e.g., thunderstorms, hurricanes) that compromise safety and access

4.6 Estimated Time

The time required to implement a protocol will vary depending on a number of factors, such as skill level, system diversity, environmental conditions, and distance between sample plots. The timeframe provided below is an estimate based on completion of a task by a skilled two-person team (i.e., not the time it takes at the beginning of the field season). Use this estimate as a framework for assessing progress. If a task is taking significantly longer than the estimated time, a problem ticket should be submitted. Please note that if sampling at particular locations requires significantly more time than expected, Science may propose to move these sampling locations.

An experienced two-person team will require approximately 30 - 60 minutes to set and bait one trapping grid (100 traps), depending on the difficulty of the terrain and the visibility of trap markers, if allowed at a given site. Checking the grid for disturbance and captures and transporting these traps to the processing station will require approximately 45 – 90 minutes per trapping grid per experienced two-person team. Processing time per trapping grid will vary with the number of captures on a grid. Each capture must be processed in less than 15 minutes; however, most captures should be able to be processed in less than 5 minutes. The final step in the process is to return captures to the point of capture, which should require approximately 45 – 90 minutes per trapping grid.

Table 5. Estimated staff and labor hours required for implementation of Small Mammal Sampling protocol.

SOP	Estimated time	Suggested staff	Total person hours
SOP C.1: Setting Traps	0.5 – 1 h per grid	2	1-2 h per grid
SOP C.2: Checking Traps	0.75-1.5 h per grid	2	1.5-3 h per grid
SOP C.3-9: Processing Captured Animals	1 – 6 h per grid	2	2 – 12 h per grid
SOP D: Equipment Cleaning	0.5 – 1 h per grid	1	0.5 – 1 h per grid
SOP E: Laboratory Sampling and Analysis	2 – 3 h per bout	1	2 – 3 h per bout
SOP F: Processing for Genetic Analysis	3 – 5 h per season	1	3 – 5 h per season
SOP G: Data entry and Validation	0.5 h per grid	1	0.5 h per grid
SOP H: Sample Shipment	3 – 9 h per season	1	3 – 9 h per season

5 SAFETY

This document identifies procedure-specific safety hazards and associated safety requirements. It does not describe general safety practices or site-specific safety practices.

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD[02]) and EHS Safety Policy and Program Manual (AD[01]). Additional safety issues associated with this field procedure are outlined below. The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.

5.1 Working with Small Mammals

Personnel working with small mammals should familiarize themselves with the Zoonotic Diseases section of AD[02]. The incidence of these diseases in humans is extremely rare, with the exception of Lyme disease in certain regions of the country, and is typically associated with working outside in vegetated areas. Although rodents and other small mammals and their ectoparasites (e.g., ticks and fleas) are critical to the lifecycle of many of these disease-causing organisms, there is no evidence that the handling of small mammals significantly increases risk of exposure to many of these diseases beyond other types of field work. One possible exception to this is Hantavirus Pulmonary Syndrome (HPS), which is believed to result from inhalation of contaminated, aerosolized urine and feces, as well as through bites. Most of the known cases of HPS have resulted from inhalation of aerosolized virus present in cabins and other remote buildings in which small mammals are nesting (Kelt et al. 2007, 2010).

There are a number of Hantavirus species in North America, and most of the cricetid rodents in North America appear to be competent reservoirs for these pathogens. Of these cricetids, *Peromyscus maniculatus* is the primary reservoir for the Sin Nombre virus, the hantavirus most often linked to HPS. This species is widespread throughout North America, but, according to Centers for Disease Control and Prevention (CDC) data, HPS cases are more numerous in western states. The highest incidence of HPS is found in California, Arizona, New Mexico, Washington and Colorado. Consequently, NEON is using a tiered approach to personal protective equipment (PPE) that reflects HPS incidence reported by the CDC (AD[02]).

Leptospirosis is a zoonotic disease found worldwide and is particularly common in tropical and subtropical climates of the United States and in Puerto Rico. It is commonly carried by rats, which may show no signs or symptoms of the disease, and which may continue to spread the disease for months or years.

According to the CDC, humans can become infected through:

- Contact with urine (or other body fluids, except saliva) from infected animals.
- Contact with water, soil, or food contaminated with the urine of infected animals.

- The bacteria can enter the body through skin or mucous membranes (eyes, nose, or mouth), especially if the skin is broken from a cut or scratch.
- Person to person transmission is rare.

5.2 Clothing and PPE

According to the NEON Operations Field Safety and Security Plan (AD[02]), whenever directly handling small mammals or working with equipment/supplies that have been in contact with small mammals, personnel are required to wear, at a minimum:

- Eye protection
  - Safety glasses with ventilation to minimize fogging up in humid environments
  - Intended to discourage rubbing of the eyes with potentially contaminated hands and protect from the unlikely occurrence of extreme splashes during blood collection
  - Face shields (disposable or re-usable) are required during trap cleaning to minimize hazards associated with splashing of chemicals or contaminated material. If re-usable face shields are worn, they must be de-contaminated between uses following guidance for the cleaning of eye protection. Specifically, face shields need to be wiped down with quat cleaner after each use.
  - Mobile eye wash must be available in the field in case of accidental contact between eyes and chemical irritants (e.g., DNA/RNA shield)
  - At all NEON sites
- Gloves
  - Latex and/or nitrile – disposable - to provide a barrier against infectious excreta and body fluids during small mammal handling at all NEON sites
  - Scratch-resistant gloves (worn under latex/nitrile gloves to allow for effective decontamination)– to provide an additional layer of protection from cuts, scratches or minor bites for new handlers. The point at which the extra gloves are no longer needed corresponds to when the trainee, as assessed by their trainer, can confidently handle all of the different species that they encounter in the field.
    - Required for new handlers: all sites in CO, NM, AZ, CA, and WA
    - Recommended: all sites in KS, TX, UT, MT, NV, ID, and OR
    - Optional but highly recommended by NEON Safety at all other sites.
  - Reusable cloth gloves with rubber-tipped fingers should be worn when checking traps at all NEON sites.
- Clothing
  - Long-sleeved shirt
  - Long pants

- Close-toed shoes with socks
- Optional: a disposable or reusable (cotton) laboratory coat or apron
- At all NEON sites

- Respiratory protection
  - Disposable respirators with N95 (HEPA-equivalent) particulate filter
    - Required at YELL (in WY) at any point when working with small mammals or around traps that have been in contact with small mammals per NPS permit.
    - Required for small mammal handling and trap cleaning activities at all sites in CO, NM, AZ, CA, WA. Respirators are not required for collection or bagging of traps or transporting closed bagged traps.
    - Recommended: all sites in KS, TX, UT, MT, NV, ID, and OR
    - Optional at all other sites
  - Optional half-face disposable dust mask with P100 filters at all sites
  - Please note that a NEON safety fit test and medical evaluation by licensed provider is required prior to wearing a respirator.

Any items of clothing that have or may have been in contact with small mammal excreta or bodily fluids should be sterilized to ensure safety. According to the Centers for Disease Control and Prevention, decontamination can be accomplished by exposing contaminated clothing to UV (i.e., sunlight) for 4-6 hours or laundering in a washing machine using hot water and any commercially available laundry detergent. Spot treatment of personal attire or protective equipment using a spray bottle filled with quat cleaner should be performed in the field during sampling. Contaminated clothing should not be washed with other personal or with family laundry. If decontamination cannot be performed immediately, potentially contaminated clothing should be stored in a closed biohazard bag.

Other personal protective equipment should be cleaned throughout each sampling day. Eye protection and shoes should be wiped down with quat cleaner. Gloves should be cleaned and disinfected. Disposable gloves and respirators should be discarded if they become torn or damaged while sampling. Care should be taken not to fold or crush respirators. At a minimum, gloves should be replaced after captures from each sampling grid have been processed. If used, half-face respirators should be fully cleaned in accordance with the NEON EHS Safety Policy and Program Manual (AD[01]). All disposable items should be sprayed with quat and disposed of in a plastic trash bag.

To ensure safety when using DNA/RNA shield to preserve samples, all personnel must wear appropriate personal protective equipment (PPE). A mobile eye wash, first aid kit, and spill kit must be available, along with proper disposal for waste. Field staff should be trained on safe handling procedures, and safety data sheets (SDS) must be readily accessible. Safety Data Sheets (SDS) shall be reviewed prior to use and readily available for chemicals used in this protocol (Isoflurane, Methoxyflurane, Dry Ice, Ethanol, etc.)

6 PERSONNEL

6.1 Training Requirements

All technicians must complete protocol-specific training as required in the Field Operations Job Instruction Training Plan (AD[04]). Additional protocol-specific required skills and safety training are described here.

The training plan for small mammal abundance and diversity will include the following components:

- Foundational training in animal care and use for Science Staff, Field Operations Managers and Field Science Technicians is provided through the Collaborative Institutional Training Initiative (CITI) (https://www.citiprogram.org). The CITI Program covers general principles of ethical care and use of animals in research, training, and testing, and includes modules focused on the care and use of particular species. Content is designed to meet USDA and OLAW requirements for basic training in the humane care and use of animals. Required modules are present after login and selection of the specific employee group.
- A classroom session will be conducted prior to the field sampling to provide an overview of the procedure and the goals of the sampling.
- Within each domain, the lead mammal ecologist will provide a review of the sampling equipment and the small mammal species of each site within that domain to seasonal staff.
- Personnel performing cervical dislocation must be properly trained and qualified in vertebrate cervical dislocation.
- Domains in the first year of sampling (i.e., while in construction) will receive laboratory-based training in handling and bleeding techniques prior to the onset of sampling.
- Prior to the start of operational field sampling, technicians new to small mammal trapping will gain experience with these techniques in the field with wild-captured mammals. Training will be provided by an experienced NEON mammalogist and can occur either through a trapping exercise on 1-2 training grids (depending on availability), or during a data collection bout on one of the long-term trapping grids. If training grids are used, all methods will be the same as proposed for operational sampling, except for the potential for additional voucher specimen collection (see SOP C.8), but will occur off of the long-term trapping grids and does not need to be organized with respect to the new moon. Each training grid will be sampled a maximum of four nights per month, yielding approximately 20 – 100 individuals (reflecting capture rates between 5 and 25%) per grid. Training grids will be sampled up to a maximum of 3-4 times per year, to provide opportunities for training whenever a new technician joins the study.
- Please note that data from training grids should only be captured on paper datasheets and do not get entered into the NEON database. Samples, but not voucher specimens, collected from these grids should be discarded. Voucher data should be entered into the mobile data entry application designed for vouchers (Mammal and Herptile: Off Grid Voucher application) – not the small mammal sampling application.

- NEON HQ or domain staff or contractor will perform hot checks of species ID on the NEON technicians involved in the data collection, if funding is available.

All technicians should have access to the following materials:

- Field guide to Mammals of North America
- Electronic field guide to mammals within the relevant domain.
- Dichotomous keys for small mammal species at each site (see RD[12] through RD[28]).
- Guidelines of the American Society of Mammalogists for the Use of Wild Mammals in Research (Sikes et al. 2016)

6.2 Specialized Skills

6.2.1 Trapping

Technicians responsible for setting and checking traps must be willing and able to carry traps in bundles up to 40 pounds and wear the mandatory personal protective equipment (PPE) described in the NEON Operations Field Safety and Security Plan (AD[02]). Technicians who are responsible for checking traps but not handling captured animals must also be willing and able to (1) record data in neat, legible hand-writing or, preferably, use a mobile data recording device (e.g., tablet), and (2) assist the mammal handler in any way (e.g., preparing tags for marking, handling or disinfecting equipment after sample collection).

6.2.2 Handling

The technicians employed to handle and process small mammals must have prior experience handling wild small mammals or receive sufficient training prior to sampling, and must be able to correctly identify and safely process all small mammals potentially found within the domain. An identification key based on external features and summary description of species expected in the study area should be available for technicians for reference. All personnel shall thoroughly review the Guidelines of the American Society of Mammalogists for the Use of Wild Mammals in Research (Sikes et al. 2011) prior to field sampling.

7 STANDARD OPERATING PROCEDURE

SOP Overview

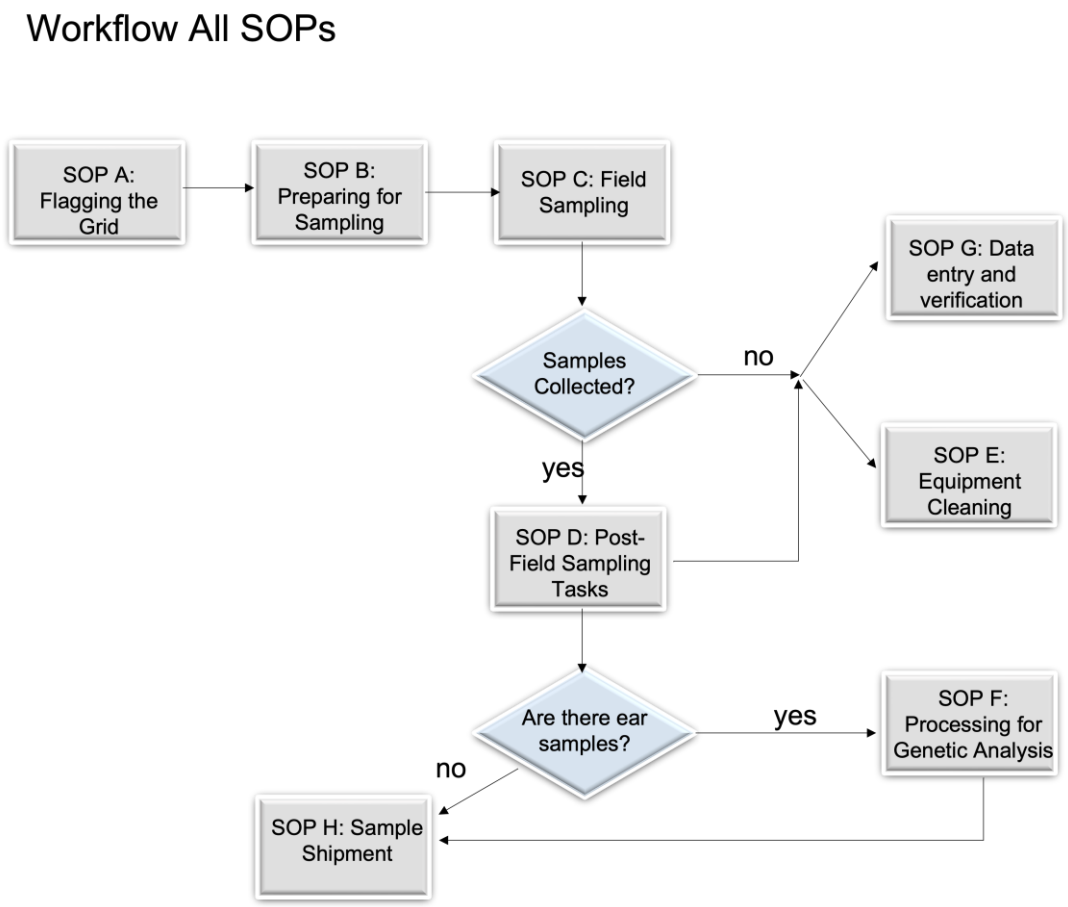


Figure 3. A high level workflow diagram that visually shows how the separate SOPs are sequentially connected.

- **SOP A**: Instructions for initial grid set up.
- **SOP B**: Gathering the necessary paperwork and equipment for sampling
- **SOP C**: Describes how to set and collect traps and process animals in the field
- **SOP D**: Provides instructions for processing samples and recording missed trapping after returning from the field
- **SOP E**: Explains the method for cleaning dirty traps
- **SOP F**: Describes the steps involved in preparing ear punch samples for genetic analysis
- **SOP G**: Explains methods for data entry
- **SOP H**: Gives guidance on sample shipment

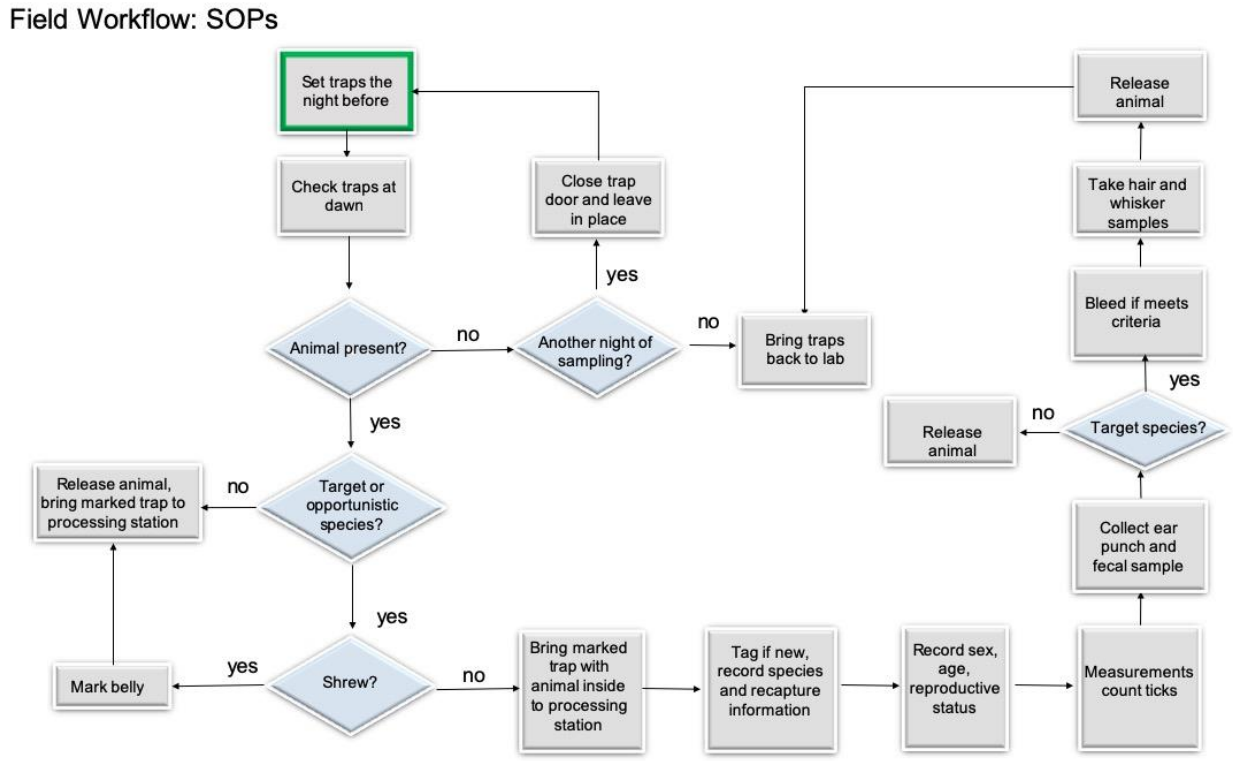


Figure 4. An expanded diagram of the workflow for the field sampling SOPs. Blue diamonds indicate decision points when implementing the protocol, gray boxes indicate tasks to be completed. The green box indicates the starting point for the diagram.

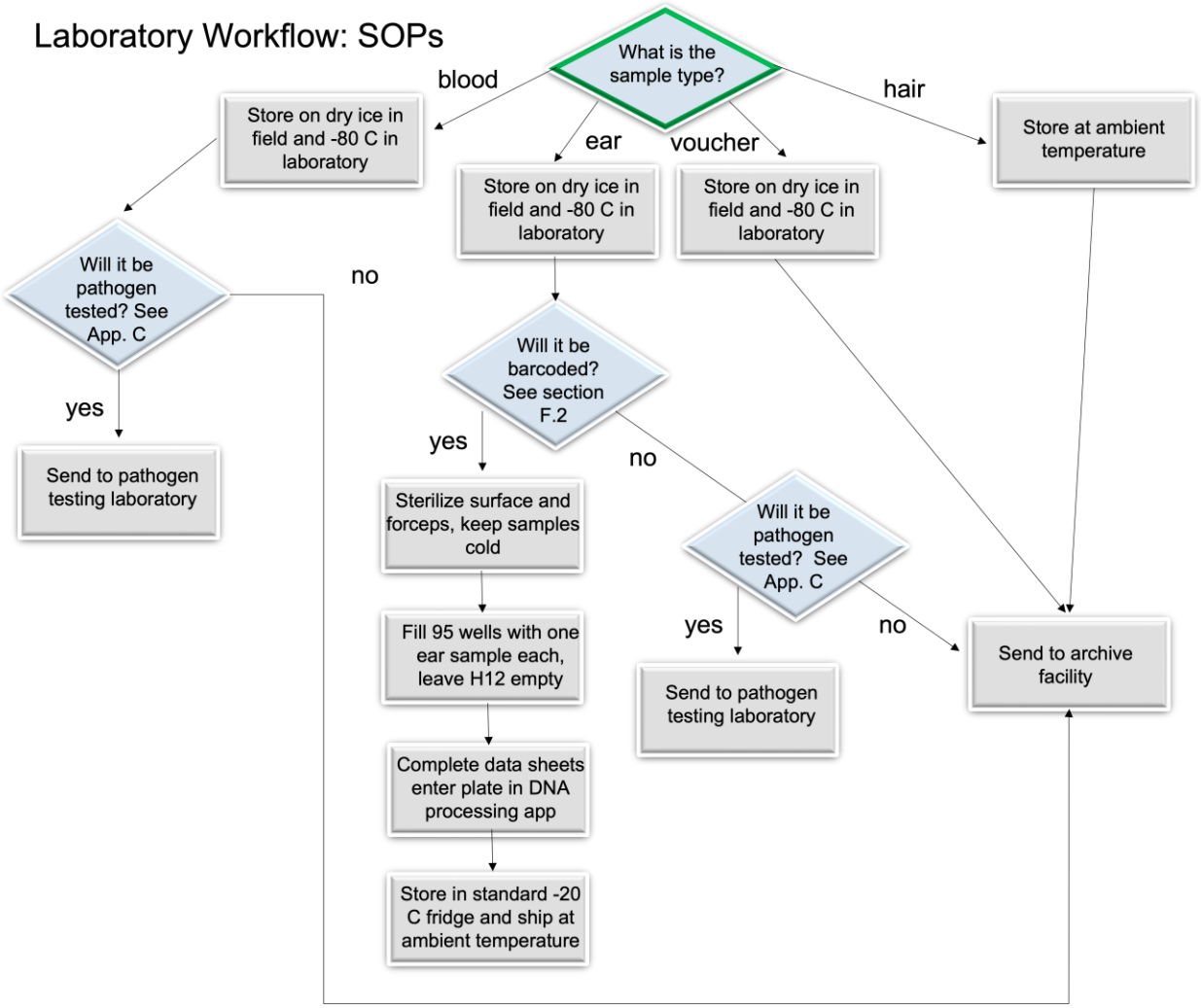


Figure 5. An expanded diagram of the workflow for the laboratory analysis SOPs. Blue diamonds indicate decision points when implementing the protocol, gray boxes indicate tasks to be completed. The green box indicates the starting point for the diagram.

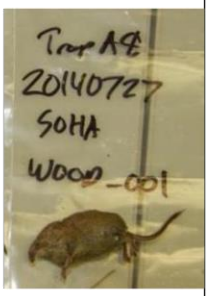
	 **Hair and whisker samples**	 **Blood samples**	 **Ear punch samples**	 **Fecal samples**	 **Voucher samples**
Species:	Target spp.	Target spp.	Target and opportunistic spp.	Target and opportunistic spp.	opportunistic
Yearly Frequency	3 bouts/yr	All bouts	3 bouts/yr	3 bouts/yr	opportunistic
Per Individual Frequency	1 per bout per individual	1 per bout per individual	1 per life of individual	1 per day per individual	N/A
Limits	10/sp/grid/bout	20/grid/day	10/sp/grid/bout	10/sp/grid/bout	opportunistic
Labels	Type I barcode	Type IV barcode	Type IV barcode	Type IV barcode	Acid-free archival tag with Type IV barcode on back
Storage Temp.	Ambient	Dry ice / -80 C	Dry ice / -80 C	Dry ice / -80 C	Dry ice / -80 C
Reminders	Full 5 mg amount				

Figure 6. A visual diagram of the suite of field-generated samples during small mammal bouts along with details about collection, labeling and storage.

SOP A Flagging the Grid

Small mammal traps are arrayed in a 10 x 10 grid, with 10 meter spacing (**Figure 7**). Plot establishment for small mammal trapping grids as described in RD[08] must be completed prior to or concurrently with this procedure. During plot establishment, a primary marker is placed at the E5 trapping station and secondary markers at the corners, if permitted. Placing pin flags marked with the corresponding trap coordinate at each trapping location immediately prior to each sampling season or bout (depending on permitting guidelines for each site) is critical to ensure timely and accurate trap setting and checking. If permitted, permanent markers suited to domain-specific conditions can be used in place of pin flags.

		A	B	C	D	E	F	G	H	I	J
↑ NORTH	**1**	A1	B1	C1	D1	E1	F1	G1	H1	I1	J1
	2	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2
	3	A3	B3	C3	D3	E3	F3	G3	H3	I3	J3
	4	A4	B4	C4	D4	E4	F4	G4	H4	I4	J4
	5	A5	B5	C5	D5	**E5**	F5	G5	H5	I5	J5
	6	A6	B6	C6	D6	E6	F6	G6	H6	I6	J6
	7	A7	B7	C7	D7	E7	F7	G7	H7	I7	J7
	8	A8	B8	C8	D8	E8	F8	G8	H8	I8	J8
	9	A9	B9	C9	D9	E9	F9	G9	H9	I9	J9
	10	A10	B10	C10	D10	E10	F10	G10	H10	I10	J10

Figure 7. The grid coordinate system, consisting of 100 trap stations 10 meters apart. Trapping grids are permanently marked at the E5 trap station during plot establishment, at sites that allow permanent markers. Grids may also be marked with secondary markers at the corners, if also permitted.

PROCEDURE

1. Using a recreational GPS, navigate to either the permanent plot marker at E5, or, if available, to a secondary marker at one of the corners.
    - **Remember** that foot traffic should be restricted to paths along the North – South lettered traplines and along traplines 1 and 10, as much as possible.
2. Stretch a 50 or 100-meter tape along the trapline from a previously marked point, heading due south or due north from the marked point. Use chaining pins or similar stake at each end to hold the tape in place.
    - Use one of the high accuracy marked points (A1, J1, A10, J10 or preferably E5; see **Figure 7**) from plot establishment to begin flagging.
        - In areas of dense vegetation, it is recommended to first build the 5 line from E5 and then use 2 x 50m tapes going north and south from each 5 flag to build the lines. Please note that this technique should only be used in dense environments, as it requires traversing the plot E-W – rather than the preferred N-S.

- The tape-based grid and the corners established during plot establishment will only agree in a perfectly flat environment. Unlike in other protocols, the tape-based measurements should take priority over the established points, although variation between these will most often be within several meters.
- The TruPulse 360R Laser Range Finder can be used as an alternative to the measuring tape in dense habitats where stretching tape is onerous.
    - See RD[10] for details on using the TruPulse rangefinder.
    - Using the TruPulse to meter out the 10m spacing between traps in dense or steep environments requires measuring both azimuth and distance with the rangefinder to maintain the straight line measurement (RD[10]).

3. **Place a pin flag** every ten (10) meters along the trapline. Traps will be set within 1 m of these pin flags during each sampling bout.

- For easier navigation in low light conditions, alternate flag colors along trapline rows (e.g., use orange flags in Rows A, C, E, G, I and blue flags for the remaining rows).

4. **Write the trap coordinate** (e.g., A2) with a permanent maker on each pin flag.

SOP B Preparing for Sampling

B.1 Technician Readiness

Field technicians should be prepared to identify all small mammal species in the area, but should also carry the appropriate dichotomous keys, lists of state and federally listed species, and the specified field guide in the event of the capture of a rare species. Technicians also need to be very familiar with the grid coordinate system, so that capture locations are accurately documented.

B.2 Preparing for Data Capture

Mobile applications are the preferred mechanism for data entry. Mobile devices should be fully charged at the beginning of each field day, whenever possible.

However, given the potential for mobile devices to fail under field conditions, it is imperative that paper datasheets are always available to record data. Paper datasheets should be carried along with the mobile devices to sampling locations at all times.

B.3 Field Equipment and Materials

A significant amount of specialized equipment is required to conduct small mammal surveys. All field personnel must be familiar and comfortable with using all the equipment before heading into the field. See Appendix E for a list of equipment necessary to complete this SOP. If dry ice is unavailable refer to RD[09] for additional required materials.

In addition, the Pesola spring scales used for weighing small mammals need to be calibrated prior to each bout, and scale integrity must be tested once per year.

1. Calibration Procedure: This process ensures that scales are calibrated to register accurate weights and have not been inadvertently adjusted.
    a. Place a weight around the mid-point of the scale's range into a bag. Note that this does not need to be a calibration weight – it can be any object around the mid-point of the weight range for the scale (e.g., measured bags of seed).
    b. Weigh the bag plus the weight to the nearest 0.1 g on the laboratory balance and record this reference weight.
    c. Clip the bag plus the weight to the spring scale and record the registered current weight. Ensure the scale is held vertically so the spring hangs freely and is not stuck.
    d. Turn the knob at the top of the spring scale until the weight registered by the spring scale matches the reference weight.
2. Testing Scale Integrity: This process ensures that scales are able to accurately register weights across their range and should be performed once per year. As the springs in the scales age there will be a point when they are no longer accurate enough for field use.
    a. Perform the calibration procedure above with a weight at the mid-point of the scale range.

b. Perform the calibration procedure above but this time with a weight in the lower 25% of the scale's weight range (e.g., for a 100g scale use ~25g weight).

c. Perform the calibration procedure a third time with a weight in the upper 75% of the scale's weight range (e.g., for a 100g scale use ~75g weight).

d. Discard and replace any calibrated spring scales registering weights that diverge from the true weight by more than 5% (e.g., for a calibrated scale that is measuring a weight that is 80g, the scale passes the integrity test if it registers a value between 76-84g).

B.4 Labels and Identifiers

1. Prepare final sample containers by affixing one Type I adhesive barcode label to each coin envelope or vial and/or one Type IV adhesive barcode label to each voucher tag or 2 mL vial used to contain each sample. Adhesive barcode labels should be applied to dry, room temperature containers in advance of their use in the field (at least 30 minutes prior but may be applied at the start of the season).

   a. If vials are used, barcode labels should be oriented such that it is possible to scan them; the scanner will not work on a curved surface. This means aligning the barcode lengthwise along a vial, *not* horizontally wrapping around a vial.

Figure 8. Diagram showing appropriate orientation of barcodes on vials to allow for scanning.

   b. Barcode labels must be associated with a unique sample and each barcode must be mapped to one sample in the database. Barcodes are unique, but are not initially associated with a particular sample, so you are encouraged to adhere barcode labels to needed containers in advance.

Figure 9. An example of a Type I and a Type IV barcode. Type I barcodes should be used on coin envelopes for hair and whisker samples, and are large-size and field-tolerant with a prefix of 'A' followed by 11 numbers. Type IV barcodes should be used on all 2mL vials and placed on the back of voucher labels. Type IV barcodes are -80 tolerant and have a prefix D followed by 11 numbers.

About barcode uses and placement

This protocol generates samples from field-caught small mammals that are then sent to external facilities for pathogen analysis, DNA barcoding, or archiving.

Although it is always acceptable to use barcodes, in some cases barcodes are absolutely required. **Table 6** provides a quick reference to the types of samples that require barcodes. The rule of thumb is that the primary field sample will ALWAYS need a barcode due to its importance in generating future samples. Likewise, the final disposition of all vialed samples must have a barcode affixed to assist in the shipping and receipt of samples destined for the Biorepository or an external laboratory.

Table 6. Barcode requirements for sample types generated by the Small Mammal Sampling protocol.

Sample Type	Description	Example Identifier	Fulcrum App	Container Type	Barcode Used	Barcode Required ?	Bar code Qty
Hair and whisker samples	Hair samples cut from trapped small mammals	OSBS.20130714.R1357.H *(SiteCode.collectDate.TagID.sampleType)*	MAM: Trap Collection	Coin envelope	Type I	Required	1 per individual
Blood samples	Blood samples from trapped small mammals	OSBS.20130714.R1357.B *(SiteCode.collectDate.TagID.sampleType)*	MAM: Trap Collection	1.5 - 2 mL cryo vial (LN safe)	Type IV	Required	1 per individual
Fecal samples	Fecal samples from trapped small mammals	OSBS.20130714.R1357.F *(SiteCode.collectDate.TagID.sampleType))*	MAM: Trap Collection	1.5 - 2 mL cryovial (LN safe)	Type IV	Required	1 per individual
Ear punches	Ear tissue samples from trapped small mammals	OSBS.20130714.R1357.E *(SiteCode.collectDate.TagID.sampleType)*	MAM: Trap Collection	1.5 - 2 mL cryovial (LN safe)	Type IV	Required	1 per individual
Voucher	Whole voucher specimens collected opportunistically	OSBS.20130714.R1357.V *(SiteCode.collectDate.TagID.sampleType)*	MAM: Trap Collection or Mammal and Herptile: Off Grid Voucher	Freezer safe plastic bag	Type IV	Required	1 per individual

B.5 Equipment and Supplies Readiness

A checklist version of this list can be found in Appendix B

- ☑ Ensure **traps** and sampling equipment are functioning and sanitized.
- ☑ Ensure safety gear (**PPE**) is available in sufficient quantities, clean, and functioning.
- ☑ Prepare pre-printed barcode **labels** and labels and materials for handwriting on the sample containers in the field.
- ☑ Prepare a small vial of **10% sugar** in water to revitalize stressed, hypothermic or heat-stressed captures. Change solution often to prevent mold growth.

A clean eye drop bottle or disposable pipette work well to administer the sugar solution.

- ☑ Ensure that all necessary field **datasheets** (RD[05])**, permits** (which may include but are not necessarily limited to land use permits, isoflurane permits etc.)**, identification keys,** and equipment (use Domain Lab checklist) are packed.

Dichotomous keys are the fastest and most reliable means for in-the-field identification. Knowing how to use one is critical for ecological field work.

Copies of permits and dichotomous keys should be stored in a field datum and never removed.

- ☑ Sterilize seed by baking in a thin layer for 10 minutes at 205°C (Dahlquist et al. 2007); or 135-150°C for 45-60 min, and mix a sufficient amount of millet (65% of seed mix) and sunflower seeds (35%). To maintain consistency across domains, mixing should be done by volume rather than by weight.
- ☑ When extremely cold temperatures are anticipated, and if appropriate for the site, prepare peanut butter between 2 unbleached paper towels and cut into 1-inch squares.
- ☑ Prepare and maintain a **list of individuals already bled** (including those in which an unsuccessful bleed attempt was made) within the current sampling bout to ensure that no individuals are bled twice within a bout. ***Note that a hard copy list is required – it is not sufficient to rely on the accuracy of the lastBled date in Fulcrum***. Also note any individuals with missing data that can be collected if recaptured in this bout, and compile a running total of the number of feces, ear, and hair samples taken.
- ☑ Prepare **quat**: if necessary, mix a batch of quat stock solution in the lab (follow manufacturer guidelines for dilution). Fill up the spray bottle(s) and field stock bottles.

☑ Prepare **isoflurane** or methoxyflurane in a fume hood or well-ventilated outdoor location. Fill up the glass bottle with rubber dropper bulb and glass bottle with screw top with isoflurane or methoxyflurane.

1 – 3 ounces should suffice for both blood sample collection, if needed (e.g., animal > 100 g), and/or if an animal needs to be euthanized due to a serious trapping-related injury.

Always wear gloves whenever handling isoflurane or methoxyflurane.

Please note that pregnant women may want to use a respirator when handling isoflurane or methoxyflurane.

☑ Pack **bleeding supplies**: bring enough supplies for processing at least twice as many individuals as you expect.

☑ Obtain **dry ice** or approved alternative freezing materials as described in RD[09]: this should be done as close to departure for the field as possible and stored in a dry ice cooler (e.g., Yeti or Thermosafe) prior to use.

B.6 Preparing for Collections Without Dry Ice

1. If dry ice is not available to take to the field for sample storage, plan to place the samples that require dry ice on ultra-cold ice packs or ultra-cold frozen aquarium rocks instead.
    a. Refer to RD[09] for detailed instructions on how to prepare and use these alternate materials. Note that the alternative materials need to be chilled for at least 24 hours so please plan accordingly.
2. These alternative freezing methods can be used in place of dry ice in those sections of the protocol that refer to sample storage at the time of collection.
    a. Make sure that you will be able to transfer samples to an ultralow freezer or dry ice cooler at the end of the sampling day, and that dry ice will be available for shipping. If samples cannot be transferred to an ultralow freezer by the end of the day, issue an Incident for Science.

SOP C Field Sampling

Data Entry Information:

Data collection should be completed using the MAM: Trap Setting app and MAM: Trap Collection app in fulcrum (see associated fulcrum manual). Any voucher specimens collected from training grids or in between bouts can be entered into the Mammal and Herptile: Off Grid Voucher app.

C.1 Setting Traps

Trapping grids consist of 100 Sherman traps. However, if conditions prevent setting of all traps on a given night, a minimum of 75 traps should be set to constitute a night of trapping.

TIMING

- Traps are set in the evening, not more than 2.5 to 3 hours before sunset.

Setting traps too early will increase the possibility of catching opportunistic, diurnal species such as chipmunks and ground squirrels; these captures could be subjected to heat stress if not shaded.

- Time sampling so that the last trap is set as the sun is setting.

TIPS & TRICKS

- Clear and consistent team communication about which plots to set is essential. Note that last minute schedule adjustments can lead to confusion and a documented communication plan involving texts, field logs or whiteboards is **required**.
- Lead mammalogists can also take the extra step of updating which plots to set in the staff schedule (Find My Shift); however, this should not replace the direct line of communication and verification described above.
- **Setting traps at a plot that is not checked the following morning is a serious animal care violation and could have very negative impacts on animal welfare and NEON's ability to continue small mammal sampling**. When in doubt, ask and verify which plots are supposed to be set on a given evening. Never make assumptions about discrepancies between the domain schedule and team-level communication about trap setting – **always verify with a mammal team lead to ensure that the correct plots are being set**. Use GPS and/or plot markers to verify you are at the correct plot.
- For efficiency, each person should carry enough traps at one time for at least two traplines (i.e., 20 traps plus a few extra).
- Always walk the traplines along the N-S axis, except when moving to the next trapline. This will constrain vegetation disturbance to narrow trails within the grids over time. Consistency is the key; E-W travel can be used if strongly preferable for a given plot.
- Whenever possible, place traps near shrubs, downed logs, burrows, or other microsites that offer shelter or potential runways. When placing traps next to runways (e.g., rocks, downed

logs), set trap parallel to the runway. Be aware of drainage issues that may cause flooding of the localized area around the trap overnight.

- Use additional flagging if trap is hidden from view.
- Make sure trap is on level ground (using your foot to level an area, if necessary), and the door remains open after placement. If necessary, adjust trap sensitivity by gently pulling or pushing catch.
- Count and double count your traps, when setting or checking traps – always know how many traps you brought out to the plot and how many you removed.

PROCEDURE

1. Upon arrival at a grid location, place at least 2" of batting in the back of the trap, ensuring the pan is visible, if batting is needed.

When overnight lows will be *<18°C (65°F), place approximately 5 cm (2 in; slightly smaller than a tennis ball) of batting into trap (except at sites dominated by heteromyids* – see site-specific appendices*).*

2. Place trap within a 1-meter radius around marked point.
    a. At sites with red imported fire ants (*Solenopsis* spp.) or ants that may cause small mammal mortality, application of granulated insecticide (e.g., Talstar brand) is required, if permitted. Place immediately around the trap on flat ground or both under and around the trap when in a grassy area. Reapply after heavy rains. If the soil is not moist and/or there is very little dew accumulation, irrigate before or immediately after application to activate the insecticide (but not to the point of runoff).
3. Toss bait into trap.
    a. Use about 1 TBSP of the seed mix (all sites) and 1 TSP of freeze-dried mealworms at select plots/sites where shrews comprise more than 20% of the captured individuals on average (as determined over the previous 12 months of trapping).
    b. Use more bait if nighttime temperatures will be < 7°C/45°F.
    c. Toss so as to distribute seed from front to back of trap.
4. Peanut butter can also be added in the event of extremely cold conditions at many sites, except where not permitted (see site-specific appendices), or where medium- to large- mammal disturbance of traps has occurred (e.g., raccoons, bears), or where fire ants occur (e.g., Jones Ecological Research Center (JERC), Ordway-Swisher Biological Station (OSBS)).

- To minimize the mess associated with the opportunistic use of peanut butter, place peanut butter between 2 unbleached paper towels and cut into 1-inch squares (R. Rowe, pers. Comm.)

5. Communicate which plots had traps set with the lead mammalogist and all domain personnel involved in mammal trap collections. This could be completed in a variety of formats including:
   a. Digital (texts to a group chat involving all trap setters and collectors).
   b. Hard copy (white board or write-in-the-rain log).

C.2 Checking Traps the Following Morning

TIMING

- Begin checking traps the following morning at dawn, within 30 minutes after civil twilight (where applicable).

In very hot climates or if ants are causing significant disturbance to a trapping grid, trap checking can begin up to an hour before dawn.

- Check all traps in the grid before processing captures.

  Counting the traps along a trapline is the best way to ensure that all traps are checked.

  At the end of the sampling bout, know precisely how many traps are being retrieved from the grid, as well as any extras that may have been brought to the processing area. A final count will then indicate whether all traps have been removed from the grid.

Any trap that is accidentally left open during the day or at the end of a sampling bout will likely result in the capture and subsequent death of an animal. This is particularly important at the plot-level – be sure to confirm with the trap setters from the previous evening to ensure that all plots that were set are collected. This could involve a confirmation text to a group chat or checking grids off on a whiteboard or hard copy paper plot setting log. Use GPS and/or plot markers to verify you are at the correct plot.

TIPS AND TRICKS

- Keep in mind that the liberal use of quat on tools and gloves, the one-time use of processing bags, and the bagging of traps prior to processing are critical to minimizing transmission of pathogens between small mammals, as well as to technicians.
- Keep in mind that very small individuals can crawl under the treadle at the back of the trap and therefore are hidden from view. Be careful handling any trap with a closed door until this possibility has been ruled out. Gentle shaking and tapping of the trap should reveal the individual.
- If a non-target animal is difficult to remove from the trap, the sides of the trap can be bent to allow the door to open outwards to facilitate removal. As a last resort the pin of the trap can be pulled to open it flat.
- Marking traps:
  - Be sure to cross out any previous markings, if present.

- If conditions are very dry, use a wet-erase marker directly on the trap.
- Assigning different colors of marker to the technicians facilitates resolution of any legibility or other issues that may arise in trap marking.
- Wet erase can be easily wiped off with alcohol wipes or during the trap cleaning process.
- If conditions are damp, use a dry erase marker directly on the trap or a permanent marker on the plastic bag into which the trap is placed.
- If conditions are very wet, a #3 pencil or bath crayons can be used directly on the trap.

PROCEDURE

1. Check the agreed upon communication method (either group text chat, whiteboard, or write-in-the-rain paper logs) for which grids had traps set. If there is a discrepancy between the schedule and the grids set, make sure to verify with the trap setting crew that the correct grids are being visited. **When in doubt, ask and verify.**
2. Put on PPE as specified in NEON Operations Field Safety and Security Plan.
3. If trap door is closed, **gently** shake the animal to the opposite end of the trap and QUICKLY peek inside to verify there is a capture and that it is not a shrew.
    - Be quick or the animal may escape.
    - Hold the trap upside down at eye level, and open the door just enough to check if feet are visible and that the tail is not of a shrew.
    - If you discover a female that has given birth in the trap while you are still at or near the trap station, release the mother immediately and either 'pour' the newborns out of the trap into a pile or remove them with nitrile-gloved hands and place in a nearby (ideally <2m away) soft and protected spot. Note the trap coordinate and species ID of the mother, to the lowest resolution possible, on the trap and return the empty trap to the processing station. The individual should be recorded as a pregnant female, with a remark about the female giving birth in the trap. If the newborns are not discovered until the trap is being processed back at the processing station, process the mother as usual and then immediately return her and the newborns to a protected spot near the original location of capture.
4. There are a variety of possible scenarios involving a closed trap (**Table 7**).
5. For all traps to be removed from a grid, label the trap with the trap coordinate, place the trap in a plastic bag, then place the bagged trap in a tree-planting bag.
    - Trap and bait can be re-used if there is no evidence that an animal visited (i.e., no feces or other sign). Consult with permit regulations regarding whether 'clean' traps need to be washed between sites; this is not a science requirement.

- If feces are present in an open trap, mark and bag the trap for removal to the processing station. If feces are present in a closed trap with no animal, pour the bait, feces and batting into a plastic bag, and collapse and remove the trap.

6. Continue checking and bagging traps in the grid.
7. Bring bagged traps to the processing station once the tree-planting bag is full or all traps are checked.
8. Close empty traps for the day IF another day of sampling is scheduled.
9. Remove all traps if it is the last day of sampling in a bout.
    - Avoid dumping seeds onto the ground, to the extent possible. Uneaten seeds should be collected into a plastic bag for disposal or re-use, per the discretion of the domain mammal lead.
    - If bait is re-used, it is recommended that the bait is re-baked at a low oven temperature (65 degrees C for 1 hour) to prevent mold growth and to prevent transfer of live invertebrates from one site to another. If conditions in a domain are dry and seed is only used at one site, re-baking is not necessary.

Table 7. Possible scenarios encountered while checking traps in the morning.

Trap contents	Marking the trap	Fate of the capture	Fate of the trap
Live capture of a target or opportunistic species or dead specimen of any species	Trap coordinate	Processing station	Processing station
Live capture of a shrew	Trap coordinate, species ID, sex, fate (Released)	Mark the belly with a colored permanent marker, if not previously marked, and release*	Processing station
Live capture of a non-target, non-mammal species, e.g., a bird or reptile	Trap coordinate, species (species ID, if known)	Immediate release (trapStatus = 2 on mobile device or datasheet)	Processing station
Live capture of a non-target, mammal species, e.g., a weasel or squirrel	Trap coordinate, species (species ID, if known)	Immediate release (trapStatus = 5)	Processing station
No capture, but feces present or bait missing	Trap coordinate	NA (trapStatus = 3)	Processing station
No capture and no feces but door closed	NA, but trap coordinate should be recorded on datasheet with appropriate code in the Notes column	NA (trapStatus = 2)	Remain at trap station or remove from grid if it is the final night of sampling at that grid for the current bout.

*To minimize handling of *Blarina spp.,* particularly by inexperienced personnel, transfer individuals to a plastic bag and then reach into the bag with the permanent marker (rather than a hand) to mark the back or belly.

C.3 Setting up Processing Station

- Divide tasks between two-person team:
  - Handler: Handles captures, makes measurements, and collects blood and tissue samples.
  - Recorder: Prepares equipment and consumables, processes samples, and records data.

PREPARATION FOR PROCESSING

1. Select a location for the processing station that is:
   a. Immediately adjacent to but not within the trapping grid.
   b. Upwind of the staging area for animal processing, where possible.
   c. Shaded, for keeping sun off of the traps in hot weather.

2. Unpack and set up the processing station for data collection, animal marking/tagging, anesthetization, tissue and blood sampling, and sterilization.
3. If working directly on the ground, line the area with trash bags, plastic sheeting, or a plastic tray to allow for spraying with quat and wiping clean in between individuals.
4. Prepare a small tray filled with quat to sterilize instruments between individuals. Place ethanol wipes nearby for easy access to sterilize tools used for ear punch collection and handling.
5. Put on the additional PPE specified in the NEON Operations Field Safety and Security Plan (AD[02]) for handling animals. Sample animals for population and pathogen data, as directed below.
6. Once processed, return captures to their respective traps and release at the sites of capture while wearing the PPE required for handling animals.
7. Replace dirty traps with clean traps, either prior to or during the trap setting effort in the evening. Bring all used traps back to the lab for cleaning.
8. Upon completion of trap collection for the day, confirm with the trap setters that all plots that were set were collected. This could be via a group text chat that verifies collection of each plot, or by checking off boxes on the whiteboard checklist or hard-copy write-in-the-rain logbook.
9. If traps are being reset at a plot, note that lean traps that have been baited on previous trap nights will require a smaller amount of bait, particularly on the trap door. Please note that too much bait or batting can cause the trap to malfunction.

PRIORITIZATION OF PROCESSING STEPS

In the event of very high capture rates, lower priority tasks may be left out of processing. **The goal is to avoid situations where captures are released without any processing.**

For simplicity, guidelines are provided according to captures per grid. If grids predictably vary in capture rates, reduced processing can be implemented on grids that do not exceed the thresholds given below, to enable increased processing on high-capture grids being processed on the same day. Please keep in mind that these are intended to be used as a guideline only; use professional discretion.

Suggested Modifications to Processing:

- >20 - <30 Captures Per Grid:
  - Blood samples – stop after 20 samples have been collected. Discard samples under 10 microliters and record attempt as unsuccessful (e.g., do not add DNA/RNA Shield).**
  - Recaptures only – eliminate size measurements
  - Hair and whisker samples – stop after 10 samples have been collected
  - Fecal samples – stop after 10 samples have been collected
  - Ear punches – stop after 10 samples have been collected***

- Reduce or eliminate tick counts and additional parasite checks

- 30 + Captures Per Grid:
  - Blood samples – stop after 20 samples have been collected. Discard samples under 10 microliters and record attempt as unsuccessful (e.g., do not add DNA/RNA Shield).**
  - All captures – eliminate size measurements
  - Hair and whisker samples – stop after 10 samples have been collected
  - Fecal samples – stop after 10 samples have been collected
  - Ear punches – stop after 10 samples have been collected***
  - Eliminate records of tick life stage presence/absence, tick counts and additional parasite checks.

**When blood sample collections are limited, attempt to distribute the 20 samples among the priority species if possible (provided in Appendix D). Please do not spend additional time counting captures per species prior to processing. The simplest, acceptable implementation of this guidance is to stop collecting blood samples once 10 samples have been collected for a given priority species, if a site has >1 priority species. For sites with priority species that are difficult to distinguish (e.g., PEMA vs. PELE), collect up to 20 samples from individuals of these species, regardless of species ID.

**For maximum time savings, include unsuccessful bleeding attempts in the count to 20.

*** In domains 01-03, 05-09 and 17, where ear tissue is tested for *Borrellia burgdorferi* (the pathogen causing Lyme disease), it is most useful to have ear tissue collected from adults captured after June 1, especially if they were successfully bled. In other domains or in bouts occurring before June 1 prioritize taking ear samples from individuals with uncertain species IDs for ear punch collection if this is possible, without expending additional effort to review captures.

C.4 Processing Captured Animals

The small mammal field datasheet is provided separately (RD[05]), but a key to the fields on the datasheet and in the mobile application can be found in Appendix A.

TRANSFERRING CAPTURE FROM TRAP

1. Record grid ID, trap ID, and trapStatus (see **Table 2**).
   - If the pointID is missing from or illegible on the trap, use 'X' in the recorded trapID to indicate the uncertainty. For example, if the trapID is missing, record the trap coordinate as 'XX'. If only half of the trapID is illegible, use the 'X' only for the illegible half (e.g., 'AX', 'X6').
2. Transfer capture to resealable plastic bag by slipping bag over end of trap that opens and then turning trap over.
   - Use standard (2 mil) thickness gallon resealable plastic bag for species < 100 g
   - Use 4 mil gallon resealable plastic bag for species > 100 g

- For particularly large or aggressive individuals:

  - Cloth or mesh wash bags can be used instead of a resealable plastic bag, if desired. Keep in mind that these bags must be decontaminated, via laundering or UV, before re-use on another individual.

- The animal should spend no more than 3-5 minutes in the bag.

3. Immediately observe the animal for signs of stress and continue to do so throughout the handling period. Each animal should be handled for no more than 15 minutes. However, average time to collect all data should be no more than 5 minutes.

- If the animal appears dead, check for rigor and for respiration within the bag. If the animal is clearly dead, collect the animal as a voucher specimen (see Section C.8).

- If there is no rigor and the animal may be overheated or dehydrated, wet the belly and administer sugar water via dropper. Remember to sterilize dropper between uses or use a new disposable pipette on multiple individuals.
- If the animal appears hypothermic, place the animal in a secure container containing a disposable hand warmer, batting and bait. Check the animal every 15 minutes, if possible, and release at the point of capture when the animal exhibits normal behavior.

4. Place bag on handling surface and maneuver the animal so the head is in the corner prior to pinning the animal behind the neck. Check capture for existing marking (ear tag or PIT tag).

5. After scruffing or otherwise securing the individual with one hand, remove animal from bag for all processing except anesthetization.

   a. When necessary, provide a thick, cotton-gloved hand for the animal to bite on as distraction during handling.

   b. Cover the animal's head with a piece of material to help calm the animal during the procedure, if necessary.

   c. A proper scruff should immobilize the individual's head and forearms. It is recommended that the tail and/or hindlegs are also secured with the remaining fingers on your scruffing hand.

   d. For species that prove challenging to effectively scruff (e.g., jumping mice, chipmunks, flying squirrels), a "bander's grip" can be used as an alternative to secure the individual for processing. This grip involves holding the animal's back against the palm of one hand, with the neck held between the bases of the index and middle fingers. If done correctly, the fingers are safely out of the way of the capture's teeth and can be used to hold flailing limbs in place.

If during processing you notice a hole in your glove, stop, put on a new glove, and discard the used glove.

IDENTIFYING TO SPECIES

6. The individual should be identified to genus or species to assess whether a blood sample should be taken. If species-level identification requires additional measurements to be taken (as described in section 8), collect the blood sample and mark the individual before taking measurements. Domain-specific lists of species codes are found on the domain-specific paper datasheets and in the drop-down menus on the mobile data entry application.

    - The full list of mammal species codes can be found on the NEON intranet in the Sampling Support Library.
    - Note that this list includes codes for instances where you cannot make an identification below genus (e.g., *Peromyscus sp.*):

    Table 8. List of codes for genus-level identifications.

taxonID	scientificName	taxonID	scientificName
AMSP	*Ammospermophilus sp.*	PESP	*Peromyscus sp.*
BLSP	*Blarina sp.*	RASP	*Rattus sp.*
CHSP	*Chaetodipus sp.*	RESP	*Reithrodontomys sp.*
CYSP	*Cynomys sp.*	SNSP	*Scapanus sp.*
DPSP	*Dipodomys sp.*	SCSP	*Sciurus sp.*
GESP	*Geomys sp.*	SISP	*Sigmodon sp.*
GLSP	*Glaucomys sp.*	SOSP	*Sorex sp.*
LESP	*Lemmus sp.*	SMSP	*Spermophilus sp.*
LPSP	*Lepus sp.*	SLSP	*Sylvilagus sp.*
MISP	*Microtus sp.*	SYSP	*Synaptomys sp.*
MUSP	*Mustela sp.*	TMSP	*Tamias sp.*
MYSP	*Myodes sp.*	TSSP	*Tamiasciurus sp.*
NESP	*Neotoma sp.*	THSP	*Thomomys sp.*
ONSP	*Onychomys sp.*	ZASP	*Zapus sp.*
PGSP	*Perognathus sp.*	ICSP	*Ictidomys sp.*
CASP	*Callospermophilus sp.*		

7. If there is any uncertainty in the species identification, please note this in the idQ (i.e., identification qualifier) field – using one of the codes below (**Table 9**). Leave blank if there is not uncertainty.

    a. Species in the genus, *Peromyscus*, are often hard to distinguish in the field. This is especially true of *P. maniculatus* and *leucopus*. In the case of these and other known cryptic species:

        - In the field, if you are leaning towards assigning one of the cryptic species to a particular individual, record appropriately and also include a 'CS' in the identification qualifier. Otherwise, you can select the corresponding cryptic species pair code (if available) or one of the generic-level codes (e.g., PESP), and no additional entry in identification qualifier is needed.

- If a desired cryptic species pair code is not available, issue a request to modify the taxon table for small mammals.

Table 9. Codes for identification qualifier entries – only needed if paper datasheets are used.

idQ	Identification Qualifier Description*
CS	cf. species
AS	aff. Species
CG	cf. genus
AG	aff. Genus
CF	cf. family
AF	aff. Family

* cf. roughly equals "not sure"; aff. Roughly equals "similar to, but is not"

8. If the identification of the individual to species required consultation of a guidebook or key, please indicate this either (a) as a comment on the paper data sheet, or (b) select from the **Identification References** drop-down menu in the mobile data entry application. If the reference is not available in the drop-down menu, please note the reference in the remarks and issue a problem ticket upon return to the lab.

C.5 Collecting Individual Data

Recaptures are processed the same way as new captures. Repeated measurements of the same individual are valuable. However, if time is limited during periods of unusually high capture rates, repeated size-related measurements of recaptures can be skipped (see Appendix A). If measurements are not taken on a particular capture instance, do not enter measurements from a previous capture instance into that record.

MARKING ANIMAL

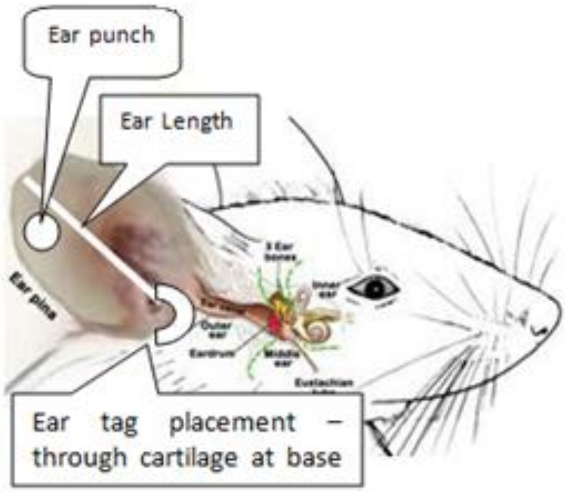


Figure 10. Schematic demonstrating the placement of an ear punch, an ear tag, and how the ear length measurement should be made on a lab mouse (Mus).

1. **Check** capture for existing marking (ear tag or PIT tag).

Figure 11. Picture of pre-loaded, gas sterilized, PIT tag in individually sealed pouch. This is the only type of PIT tag that is IACUC-approved for use on the animals.

2. **Mark** the individual (if needed) with ear tag or pre-loaded PIT tag from a gas sterilized, individually sealed pouch (**Figure 11**). Mode of tagging will be based on the length of the external pinnae, as some species, such as voles (e.g., *Microtus spp., Myodes spp.*) and pocket mice (e.g., *Chaetodipus spp., Perognathus spp.*), do not have sufficient external pinnae for securing ear tags. Discretion can be used by field personnel to select the appropriate tagging method. For example, technicians have found that ear-tagging is effective in *Myodes gapperi* and *Microtus pennsylvanicus.* Jumping mice (*Napeozapus spp., Zapus spp.*) can be marked using either method, as technicians have reported varying success with both techniques.

- Shrews will not be permanently marked; shrews are temporarily marked using a permanent marker.
- Use ear tag if pinnae are of sufficient size. Attach to right ear (preferred) or left ear, if needed.
    - If an animal appears to have a torn ear due presumably to the loss of an ear tag, attach a new ear tag to the intact ear.
    - If an animal has an ear tag that was not properly attached (e.g., attached in the outer margin of the pinna), remove old tag and attach a new ear tag to the other ear.
    - Ear tags **must** be unique within a domain.
        - Be sure that new shipments of ear tags do not have the same numbers as previous shipments.
        - The quality of the mark-recapture data is compromised when duplicate tagIDs are used within a domain.
        - Be sure that once you reach 9999 that you order ear tags that allow for 5 numeric digits.
- Use a PIT tag if pinnae are too small for an ear tag. All PIT tags and needles must be pre-loaded from a gas sterilized, individually sealed pouch.
    - PIT tags are frequently required for voles and pocket mice.
    - PIT tags should be inserted near the middle of the back of the animal, oriented so that the needle points towards the head.
    - Suggested technique: Place animal flat on processing surface, with the two middle fingers of one hand securing the back of the head, while the fur is pinched with the thumb and forefinger of the same hand. Use the other hand to insert the needle into the tent of fur. Be careful not to pierce through the skin again (you should feel the tag being released from the applicator as it is inserted).
    - The point of needle insertion can be sutured using veterinary tissue adhesive to reduce PIT tag loss rates.
    - After spraying with quat, dispose of used PIT tag needle in sharps container. To prevent needle sticks, needles should not be recapped prior to discarding into the sharps container.
    - PIT tag reader should be kept in a sealed plastic bag, to facilitate disinfection (i.e., the bag can be sprayed with quat and wiped clean after each use).

3. **Record** the tag number on mobile device or datasheet in tagID fields.

    - Format for ear tag is LXXXX for left ear or RXXXX for right ear (preferred).
        - Ear tags that do not have ‘NEON’ laser-etched on them should be indicated by adding an ‘O’ for Other in front of the ear tag id (e.g., OL1001).
    - PIT tags:

- Note that some PIT tags have two different serial numbers – one labeled decimal and the other hexadecimal. Please confirm which one the reader reads and please record that one.
- If using a paper datasheet, write down last six digits of serial number for PIT tags and place one bar code sticker on the back of the datasheet.
- If using a mobile device, record the last six digits of serial number for PIT tags.
  - It is recommended that you keep track of the PIT tags used in a given bout until after data QA/QC has been completed, by either organizing the empty envelopes or the barcode stickers provided.
- If the PIT tag reader stops working, do not collect samples.

- If an individual has a ripped or punched ear indicative of a lost tag or the individual's tag was intentionally replaced (due to poor initial placement):
  - If an ear tag has apparently been ripped out of the ear:
    - Record the previously marked ear (L or R) in the Ripped Ear/Tag Replaced column
    - It is optional to record the ripped ear every time the individual is captured.
  - If an ear tag has been intentionally replaced:
    - Record the previously marked ear (L or R) in the Ripped Ear/Tag Replaced column and note the ID of the removed tag either (a) in this same field on the mobile device or (b) on the back of the datasheet.
  - If an animal has evidence of an ear punch but not clearly a torn ear tag:
    - Record the punched ear (L or R) in the Ripped Ear/Tag Replaced column
- If an individual escapes after a sample is collected but prior to tagging, use the convention described for untagged voucher specimens below (SOP C.8).

4. **Record** the recapture status for all captures.
   - Available options are Yes, No, and Unknown
   - For individuals that have had a tag lost or intentionally replaced:
     - If the previous tagID is known: mark the individual as a recapture when replacing the tag.
     - If the previous tagID is unknown: mark the individual as unknown (i.e., record 'U' in the Recapture field), if the animal is clearly a recapture.
     - If the animal escapes prior to assessment of whether it has a tag, record 'U' for 'unknown'.
     - If an individual with a visible tag escapes after seeing an ear tag but before the tag can be read, the recapture can be marked as Yes, and the no tag: not bled option should be selected

ASSESSING SEX, REPRODUCTIVE CONDITION, AND AGE

5. Note sex and reproductive condition and enter codes on mobile device or datasheet. If the data below do not capture the observed condition sufficiently, please add remarks with any additional details you deem pertinent.

   Males

   - Scrotal (S): testes may be descended (obvious bulging under the tail)
   - Non-scrotal (N): testes not descended (abdominal)
   - Unknown (U): testes not able to be assessed due to unusual circumstances (e.g., botfly)

   Females

   - Nipples
     - Enlarged (E)
     - Not enlarged (N)
     - Unknown (U): nipples not able to be assessed due to unusual circumstances (e.g., botfly) – recommend adding remarks to explain why it is unknown
   - Pregnant (P)
     - Pregnancy can be determined by palpating the abdomen for fetuses or by assessing the width of the pubic symphysis
   - Vagina
     - Swollen (S) – indicates estrous (should also be used if menstruation is observed)
     - Plugged (P) – some use the term Perforate
     - Neither (N) – some use the term Non-perforate
     - Unknown (U): – vagina not able to be assessed due to unusual circumstances (e.g., botfly) – recommend adding remarks to explain why it is unknown

   Unknown

   - If an individual escapes or needs to be released before you can examine the reproductive condition, or the taxon is difficult to assess (e.g., shrews), please be sure to denote 'U' for unknown.

     Note animal age: juvenile, sub-adult, or adult on mobile device or datasheet (see also quick reference in Appendix A). If it is difficult to determine whether an individual is a subadult or an adult, the primary deciding factor should be reproductive status, followed by pelage (when relevant) and finally overall size (not a singular measure of weight).

TAKING MEASUREMENTS

Take and record standard measurements to the nearest millimeter, using standard rounding guidelines:

6. Right hind foot: Using the 6-inch flexible ruler, measure the distance from the back of the heel to the end of the longest claw (beyond the fleshy toe).
7. Take additional measurements, at your discretion, if useful for species discrimination. **Refer to the domain-specific dichomotous key for guidance.**
    - **Ear length:** Insert the end of the ruler in the notch at the base of the ear and measure the maximum length to the distal portion of the pinna (medial aspect), excluding hairs that project beyond the fleshy portion.
    - **Tail length:** Pin the animal onto the handling surface, belly down. Bend the tail up at a right angle. Use the 6-inch ruler to measure from the bend on the back at the base of the tail to the tip of the fleshy part of the tail, excluding projecting hairs.
    - **Total length**: Place animal, belly down, on the 12-inch rigid plastic ruler and hold it so that the body and tail are straight and taut, but not stretched. Measure the distance from the tip of the nose to the tip of the fleshy part of the tail, excluding any hairs that project beyond the tip.

CHECKING FOR PARASITES

Check **only** the mammal's head and neck area for attached ticks, gently blowing in a steady stream and using fine-tipped forceps to part the fur where necessary. Some individuals readily produce fecal samples when blown on, so these data may be collected simultaneously (see below). If wearing a respirator, just use forceps to part the fur. Common tick attachment locations are on the edges of and behind the ears, at the base of the neck, and at the roots of the whiskers. The scruff grip may need to be adjusted to check the neck – for mice, holding the tail while adjusting can reduce escapes. Tick life stages are identifiable by size:

- Larvae are approximately the size of a poppy seed, and only slightly larger when engorged.
- Nymphs are approximately the size of a sesame seed, and somewhat larger when engorged.
- Adults are approximately the size of a grain of rice, but broader and flatter, and can be up to jelly bean-sized when engorged.

On pathogen grids, the total number of ticks attached to the head and neck of the individual should be recorded into the appropriate bin. Bin sizes include 1-5, 6-20, >20. Spend no more than 60 seconds estimating the number of attached ticks, which cannot be brushed off. Unattached ticks crawling on the fur should not be recorded, but should be added in the remarks as "unattached tick". If animals are deceased at the time of checking for ticks, the boxes for 'unknown' should be selected for attached larval, nymphal and adult ticks since ticks can crawl away when an animal dies.

Any tick life stages attached to the individual L(arvae), N(ymphs), and A(dults), or Z(ero) should be circled on the datasheet or selected in the mobile application. If an individual was not examined, do not circle anything on the datasheet and select 'Unknown' in the mobile application.

Check the entire animal for fleas or botflies and report whether any are present. If other types of ecto/endo-parasites are observed during this check (e.g., mites, fecal parasites), they can be categorized as 'other' with the specific types of parasites denoted in the remarks. When time permits, the 'remarks' field can be used to indicate the quantity and location of any observed parasites – e.g., 2 botflies on throat; orange mites on both ears; etc.

C.6 Collecting Samples

If possible, use different forceps for each sample. In between processing individuals, all tools that came into contact with an individual should be cleaned with quat.

SPECIMEN LABEL AND STORAGE REQUIREMENTS

- Beginning in 2022 all vials for sample storage must be rated for storage in liquid nitrogen (LN - 196°C). Vials should be self-standing, 1.5 - 2.0mL in size, have an O-ring and be externally threaded.
- If ultra-cold ice packs or aquarium rocks are used for field-storage of samples instead of dry ice, make sure this is indicated in the 'samplePrepMethod' field. Dry ice alternatives can be used in place of dry ice for all instances referring to dry ice in SOP C.
- Adhesive barcode labels should be applied to cryovials and coin envelopes prior to heading out into the field, as described in section B.5. This is required if conditions are expected to be damp. Adhesion is further enhanced if the labels are placed on containers at least 30 minutes prior to introducing to dry ice or -80C. Do not place labels over textured or ridged surfaces on vials since this compromises the integrity of the bond.
- Barcodes are required for all samples; however, in the unlikely event that a barcode label is not available the following labeling should be used:
  - Site Code (e.g., RMNP)
  - Date (Year YYYY, month MM, day DD)
  - Tag ID (RXXXX or last 6 digits of PIT tag)
  - Sample Type (B for blood; E for ear; F for feces; H for hair and whiskers, V for vouchers)

EXAMPLE:
OSBS.20130714.R1357.B

Note: For hand-written labels, it is recommended that cryovial labels be used, with some information pre-printed. Use fine point permanent marker (Sharpie or equivalent) for writing on cryovial labels, coin envelopes, or directly on the cryovials.

Recommended sample management

- Process animals in order of trap coordinate, from A1-J10, and place vials in boxes in order of processing to assist in error resolution.
- Place sample in type-specific columns in the cryovial box in the field and all the samples collected from one animal in the same row. Skip spaces if a sample wasn't collected for a given animal.
- Back in the lab, transfer sample types to separate cryovial boxes while conducting quality assurance for storage and shipment.

1. For all target and opportunistic species during only 3 bouts per year per site**:**

    a. Collect any fresh, uncontaminated feces from the animal using either forceps or scooping the sample directly with the cryovial, then label. Limit collection to 10 samples per species per plot per bout.

    - Do not collect feces from the trap.
    - Collect as much fecal material as possible, but note that any amount of material is still valuable.
    - Store cryovial on dry ice for transport back to the lab.
    - Indicate on mobile device or datasheet (“F” for feces) if sample was collected. If available, scan the barcode label with the tablet, double-checking that the barcode was successfully scanned before moving to the next sample.

Table 10. Summary of samples to be collected. Note that the frequency per year is a minimum, and if a low-yield bout is chosen for sample collection, additional sample collection can be undertaken if time permits.

Sample	Frequency per Individual	Frequency per Year	Optimal Sample Size	Storage container	Label	Field storage	Long-term storage
Blood	Once per bout	Every bout	20 samples per plot per day	Vial rated to -196°C	Type IV Label rated to -80°C	Dry ice	-80 °C Ultralow freezer
Fecal	Every capture event	3 bouts per year per site	10 samples per species per plot per bout	Vial rated to -196°C	Type IV Label rated to -80°C	Dry ice	-80 °C Ultralow freezer
Ear punch	Once per life of individual	3 bouts per year per site	10 samples per species per plot per bout	Vial rated to -196°C	Type IV Label rated to -80°C	Dry ice	-80°C Ultralow freezer
Hair	Once per bout; only resample if it has grown back	3 bouts per year per site	10 samples per species per plot per bout	Archival coin envelope	Write on envelope with Type I Label	Ambient	Ambient
Whiskers	Once per bout	3 bouts per year per site	10 samples per species per plot per bout				
Vouchers	Opportunistically	Opportunistically	Opportunistically	Resealable plastic bag	Acid-free, archival tag with Type IV Label	Dry ice	-80°C Ultralow freezer

b. Collect one ear tissue sample per individual, preferably from the untagged ear. One ear tissue sample is to be taken per the lifetime of an individual, regardless of whether it has clearly lost a tag or not. Limit collection to 10 samples per species per plot per bout. Note that domains 01-03, 05-09 and 17 should preferentially take ear samples from successfully bled individuals after 6/1 (e.g., if sample numbers are reduced due to high captures). In these domains, ear tissue collected in June or later is tested for *Borrelia burgdorferi* (the pathogen causing Lyme disease) and it is useful to be able to pair these results with the results from blood samples from the same individuals. If any domains struggle to meet the sample size thresholds needed for all competing uses (barcoding, pathogen testing, archiving), it is permissible to collect ear samples at all bouts rather than just the 3 required bouts.

- Using a clicker-style 2000 Micron (2 mm) tissue biopsy punch, collect sample from near the edge of the untagged ear; OR

- Using iris scissors, collect sample by cutting a small triangle of tissue from the edge of the ear
- Place ear tissue in cryovial and label.
  - If the ear tissue gets stuck in the biopsy punch, remove with forceps. Forceps should by rinsed in quat and wiped clean prior to reuse.
- Use a sterile, individually-wrapped alcohol pad to clean any tools that came into contact with the ear tissue (ear punch, scissors and/or forceps) and let the tools air dry. This step is necessary to ensure that any DNA remaining on the tools is fully degraded to avoid cross-contamination of genetic material between samples that may get genetically tested.
- Indicate on mobile device or datasheet if sample is collected. If available, scan the barcode label with the tablet.

2. For target species:
   a. Cut a tuft of hair (at least 5-7 mg**; Figure 12**) from the rump of the individual with scissors. One method is for the recorder to secure the tuft of hair with forceps while the handler cuts. An alternative method is for the recorder to simply hold the coin envelope underneath the rump while the handler clips the hair. Pinning the animal on the ground may facilitate the process.

a.

b.

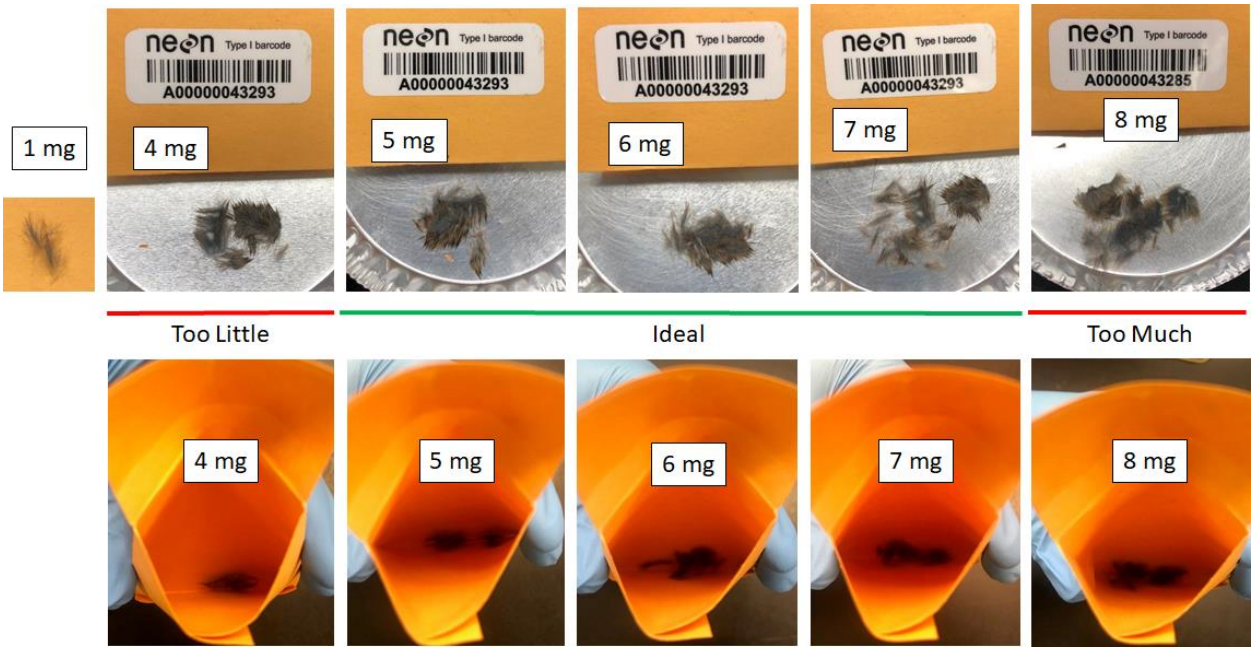


Figure 12. Example of the target 5 mg of hair collected from a museum specimen (a) and examples showing the target range of 5-7 mg of hair (b). Photo credits: Tara Smiley (a) and Tamara Hillman (b).

b. Pluck 2 whiskers with forceps (or similar), or clip with cuticle scissors as close to the base as possible without injury from the front half of the nose.

   i. It is preferable to collect one whisker from each cheek, but, if two are inadvertently collected from one side, do not collect more from the other cheek.

c. Limit collection to 10 samples per species per plot per bout.

d. Place hair and whiskers in archival coin envelope together. Do NOT seal coin envelopes; leave flaps folded over but unsealed.

e. Collect these samples once per individual per sampling bout. If an individual is suspected to be a recapture that has lost a tag, do not collect samples if it is captured on the second or third day of a bout. Although not likely to negatively impact the welfare of the animal, it is best to avoid double collection of whiskers within one sampling bout. Do not collect additional hair if an individual has not re-grown the hair removed during sampling in a previous bout.

Indicate on datasheet or mobile device if samples are collected. If a sample does not get entered into the database, then all resulting data and specimens will be lost.

C.7 Sampling for Rodent-borne Pathogen Analyses

Anesthetization and blood sampling should be done in a well-ventilated area and the handler should be upwind of animal being processed (e.g., back to the wind).

CRITERIA FOR BLEEDING ANIMALS

Bleed animals that meet all of the following criteria:

- Member of the Cricetidae, Muridae, or Dipodidae families
  - Not excluded based on permitting regulations (e.g., protected species)
- Weighs at least 10 g
- No pronounced or physically debilitating injury
- Has not yet been bled (whether the attempt was successful or not) during the current sampling bout
  - If uncertain whether or not an animal has been bled during the current sampling bout (for example, due to a recently lost tag), err on the side of caution and do not bleed.

PROPER INFECTION-CONTROL TECHNIQUES

- Disinfect all equipment that is used during processing of a capture before processing the next.
- Disposable items (e.g., gauze, lancets, paper towels used for clean-up) should be sprayed with quat and properly disposed of (e.g., trash bag, sharps container).

BLOOD COLLECTION TECHNIQUES

- The mandibular blood sampling technique, which involves collection from the submandibular and/or facial vein or artery, has proven successful to date across all species, except for heteromyids. The retro-orbital technique is no longer an allowed technique for NEON.
- The mandibular technique is widely used on laboratory mice, but has limited application to date in the field. It is known to work well on *Peromyscus spp*.

Anesthetization/Euthanasia

- The use of anesthesia is not required for the mandibular bleeding technique, but anesthesia is recommended for use on larger animals (e.g., >100 g), if the procedure is performed by inexperienced personnel, or if the technician cannot maintain a scruff.
- The effectiveness of isoflurane and methoxyflurane varies with ambient conditions (e.g., temperature, relative humidity) and across species. Therefore, a gradual increase in dosing is recommended to avoid accidental euthanasia.
- The required inhalation to effect time should not be longer than 1-5 minutes.
- The animal must not be released until signs of full recovery (i.e., resumption of normal movement and behavior) are observed. Take steps to heat or cool animals that are slow to awaken.

1. If anesthesia is required, place 3-5 drops (~0.2 mL) of isoflurane or methoxyflurane onto a cotton ball. Place cotton ball:

    a. (preferred) in an appropriately sized conical centrifuge tube (15mL, 50mL, or 100m–) - the head of the small mammal should fit comfortably in the tube but leave minimal space surrounding the head to allow for an adequate supply of oxygen to enter the tube (while limiting the amount of anesthetic escaping the tube). Remove the capture from the plastic bag, and, once properly scruffed, insert the capture's head completely into the tube.
        1) Please note that this method is preferred, as it can decrease the handling time because the animal is exposed to much higher concentrations of anesthetic. Therefore, this method requires increased vigilance (relative to the tea strainer method below) to prevent overdosing of the animal. Moving the animal's head in and out of the tube can control concentration of the anesthetic.

        OR

    b. in a spring-loaded tea strainer, and place the tea strainer in the bag with the small mammal.

2. Avoid direct contact between the animal and the cotton ball. If the animal does not respond within 1-2 minutes, additional isoflurane or methoxyflurane can be added, 3-5 drops at a time, to the initial dose.

    a. The rodent's rate of respiration, spontaneous movements, responses to tactile stimulation, and ability to retain sternal recumbency must be monitored in order to gauge the state of anesthetization.

3. Once the animal is stable and non-responsive to tactile stimulation, the bleeding procedure can be performed (described below).

4. Any animals encountered with significant injuries or found moribund in the field should be euthanized by placing the animal in a plastic bag with a cotton ball soaked in approximately 5mL isoflurane (Parker et al. 2008) or methoxyflurane. This method is approved by the AVMA

Guidelines (Leary et al. 2013). The rodent's rate of respiration, spontaneous movements, responses to tactile stimulation, and ability to retain sternal recumbency will be monitored, in order to verify death. Death will be confirmed via cervical dislocation. Personnel performing this procedure must be properly trained and qualified in vertebrate cervical dislocation.

Mandibular Bleeding

- The 4 or 5 mm lancet sizes are appropriate for most species under 40 grams, except *Rattus spp*. The size affects the depth of the puncture, and so the selection of size is dependent on the force used by a particular handler. As a guideline, use the 4 mm for individuals < 20g, the 5 mm for those >20 grams, the 5–5 - 6mm for individuals >60 grams, and the–7 - 8mm for individuals >140 g.

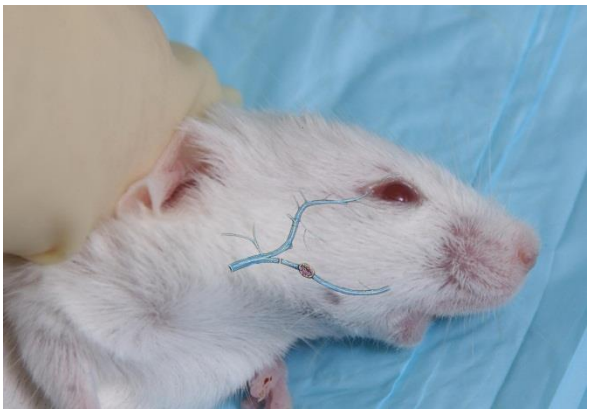


Figure 13. Schematic demonstrating where the facial vein and the submandibular vein meet at the rear end of the mandibular bone on a lab mouse (Mus).

The facial vein (lower branch) is typically the target for blood collection, but the vascular bundle associated with the junction of these vessels can also be used. From http://www.medipoint.com.

5. Securely scruff the rodent between its shoulder blades in one hand.
6. Locate the back of the mandible using the blunt end of the lancet to determine appropriate placement of the lancet.
7. The optimal puncture point is at the back of the jaw of the mouse, very slightly behind the hinge of the jawbones, toward the ear, just behind the point at which the upper and lower jawbones meet (Golde et al. 2005).
8. Puncture the cheek with a quick, firm thrust with the lancet. Be ready with the cryovial. Tilt the head to facilitate blood flow into the cryovial. Withdraw a volume of blood less than 1% of the

rodent's body weight (e.g., 0.2 mL -- 200 microliters -- of blood from a 20g mouse) with an optimal target volume of .08mL (80 microliters); **Figure 14**.

a. Blood flow can be remarkably rapid and of high volume with this method. Familiarize yourself with the blood sample guidelines relative to the approximate fill levels in the given cryovial.

b. Although 20 microliters is sufficient for pathogen testing, the optimal volume is 80 microliters, so do not intentionally stop collection early once the 20 microliter threshold is reached. That being said, there is no need to augment the volume if blood flow stops naturally, particularly after 20 microliters is reached.

c. If an animal shows signs of lethargy or lack of responsiveness, administer sugar water as soon as possible.

d. If blood flow is too low, use the lancet to puncture the same spot with a bit more force or gently move the animal's head up and down to facilitate bleeding.

e. If blood is smearing into the fur, rather than forming drops, apply eye ointment to the area prior to lancing.

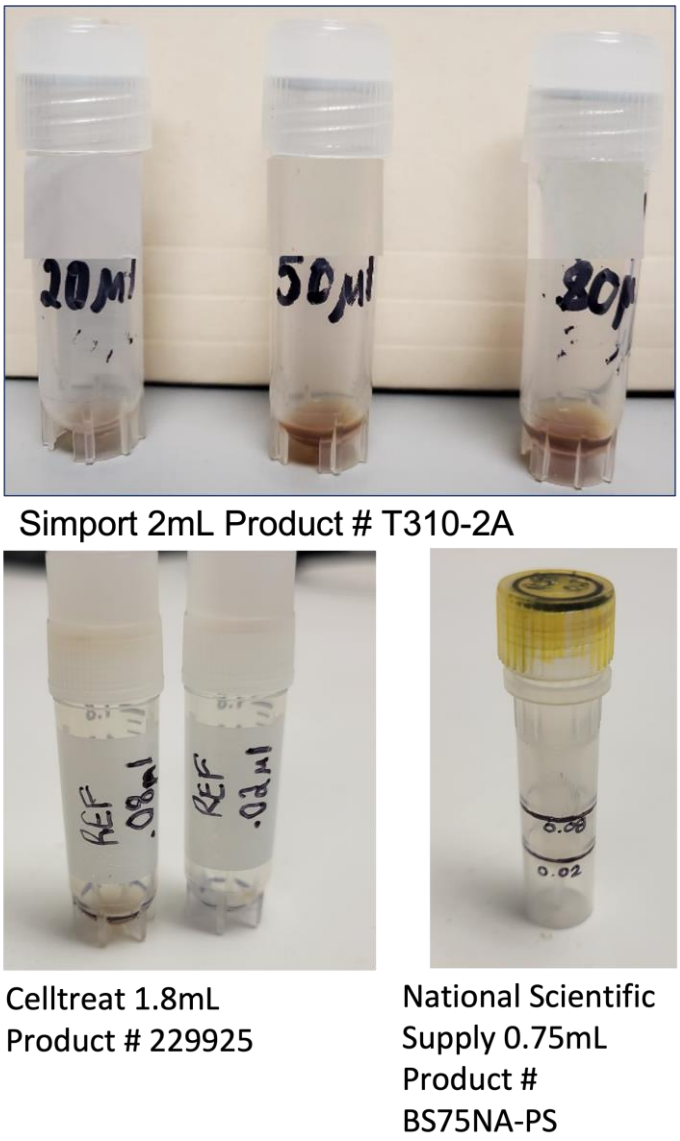


Figure 14. Examples of the minimum (20 microliters – 0.02 mL) and desired blood sample volumes (80 microliters – 0.08 mL) needed for pathogen analysis. Note that samples below 20 microliters should be saved but marked as QNS (quantity not sufficient). Several different sizes of cryovials are shown along with product numbers for reference.

9. In the event of an unsuccessful attempt, the other cheek can also be used. **Do not try more than three attempts per cheek** or as otherwise directed by site permit limitations (e.g., two per cheek at GRSM)**.**

10. Even if the first attempt of the bout was unsuccessful, bleeding of an individual should only be attempted once per bout.

11. Blood sample volumes should be recorded and handled differently depending on specific thresholds:

a. Note that the optimal/target blood sample volume is 80 microliters.

b. Samples that are so small that they stick on the side of the vial and fail to slide down and pool at the bottom are typically less than 10 microliters (0.01 mL). At low to moderate capture rates when processing time allows, these samples should have 2-3 drops of DNA/RNA Shield added to the vial with a sterile disposable pipette immediately after collection (prior to storage on dry ice). Samples should then be recorded as QNS and the volume selected should be < 10 microliters. The vials should be clearly marked in the field with a permanent marker since they will be handled differently from the samples that are 20 microliters and over. When capture rates are high (> 20 individuals) and time does not permit addition of DNA/RNA shield, these samples should be discarded and recorded as unsuccessful.

c. Samples that are large enough to pool at the bottom of the vial but not reaching the 20 microliter threshold required for pathogen testing (**Figure 14**) should be recorded as QNS and the volume selected should be 10-20 microliters. In these cases, no additional solution is added to the vial. These vials should also be marked in a different way from the < 10 microliter samples to enable faster organization of samples back in the lab (helps to maintain the cold chain required for these samples).

d. Samples that are 20 microliters and above should be recorded as > 20 microliters and are considered the lowest amount suitable for pathogen testing.

12. When the desired amount of blood has been collected, place a fresh piece of sterile gauze over the puncture point and pinch closed for up to 30 seconds to stem further bleeding.
13. Seal the cryovial with a screw cap and store on dry ice.
14. Dispose of lancet in sharps container, and spray used gauze with quat and place in trash bag.
15. Record the blood collection on the datasheet with an ‘M’ for mandibular.

After processing for that individual is complete (but no more than 15 minutes after collection), place sample in 4 mil resealable plastic bag or cryovial storage box (cardboard preferred) on dry ice and KEEP FROZEN until sample can be transferred to the -80°C freezer in the lab.

Summary of Blood Sample Volume Guidelines

- Samples that represent just a smear on the side of the vial should have DNA/RNA shield added with a sterile pipette to ensure future utility. These should be recorded as QNS with selected volume of < 10 microliters. If time does not permit this processing step these tiny samples should be discarded and blood sample method recorded as unsuccessful.

- Samples between 10-20 microliters do not receive solution and should pool at the bottom of the vial but are not sufficient volume for pathogen testing. These should be recorded as QNS with selected volume of 10-20 microliters.
- Tick-borne pathogen testing requires at least 0.02 mL (20 microliters).
- Extra blood for archiving is also desirable (approximately 0.06 mL – 60 microliters).
- Desired sample volume = 0.08 mL (80 microliters).

To avoid cross-contamination, follow final steps and clean up procedures described in SOP C.9 before processing the next animal. Vouchers should be processed after all live captures have been processed.

C.8 Voucher Specimens

Opportunistic collection

All animals that die during regular sampling should be collected as voucher specimens. Dead animals should be processed only after all the live ones have been processed. Blood, whisker, hair, and ear tissue samples do not need to be collected from dead individuals. Vouchers that are collected from a known plotID during sampling should be recorded in the Small Mammal Sampling mobile data entry application. Vouchers that are collected from locations outside of the plot, at unknown locations, and/or outside of the regular sampling effort should be recorded in the Mammal and Herptile: Off Grid Voucher mobile data entry application.

Intentional collection

Intentional collection of vouchers has not yet been funded. Training grids can also be used as a source of voucher specimens of target species, to both provide a historical record of the taxonomic identifications used in this study and enable additional scientific study, if funding is available. Voucher specimens of all resident species shall be collected from each domain, with a target minimum of 5 vouchers per species collected every 5 years. Ideally, these specimens will include skin, skeleton, and frozen tissues (e.g., liver, heart). These specimens minimally provide a long-term record of the taxonomy of the species being studied, as a reference for verification or evidence to support taxonomic changes that occur as the science advances.

Whenever training grids are sampled, the captured individuals of target species only should be used to meet the sample size criteria above. Individuals selected for vouchering should first be processed for training purposes and then immediately euthanized, as described in SOP C.5 ‘Anesthesia/Euthanasia’. The process for determining the vouchering needs to meet the desired sample sizes will be to evaluate the incidental deaths within a domain after the first 3 years of sampling; any species not yet vouchered adequately can then be targeted over the next two years, before the subsequent 5-year cycle begins. Please note that data from the training grids, including voucher specimen data, do not get entered into the small mammal mobile application, as these locations are not long-term sampling locations. Voucher specimen data collected from training grids only should be captured on paper datasheets and then transcribed into the Mammal and Herptile: Off Grid Voucher application.

Collection Procedure

1. Label a specimen tag with the sampleID on the front and affix a barcode label to the back of the tag as described in Section B.5.

    a. Tags can be printed or hand-written on sturdy (not printer) paper. Archival quality Pigma pen must be used for hand-written tags. Pencil may not be used to write information on the tag unless it is the uncommon #3 hard lead pencil – but this must be verified prior to use or the tag information will smear and become unreadable.

    b. If an individual does not have a tag AND and the voucher was collected from a known plotID during the course of sampling (Small Mammal Trap Checking application), assign a tagID with the format: 'O' + 3 digit number of plotID + trapCoordinate + YYYY + MM + DD (e.g., O003A520160518).

        i. If two or more untagged specimens are collected in the same trap, add an A/B/etc. to the end of the sampleID.

        ii. Note that this tagID should be associated with all samples collected from a vouchered specimen, if the samples were collected prior to death.

    c. If an individual does not have a tag AND and the voucher was collected from locations outside of the plot, at unknown locations, and/or outside of the regular sampling effort (Mammal and Herptile: Off Grid Voucher application), assign a tagID that corresponds to the time of collection (HH:MM), resulting in a voucherID with the format: siteID.YYYYMMDD.HH:MM.V (e.g., TALL.20181110.10:42.V)

    d. Note that the mobile data entry applications will auto-generate the voucherID, and so it is **imperative** that labels on all associated samples exactly match the format provided in the data entry application.

2. Securely affix the tag to the right hind foot above the ankle using cotton thread. Since long threads tend to become tangled during storage, tie the tag as close to the leg as possible. Note that the archive facility will replace the thread and tag upon processing of the voucher.

3. Place the animal in a resealable plastic bag and immediately place on dry ice in the cooler.

    a. Visibility of the teeth is often required for identification of shrew vouchers. To facilitate tooth visibility after freezing a shrew voucher it is recommended to use the storage bag to push the lips back and up. This can be accomplished by pushing the shrew voucher into the corner of the bag until its nose and lips are pushed back away from the teeth. Additional materials (paper towels / polyfill) can then be used to keep the shrew in place while on dry ice.

4. Indicate that a voucher has been collected on datasheet or mobile application.

5. Vouchers should be grouped in bags by site and year when they are shipped to the biorepository to facilitate processing.

Note: **Specimens in poor condition should first be offered to the identified repository prior to disposal, if required by the state collection permit**. If the repository refuses to accept specimens in poor condition, they should be sprayed liberally with disinfectant, double-bagged, and placed in the trash. As a general rule, the Biorepository will accept and archive the following:

i) any specimens with intact skulls regardless of body condition or whether identification can be determined

ii) any specimens or tissue for which an identification to family or better can be determined, even if the body condition is poor.

C.9 Final Processing Steps and Cleanup

After all samples have been collected:

1. Small captures can be weighed with the scale clipped directly to the base of the tail. Large captures or those that cannot be weighed by the tail should be weighed in a cloth or plastic bag. Next, the bag should be weighed without the animal inside. The two weights can be recorded directly into the app, or the weight of the animal (bag+animal weight – bag weight) should be calculated and entered onto the datasheet. Make sure all cryovials are labeled correctly, put in cooler with dry ice, and entered on the datasheet or in the mobile application. Hair and whiskers are stored at ambient temperature.
2. Put animal back into trap (trap is still in plastic bag) for transport back to point of capture.

Equipment is cleaned and sterilized in the field between processing of individuals to prevent cross contamination. The recorder is typically responsible for these tasks.

3. After spraying with quat, place all contaminated consumables (e.g., paper towels, plastic bags, gauze, and cotton) in the trash bag.
4. Ensure that any tools that came into contact with ear tissue are wiped with a sterile individually wrapped alcohol pad.
5. Place all used small instruments in the tray filled with quat for at least 5 full seconds (e.g., clip of spring scale only, forceps, biopsy punch, tea infuser spoon, scissors).
    - Dry instruments with paper towel before use.
6. Spray quat on larger reusable equipment (e.g., insulated cooler, squirt bottle containing quat). Use paper towels to carefully and thoroughly wipe the surfaces.
7. Spray down the processing surface with quat. Wipe processing surface with paper towels.
8. Always spray contaminated areas of clothing with quat as soon as possible.
9. Spray quat on gloved hands of animal handler and then own hands.

- Wipe hands together and dry with paper towels as needed.
- Sterilized gloves can be reused with the next animal but should be changed if a hole develops and after each grid is completed.

10. You are now ready to process the next animal.

Process all individuals on a grid before releasing animals at point of capture, unless extra personnel are available or an animal has given birth in the trap.

C.10 End of the Sampling Day

SAMPLES AND SPECIMENS

1. Keep all samples stored in cryovials on dry ice for transport back to the lab.
    - Frozen samples must remain frozen at all times. Repeated freeze-thaw cycles will compromise the integrity of the sample.
    - Transfer frozen samples to ultralow freezer (-80°C).
    - Store all voucher specimens (both on and off-grid) in an ultralow freezer (-80° C) and record on freezer log, if available.

EQUIPMENT – IN THE FIELD

When all animals are processed and released, clean up as described in previous section, plus do the following.

1. Spray used batting with quat and dispose of in trash bag.
    a. Clean, dry batting can be reused.
2. Pack up all supplies and equipment, once they are clean and dry.
3. Clean PPE as directed by EHS Safety Policy and Program Manual and dispose final round of nitrile gloves and wipes.
4. Close and tie the trash bag(s). Place bag in bed of pickup truck for transport back to the lab
5. If another night of sampling is scheduled, be sure that all traps are closed until dusk.
6. Be sure to replace dirty traps with clean ones.
7. If another night is not scheduled, collapse all traps and place in large plastic bag.
    - Place bag in bed of pickup truck for transport back to the lab or outside of passenger compartment of vehicle to prevent exposure to any remaining pathogens, if present.
    - Be sure to keep clean and dirty traps separate, as dirty traps should not be reused until they have been cleaned and sterilized.

8. Be sure that all soiled disposable sharps (e.g., PIT tag needles, heparinized microhematocrit tubes) have been disposed of in a 1 quart, slip-top, OSHA NIOSH/CDC compliant sharps container in the field, and is in a sealed plastic bag when not in use.

SOP D Post-Field Sampling Tasks

Process all frozen samples immediately upon returning to the lab. To keep samples frozen, always endeavor to minimize handling time and, while handling, always stage cryovials containing samples using a lab-top cooling device, dry ice bed, or similar. Once samples are frozen, they must remain frozen; plan accordingly. Any sampling that was missed should also be documented with an incident in Service Now and a samplingImpractical record.

D.1 Sample Processing in the Lab

1. **Frozen samples (blood, ear, feces):**
    a. Sort frozen cryovials into cryovial storage boxes according to sample type.
    b. Be sure to **label the outside of all storage containers (e.g., cryovial storage boxes) with the domain, collection year, and sample type.** Storage Container IDs should follow the format DXX.YYYY.#.(sample type letter from sampleID – e.g., B for blood), where # indicates the number of the box (1 – n). Place a type 2 barcode onto the storage container and use the inventory application to track samples. Use of the inventory application creates a record of the well coordinate location of each sample in the box and allows for the rapid creation of shipments. Please place freezer box label and barcode on the side of box and the side of the lid with A1 in back left corner.
    c. Secure the lid to the box with a rubber band.
    d. Record all samples onto a manifest with the corresponding well coordinates (RD[05]) and storage container ID. This is ideally accomplished via the Inventory data entry application, and it is recommended that barcodes are scanned into the application and well coordinates recorded.
        i. This manifest can then be used to compare to a downloaded csv from the data viewing application, Magpie (RD[04]), if needed.
        ii. This approach allows you to reference sampleID data without removing samples from the ultralow and to quickly locate particular samples as needed for disposal, bar-coding, etc.
    e. Although the inventory application is the recommended method, an alternative approach for generating the manifest (available only if mobile application has been used) is to:
        i. Sync the mobile tablets
        ii. Download the data from the data viewing application, Magpie (RD[04])
        iii. Sort records by tag ID
        iv. Copy records into the master running inventory
        v. Record sample container IDs and well coordinates for each sampleID in the manifest

vi. This allows for the rapid discovery of any data recording errors the same day (e.g., sample did not get marked as collected in the field or was inadvertently marked as a different sample type).

2. **Ear punches**

   a. A subset of the ear tissue samples is used for barcoding (see SOP F and Appendix C).

   b. A subset of ear tissue from domains 01-03, 05-09 and 17, where ear tissue is tested for *Borrellia burgdorferi* (the pathogen causing Lyme disease) is sent for pathogen analysis (see Appendix C).

   c. The remaining ear tissue samples are shipped to the archive institution indicated in the CLA shipping document on CLA's NEON intranet site, according to the instructions in SOP H.

   d. The final destination of ear samples is selected by Science at the end of the field season and communicated via ServiceNow Appendix C.

3. **Hair/Whiskers, Fecal samples, Voucher specimens**

   a. All samples should be shipped to the archive institution indicated in the CLA shipping document on CLA's NEON intranet site, according to the instructions in SOP H.

4. **Blood samples**

   a. A subset of blood samples is sent for pathogen analysis (see Appendix C 8Appendix C)

   b. The remaining blood samples are shipped to the archive institution indicated in the CLA shipping document on CLA's NEON intranet site (see SOP H and Appendix C 8Appendix C).

   c. The final destination of blood samples is selected by Science at the end of the field season and communicated via ServiceNow (Appendix C 8Appendix C)

D.2 Sample Preservation

- Store **ear punches, fecal samples, and blood samples** in an ultralow (-80°C) freezer.
- Store **voucher specimens** in individual, labeled plastic bags in an ultralow (-80°C) freezer. Label by writing the 'voucherSampleID' on the bag in permanent marker. If a sampleID is not available (e.g., specimens captured on training grids), record siteID, date, and species code on the bag instead. When shipping vouchers to the biorepository, individually bagged vouchers should be grouped into bags by site and year to facilitate specimen handling.
- Store **coin envelopes** containing hair and whisker samples in labeled, small plastic bags at ambient temperature and low humidity. To avoid excess moisture build-up, do not completely seal the plastic bags and use desiccant, if necessary. Humid conditions will often seal the envelopes inadvertently, making the sample more difficult to work with.

D.3 Sample Disposal

- If a sample does not end up with any corresponding data in the database, the sample loses all scientific value.
- If a sample does not have any associated data (minimally, date and location):
  - Review the data records for the corresponding tagID (if a barcode label is not used) and check whether the sample was simply not recorded as intended; fix the data, if applicable.
  - If you cannot find a matching data record, the sample should be discarded. These samples are not considered biohazardous, so the entire vial can be disposed of normally. Do not open the vial to spray quat inside. Please see voucher specimen section above for proper disposal of voucher specimens, if permitted.
  - Example: You have an ear sample for R1234 from trap A4 on 20180601 for plot HEAL_010. Your sampling bout took place from 20180602 to 20180604, and you have another ear sample for R1234 on 20180602. Therefore, the first sampleID was likely recorded in error and cannot be matched to a record. Discard this sample.

D.4 Document Incomplete Sampling Within a Site

Small mammal sampling is scheduled to occur at all prescribed sampling locations according to the frequency and timing described in Section 0. Ideally, sampling will occur at these sampling locations for the lifetime of the Observatory (core sites) or the duration of the site's affiliation with the NEON project (gradient sites). However, circumstances may arise requiring that sampling within a site be shifted from one particular location to another. In general, sampling is considered to be compromised when sampling at a location becomes so limited that data quality is significantly reduced. If sampling at a given plot becomes compromised, a problem ticket should be submitted by Field Science to HQ Science.

There are two main pathways by which sampling can be compromised. First, sampling locations can become inappropriately suited to answer meaningful biological questions (e.g., a terrestrial sampling plot is compromised after road-building activities, or a stream moves after a flood and the location is no longer within the stream channel). Second, sampling locations may be located in areas that are logistically impossible to sample on a schedule that that is biologically meaningful.

For small mammal sampling, a given plot must **be able to be** sampled (minimum of 75 traps per plot-night) on a minimum of 80% of scheduled plot-nights per calendar year over a two-year period. Plots that cannot be sampled on this schedule for access reasons (e.g., flooding, safety) as opposed to weather or resource-related reasons should be considered compromised.

If a scheduled bout of sampling is canceled, a problem ticket should be submitted by Field Science staff.

To document locations not sampled during the current bout:

1. Review Fulcrum records to determine which locations were not sampled but were scheduled to be sampled.

2. Create an incident with the following naming convention to document the missed sampling: 'TOS Sampling Incomplete: MOD – [Root Cause Description]'
    a. Example: 'TOS Sampling Incomplete: MAM – Could not access plot due to permanently closed road'
3. Staff scientists review incident tickets periodically to determine whether a sampling location is compromised.
4. Create a 'samplingImpractical' record to document any scheduled nights of sampling missed at each plot.

SOP E Equipment Cleaning in the Laboratory

E.1 Timing

Cleaning of dirty traps occurs at the Domain Support Facility, at the earliest convenience of the domain staff. Cleaning should follow the guidelines provided in the NEON Operations Field Safety and Security Plan (AD[02]). Dirty traps must be cleaned before re-deployment in the field. If stored, dirty traps must be stored in plastic bags in a well-ventilated area posted with Biohazard per Biosafety Level 2 requirements.

E.2 Equipment Cleaning and Disposal Procedures

To reduce the risk of disease transmission to technicians and among captured small mammals, thorough cleaning and disinfection of equipment that is known to have been in contact with small mammals is required.

1. Traps that should be cleaned include:
    a. Cleaning of traps that are extremely soiled, full of bait, contaminated by ants, slugs, etc., or to be transported for use at another site.
    b. Small mammal traps that have contained trapped animals
2. Traps requiring cleaning will be removed from the trapping grid, transported back to the domain lab in a plastic bag, in the bed of a pickup truck separated from the passenger compartment. At the domain lab, dirty traps will be thoroughly cleaned, as described below.
    a. A solution of quaternary ammonia (follow manufacturer guidelines for dilution) or a 10% bleach solution (i.e., 1:10 dilution with water) should be mixed in a carboy, or similar container.
    b. Never mix a bleach solution with ammonia solution (quat), as the resulting vapors are extremely dangerous. Cleaning is best performed in a well-ventilated area, while wearing a face shield and the full PPE required for handling small mammals at a given site. Chemical-resistant rubber gloves should be worn in place of nitrile gloves.
    c. Traps must then be soaked in the quaternary ammonia solution for a minimum of 10 minutes (as specified by the manufacturer guidelines) or the bleach solution for 5 minutes, and scrubbed out with stiff bristled brushes.
    d. Traps will be rinsed thoroughly with water, to avoid damage and to remove as much of the disinfectant scent as possible.
3. These traps will be replaced with clean traps before the next night of trapping. Back at the laboratory, Mesh wash bags used for animal handling must be decontaminated via laundering or UV.

SOP F Processing for Genetic Analysis

F.1 Ear Punch Sample Processing Timing

A subset of ear tissue samples will be prepared for DNA barcoding, to provide quality assurance of species identification. Science will communicate which samples have been selected for barcoding at the end of the field season (after October 31). DNA barcode samples must be shipped to the contracted barcoding facility by February of the following calendar year in which they were collected.

This portion of the protocol requires flame sterilization in the presence of ethanol, which is a highly flammable liquid, and therefore extreme caution must be used. These precautions include separating the container of ethanol from the flame by at least 16 inches and following all PPE requirements in the Chemical Hygiene Plan, including the use of a lab coat, gloves and safety glasses. Loose hair and dangling jewelry should be secured or removed. Before using any flame, take care to ensure that all flammable objects and chemicals are removed from the immediate workspace and shelves above the area, and that domain staff are aware of the location of fire extinguishers. Be aware that ethanol fumes can ignite and spread to the container of ethanol if it is too close to where the flame sterilization is occurring.

F.2 Ear Punch Preparation

1. Locate the small mammal ear tissue samples to be barcoded from the list provided by Science in Service Now.
    a. There will be up to 95 individuals for 1 DNA barcode plate per domain. Samples have been selected to prioritize inclusion of a minimum of 3 individuals per species in a domain if available. The next priority goes to individuals with species identifications with uncertainty associated with them as communicated via the identificationQualifier field (10 individuals or 11% of individuals sampled).
    b. Print one 96-well datasheet per plate (RD[05]), unless entering data directly into the DNA Sample Processing data entry application.
    c. Prepare a workspace with shipping box, 96-well microplate with row caps loosely attached, forceps, lighter, pencil or ethanol-safe pen, and gloves.
    d. Before placing tissue into plates, please read section F.3 **and** the more detailed DNA Sample Preparation Instructions, provided by the Canadian Centre for DNA Barcoding (CCDB).

F.3 Ear Punch Sample Processing in the Lab

If sufficient numbers of samples are available, fill each microplate completely (95 specimens) before shipping. If sample numbers preclude reaching 75% capacity of the plate, issue a problem ticket to Science for guidance.

1. Don proper PPE (laboratory coat, gloves, safety glasses). Secure or remove loose hair or dangling jewelry.

2. Remove all flammable objects and chemicals from immediate workspace and shelves above the area and make note of the location of fire extinguishers.
3. Wipe down the work area with 95% ethanol.
4. Prepare specimens for barcoding.
    a. Work with a single microplate at a time and enter all data before proceeding to the next microplate. It is recommended that a white piece of paper is placed under the microplate to assist in seeing the ear samples in the wells.
    b. To keep samples frozen, stage cryovials containing samples using a lab-top cooling device, dry ice bed, or similar. Once the samples are in the well with ethanol, the cold chain does not need to be maintained.
    c. Fill out the 96 well datasheet with the plate number, sample location in the plate, barcode lab and tag ID.
    d. DO NOT place any foreign objects (e.g. labels) into sampling wells. If something falls into a well (e.g., eyelash), note it and do not place a sample into that well. Move to the next well.
    e. Cover wells that are not in use with row caps to mitigate contamination. Note that strip caps are numbered and correspond to numbering on plates.
    f. Prior to beginning, and between each specimen, wipe the forceps with a Kim-wipe, then dip them in a container of 95% ethanol.
        i. Ethanol should be stored in a pyrex or metal container that is free of cracks and has a lid that can be used to smother ignited ethanol (e.g., pyrex glass petri dish with a lid).
        ii. Use only enough ethanol to cover the tips of the tools that are in contact with the ear tissue.
        iii. The container of ethanol should be at least 16 inches away from the primary work area so that it is far removed from any spaces where the use of flame occurs. Any drips or spills of ethanol must be completely dried from the workbench. Note that ethanol fumes can ignite and spread to a container if it is too close to the flame area.

    g. Once all safety precautions are in place, a flame should be used to sterilize the tools for at least 2 seconds to ensure that no residual tissue is present.
        i. If the ethanol ignites a fire that cannot be smothered with the lid of the container, a fire extinguisher should be used if the person has been trained in its proper use.
        ii. If a fire extinguisher cannot be used, the area should be evacuated while notifying others of the fire. Shut the door and pull the fire alarm then report the fire to the fire department.
    h. Place the ear tissue sample in the well (**Figure 15**).

i. Ear tissue can get stuck in the lid of the vial, so be sure to search the vial thoroughly if tissue does not appear to be present.

ii. Static from the plate and on the forceps can make it difficult to get the tissue into the well.

iii. Be gentle so that the sample does not end up in a different well.

iv. It can be helpful to gently tap the forceps to shake the tissue into the well. If it has gone into a different well but is the only sample in the well, do not remove it. If it has gone into a different well that already has a sample in it, both samples should be discarded and well should remain empty.

v. If an ear sample accidentally falls onto the counter prior to be placed in a well, rinse the sample with ethanol before placing in the well.

i. Repeat until you have filled all wells in the microplate, **EXCEPT** for well H12 which always remains empty as a negative control (fill 95 wells).

j. Cover plate.

k. Complete data entry prior to filling a new plate.

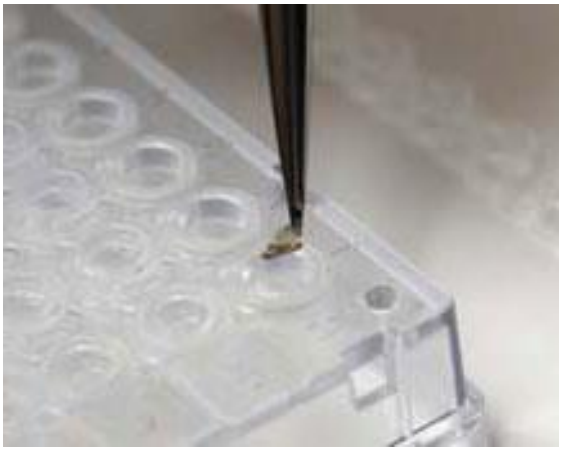


Figure 15. Placing tissue in a well.

F.4 Ear Punch Data Handling

STOP after each plate and enter the Plate number and Sample location into the Barcode Plate datasheet and/or DNA Sample Processing data entry application. Plate number is the unique plate number provided by CCDB. Sample location refers to the position each sample occupies in the plate (A01-H12). Have another staff member double-check data entry.

CCDB provides specific instructions for data handling, as provided in the document Instructions_Microplate.pdf. Read this document thoroughly before shipping. Key points include:

1. Biological Material Analysis Agreement

a. A Biological Material Analysis Agreement (BMAA) is provided by CCDB with each plate. This form will tell you the plateID for each plate you receive (i.e., CCDB-31771 - microplate). Check the box under item 1 and sign the BMAA where indicated.

2. Sample Record Data Input Sheet

a. There is a CCDB specific form called CCDB-00000_Record.xls under the supporting documents of the Sampling Support Library on the Small Mammal page. Fill in this form following instructions in the InterationalShippingGuide_mammal.ppt document, also available on the CLA page on the NEON intranet as well as linked in the Sampling Support Library on the Small Mammal page.

When complete, the CLA shipping email with the manifest should be forwarded with the BMAA and Sample Record Datasheet attached to lims@ccdb.ca to initiate processing of the plates.

F.5 Sample Preservation

Small mammal ear samples should be maintained at -80C until they are placed in well plates for DNA barcoding. Once plated, these ear samples will be submerged in a small quantity of 95% ethanol within the well to preserve the tissue, allowing for the shipment of these samples at room temperature. Store any filled plates in the refrigerator until ready to ship. Once ready to ship, the prepared plates should be removed from refrigerator and then shipped under ambient conditions. Please note that plates provided for DNA barcoding are not ultralow (-80 C) safe.

F.6 Sample Shipping

Follow the instructions in the InterationalShippingGuide_mammal.ppt document, available in the Sampling Support Library on the NEON intranet. At the end of the process, double-check that these items are included in the shipment:

- Shipping label from FedEx
- Shipper's address (DSF)
- Destination address (CCDB)
- Manifest
- Biological Material Analysis Agreement (BMAA) that came with the plates
- International Ground One-Time General Agency Agreement (3 copies)
- Commercial Invoice (3 copies)

Use the Shipping data entry application and select 'DNA Sample Processing [PROD]' as the source application to view only those ear punches that are to be DNA barcoded. The batch mode will allow for rapid selection of those identifiers in the plate.

Shipments from D18/D19 must be shipped by air rather than ground. Additional actions are required:

- Label the box with an "Accepted quantities" sticker, which indicates that the amount of ethanol being shipped is less than 30ml (pg. 270 E2 EQ 2.6 of IATA Handbook).

- Anything over 30 ml (but under 1 liter) would be considered “limited quantity” which would require a dangerous goods shipping declaration. No declaration is needed for quantities less than 30ml.

- On the “Accepted quantities” sticker, write a “3” to indicate the hazard class (3 = flammable).

SOP G Data Entry and Verification

The importance of thorough, accurate data entry and transcription cannot be overstated; the value of the efforts in the field is only manifested once the data are properly entered for delivery to NEON's end users.

Mobile applications are the preferred mechanism for data entry. Data should be entered into the protocol-specific application as they are being collected, whenever possible, to minimize data transcription and improve data quality. For detailed instructions on protocol specific data entry into mobile devices, see the NEON Internal Sampling Support Library (SSL). Mobile devices should be synced at the end of each field day, where possible; alternatively, devices should be synced immediately upon return to the Domain Support Facility.

However, given the potential for mobile devices to fail under field conditions, it is imperative that paper datasheets are always available to record data. Paper datasheets should be carried along with the mobile devices to sampling locations at all times. As a best practice, field data collected on paper datasheets should be digitally transcribed within 7 days of collection or the end of a sampling bout (where applicable). However, given logistical constraints, the maximum timeline for entering data is within 14 days of collection or the end of a sampling bout (where applicable). See RD[04] for complete instructions regarding manual data transcription.

Quality Assurance

Data Quality Assurance (QA) is an important part of data collection and ensures that all observational data and samples are accurate and complete. This protocol requires that certain QA checks be conducted in the field (i.e., before a field team leaves a plot or site), while others can be conducted at a later date in the office (typically within a week of collection). Field QA procedures are designed to prevent the occurrence of invalid data that cannot be corrected at a later time, and to ensure that data and/or sample sets are complete before a sampling window closes. Incomplete data and/or sample sets cannot be supplemented by subsequent sampling efforts if the sampling window has closed. Invalid meta-data (e.g. collection dates, plotIDs) are difficult to correct when field crews are no longer at a sampling location. Office QA procedures are meant to ensure that sampling activities are ***consistent*** across bouts, that sampling has been carried out to ***completion***, and that activities are occurring in a ***timely*** manner. The Office QA will also assess duplicative data to maintain data ***validity*** and ***integrity***.

- A template QAQC checklist for the small mammal sampling protocol is available on Sharepoint and can be modified to accommodate site-specific needs.
- All QA measures needed for this protocol are described in the Data Management Protocol (RD[04]).

Additional data quality tools are available for the quality checking of small mammal field data. The [MAM] Small Mammals QC App provides a number of data visualizations and alerts to possible issues in the data. This QC app is available from the aviary and also linked on the Small Mammal page of the

Sampling Support Library. Be sure to carefully read the 'About this app' page for guidance related to how to respond to errors and warnings. In particular, data should not be changed after the fact (without the animal in hand) in response to notifications regarding changes in the taxonID, sex, body measure, plotID of a recaptured animal, or notifications of anomalous body measurements for a given species. These are to be used only for informational purposes (possibly indicating the need for additional technician training/guidance).

Protocol-specific instructions

- Can be found on the NEON intranet in the Sampling Support Library.
- Do NOT enter data from training grids in the PROD mobile data entry application; these data should be collected on paper datasheets and can be entered into the CERT application.

Sample Labels & Identifiers

If available, adhesive barcode labels should be applied to dry, room temperature containers in advance of their use in the field (at least 30 minutes prior but may be applied at the start of the season). Use the appropriate barcode label type with each container (i.e., cryo-safe barcode labels only used for samples that are stored at -80°C, etc).

Barcodes are scanned into the mobile application when the sample is placed into the container; only one barcode may be associated with a particular sample. Do not reuse barcodes. If a barcode is associated with multiple samples, the data ingest system will throw an error and refuse to pull in entered data

Data and sample IDs must be entered digitally and quality checked prior to shipping samples to an external facility.

SOP H Sample Shipment

Follow instructions in the NEON Protocol and Procedure: Shipping Ecological Samples, Sensors, and Equipment to ship samples to external laboratories or the biorespository (RD[11]).

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APPENDIX A QUICK REFERENCES

A.1 Quick Reference: Checking Traps and Processing Captures

STEP 1 - Check ALL traps in grid for captures.

IF trap door CLOSED	IF trap door OPEN
Peek inside to see if there is a capture or feces. Immediately release non-target captures and females that have given birth in the trap along with her young. Write grid coordinate on trap. Place trap in plastic bag, for transport to processing station (even if capture has been released)	Clean trap can be reused. Traps with feces only should be marked, bagged, and taken to processing station. If mid-bout, leave empty trap in place and **close** door. On last day of sampling, remove trap.

STEP 2 – Set up processing station.

STEP 3 – Transfer capture to plastic bag (use stronger 4 mil bags if capture > 100g).

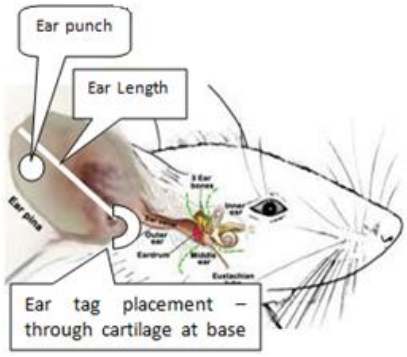
STEP 4 – Assess animal for signs of stress. Treat/release as needed.

STEP 5 – Modify processing, if necessary, based on total number of live captures of target or opportunistic species on the grid.

Captures Per Grid	Suggested Modifications to Processing
>20 - <30	Blood samples – stop after 20 samples have been collected, DNA/RNA shield addition optional for samples < 10 microliters, discard instead** Recaptures only – eliminate size measurements Hair and whisker samples – stop after 10 samples have been collected Fecal samples – stop after 10 samples have been collected Ear punches – stop after 10 samples have been collected*** Eliminate estimates of tick numbers (e.g., binned values)
30 +	Same as above plus: All captures – eliminate size measurements Eliminate tick searches

CRITERIA FOR BLOOD SAMPLING	
COLLECT blood from: • Cricetids that are > 10 g • Dipodids that are > 10 g • Murids that are > 10 g **UNLESS** individual has: • Pronounced or physically debilitating injury, and/or • Already been captured and bled during **current** sampling bout.	**DO NOT** collect blood from: • Sciurids - chipmunks, squirrels, etc. • Soricids – shrews • Talpids – moles • Geomyids – pocket gophers • Heteromyids – kangaroo rats, pocket mice • Any protected species listed on state or federal permit

STEP 6 – Mark Individual (if needed)



MARKING GUIDELINES

- Do not tag shrews or non-target species.

Ear Tag:

- Use if pinnae are of sufficient size.
- Right (R) ear preferred.
- Record ear (L or R) and ID number on datasheet.
- For recaptures, ensure that NEON is on one side of the tag. If not, record 'O' for other and the tag number.

PIT Tag:

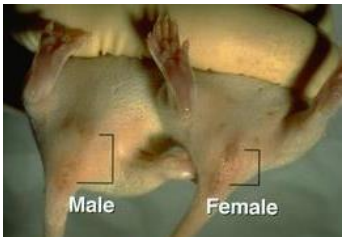
- Use if pinnae are of insufficient size (e.g., voles and pocket mice) or if ears are otherwise too damaged to support an ear tag.
- Ensure that PIT tags are pre-loaded and come from a gas sterilized, individually sealed pouch
- Record last 6 digits of tag # on datasheet.
- Dispose of needles in Sharps container.

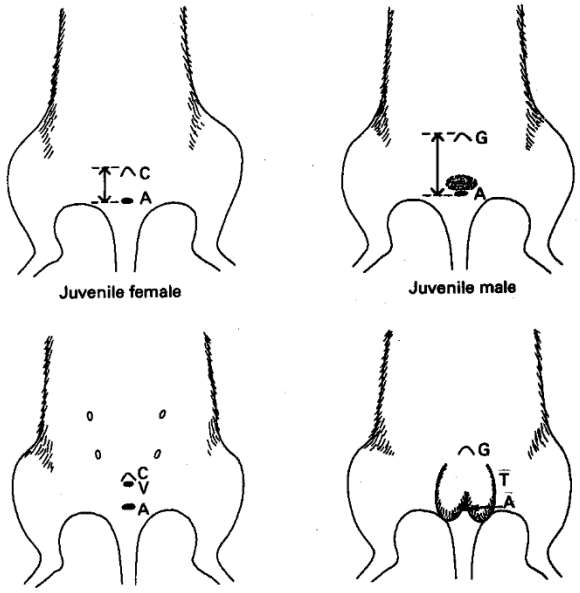
STEP 7 – Assess age, sex, and reproductive condition.

Age

Most juvenile cricetids are a uniform steely grey.

Sex





External sex difference in rodents. A = anus; C = clitoris; G = genital papilla; V = vaginal opening; T = testes. The A-C distance in female rodents is less than the A-G distance in males. From Watts and Aslin 1981.

STEP 8 – Proceed with sample collection, including bleeding, if required.

ENSURE that all collected samples are indicated on the datasheet. If a sample does not get entered into the database, then all resulting data are lost and samples will need to be discarded.

Sample	Description	Frequency	Storage container	Label	Field storage
Hair	tuft (~5-7 mg) from rear	once per bout	Archival coin envelope	Type I barcode	Ambient
Whiskers	pluck or snip at base, one from each cheek	once per bout			
Fecal	fresh only	every capture event	vial rated to -196°C	Type IV barcode	Dry ice
Ear punch	punch from outer margin of untagged ear	once per life of individual	vial rated to -196°C	Type IV barcode	Dry ice
Vouchers	entire specimens	opportunistically	resealable plastic bag	Type IV barcode	Dry ice
Blood	Collected via mandibular technique	Once per bout	Vial rated to -196°C	Type IV barcode	Dry ice

STEP 9 – Measure hind foot length (all species).

STEP 10 – Measure ear length/tail length, and/or total length (if needed for species ID)

STEP 11 – Weigh

STEP 12 – Put back in trap for transport back to point of capture and release.

STEP 13 – Clean all gloves and tools with quat before using on the next individual.

A.2 Quick Reference: Decision Tree for Processing

In the event of very high capture rates, lower priority tasks may be left out of processing. **The goal is to avoid situations where captures are released without any processing.**

For simplicity, guidelines are provided according to **captures per grid**. If grids predictably vary in capture rates, reduced processing can be implemented on grids that do not exceed the thresholds given below, to enable increased processing on high-capture grids being processed on the same day. Please keep in mind that the decision tree is intended to be used as a guideline only; use professional discretion.

Captures Per Grid	Suggested Modifications to Processing
>20 - <30	Blood samples – stop after 20 samples have been collected** Blood samples – discard samples less than 10 microliters Recaptures only – eliminate size measurements Hair and whisker samples – stop after 10 samples have been collected Fecal samples – stop after 10 samples have been collected Ear punches – stop after 10 samples have been collected*** Eliminate estimates of tick numbers (e.g., binned values) and checks for other parasites
30 +	Blood samples – stop after 20 samples have been collected**

	Blood samples – discard samples less than 10 microliters All captures – eliminate size measurements Hair and whisker samples – stop after 10 samples have been collected Fecal samples – stop after 10 samples have been collected Ear punches – stop after 10 samples have been collected*** Eliminate tick searches and checks for other parasites

**When blood sample collections are limited, attempt to distribute the 20 samples among the priority species if possible (provided in Appendix D). Please do not spend additional time counting captures per species prior to processing. The simplest, acceptable implementation of this guidance is to stop collecting blood samples once 10 samples have been collected for a given priority species, if a site has >1 priority species. For sites with priority species that are difficult to distinguish (e.g., PEMA vs. PELE), collect up to 20 samples from individuals of these species, regardless of species ID.

**For maximum time savings, include unsuccessful bleeding attempts in the count to 20.

***If possible, without expending additional effort to review captures, prioritize individuals with uncertain species IDs for ear punch collection.

A.3 Quick Reference: Challenging Conditions

Small mammal sampling can be performed under a variety of weather conditions. Care must be taken, however, to prevent conditions such that the trapped individual cannot thermoregulate properly, either in hot or cold conditions. Such conditions will result in the death of the trapped individuals.

MORTALITIES

- **Each mortality must be reported to the Field Operations Manager within 24 hours** of processing, in accordance with all state- and site-specific permit requirements.
- **If ≥ 5 individuals** on any given trapping grid during a single night of trapping **die, the trapping** on that grid should be **discontinued** until the next scheduled sampling bout, and a **problem ticket should be issued** detailing the locations, species, sex, and ages of the mortalities. Any other potential influences on the mortality should also be included (e.g., weather etc.).
- Note that the samplingImpractical reason for grid closures due to mortality is 'Disturbance'. Refrain from including additional remarks in the data since these are not necessary for end users.

LOGISTICAL HURDLES

- If there is any chance (i.e., >0%) that traps cannot be checked the following morning at dawn, traps shall not be set (e.g., impassable roads).
- If one night of trapping within the sampling bout is missed, **trapping may be resumed** and continued as normal at any time **within 5 days** of the latest night of trapping.

- If **>15** traps are destroyed on a single grid on any given night, traps should be removed from the site and that sampling bout terminated prematurely. The Field Operations Manager shall be informed as soon as possible, and a problem ticket should be issued.

COLD WEATHER

- **Bedding** should be used when low temperatures are expected to be **< 18°C (65°F), except** at sites where heteromyids dominate.
- **Trapping should not occur** on nights when **both** very cold temperatures (< 5.5°C (42°F)) and (a) precipitation in the form of **rain** are expected (>20% chance at sites with bedding; >5% chance at sites that cannot use bedding) or (b) dew is expected (i.e., if humidity is >75% and the projected minimum temperature is below the dew point), except if otherwise indicated in the site-specific appendices.

HOT WEATHER

- When ambient temperatures are expected to reach 27°C (80°F), by 10 a.m., extra effort must be made to **ensure that all traps** containing captured **individuals are processed or placed in the shade as soon as possible**. Initiation of trap checking before sunrise may be necessary in extremely hot environments, especially where shade is lacking.
- If trap checking **does not begin** prior to 8 - 9 am and **all traps are not shaded**, all traps should be opened to release animals and avoid heat-induced mortality. The trap night should be repeated the subsequent night by resetting the traps.

A.4 Quick Reference: Small Mammal Sampling Datasheet

Column Number(s)	Data Field	Description/What to Enter
1-3	plotID	Enter number only (Use leading zeros where applicable.)
4-5	trapCoordinate	Indicate point of capture with grid coordinate e.g., B5. Indicate uncertainty with an 'X'
6	Notes	Information on trap condition and quality. Use codes (1 through 6) from top left corner of datasheet. See below.
7-10	taxonID	Use 4 letter species code (examples listed on top of datasheet). Create own code if captured species not listed and record full name on back of each Datasheet on which the code is used.
11	idQ – identification Qualifier	CS – cf. species; cf. = "not sure"; AS – aff. species; aff. = "similar to, but is not" (full list in the protocol above)
12	Sex	Male (M) or female (F) or unknown (U).
13-18	Ear/PIT	Unique tag ID, format: Ear tags: RXXXX or LXXXX; PIT tags: **last** 6 digits of serial number
19-23	Age & repro status	Use uppercase letter codes from datasheet
24-25	HFL	Hind foot length (mm) – to nearest millimeter
26-27	Ear	Right ear length (mm) – to nearest millimeter
28-30	Tail	Tail length (mm) – round to nearest millimeter
31-33	TTL	Total length (head + body) (mm)
34-36	WGT	Weight (g) – round to nearest gram
37	Recapture	Yes/No/Unknown – indicates whether an individual is a recapture

38	Ripped Ear/Tag replaced	Indicate from which ear the tag was presumably lost (R or L), or the tag ID (ear or PIT) replaced. Record 'U' in the Recapture field if the previous tagID is unknown (and the animal is clearly a recapture).
39	Fate	Indicate history/condition of capture. **E**scaped, **D**ead, **N**ot Processed, **P**rocessed. Dead supercedes the Not Processed option.
40-42	Parasite Information	Circle all letters that apply to indicate which tick life stages are attached to the individual's head and neck if present, as well as whether any botflies or fleas are present.
43	Binned tick count	If an estimate of tick numbers is performed (pathogen grids), circle the bin that represents the number of all ticks of any life stage attached to the head and neck.
44	Blood	Indicate whether was blood sample was successfully collected using the **M**andibular technique, **U**nsuccessfully collected, or a **Q**uantity Not Sufficient was collected.
45-49	Samples	Indicate type of sample collected: **F**ecal, **E**ar, **H**air, **W**hisker, or **V**oucher.
50	Comments	Indicate there are comments on back of datasheet ("C").

- If traps are not set on a particular grid as scheduled or if no individuals are captured, these should be recorded in the NOTES field as a line on the datasheet for that given date, grid, and bout combination.
- If traps are damaged or disturbed overnight, note trap locations and code the nature of the disturbance on the datasheet in the NOTES field, with any other known details described on the back of the datasheet.

NOTES codes:

Definitions	Application Rules
1 – traps not set	Used at the level of the entire trapping grid, or, if some traps on a grid were set and others were not, can be used to indicate which ones were not set. This can also be used in the extremely rare event that a set trap goes missing due to predator disturbance.
2 – trap disturbed/door closed but empty – no animal sign	Used per trap coordinate, when necessary. Also used if a trap was set too tightly to successfully capture an animal overnight or for the capture of a non-mammal species (e.g., bird or reptile).
3 – trap door open or closed with feces left behind or bait missing	Used per trap coordinate, when necessary.
4 – >1 capture per trap	Used per trap coordinate; in the rare event of multiple captures per trap; enter this note code for each individual
5 – single capture in trap	Used per trap coordinate, when necessary
6—no captures	Used ONLY at the per grid level when using paper datasheets; there is no need to write down every trap that has been set but is empty

APPENDIX B CHECKLISTS

B.1 Trapping Small Mammals

Always have on hand:

- ☑ Copy of IACUC protocol form and IACUC approval letter
- ☑ Copy of up-to-date state collection permit
- ☑ Copy of all necessary permits
- ☑ Personal ID
- ☑ GPS with grid locations
- ☑ Compass to aid in following trap lines

Layout of Small Mammal Sampling Grid

	A	B	C	D	E	F	G	H	I	J
1	A1	B1	C1	D1	E1	F1	G1	H1	I1	J1
2	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2
3	A3	B3	C3	D3	E3	F3	G3	H3	I3	J3
4	A4	B4	C4	D4	E4	F4	G4	H4	I4	J4
5	A5	B5	C5	D5	E5	F5	G5	H5	I5	J5
6	A6	B6	C6	D6	E6	F6	G6	H6	I6	J6
7	A7	B7	C7	D7	E7	F7	G7	H7	I7	J7
8	A8	B8	C8	D8	E8	F8	G8	H8	I8	J8
9	A9	B9	C9	D9	E9	F9	G9	H9	I9	J9
10	A10	B10	C10	D10	E10	F10	G10	H10	I10	J10

Setting Traps:

- ☑ Each person should carry enough traps at one time for at least two traplines (i.e., 20 traps plus a few extra), for efficiency.
- ☑ Always walk the traplines along the N-S axis, except when moving to the next trapline. This will constrain vegetation disturbance to narrow trails within the grids over time.
- ☑ Whenever possible, place traps near shrubs, downed logs, burrows, or other microsites that offer shelter.
- ☑ Place trap, making sure trap is on level ground and the door remains open. If necessary, adjust trap sensitivity by gently pulling or pushing catch.
- ☑ Bait trap, by distributing about a tablespoon (use more in colder conditions) of seed mix throughout the trap, including near the entrance to the trap.
- ☑ When overnight lows will be <18°C (65°F), place approximately 5 cm (2 in) of batting into trap (except at sites dominated by heteromyids).

Setting Equipment

1 Traps (100 per grid + extras)

2 Tree planting bags (1 per person or per 40-50 traps)

3 Bait: Sterilized millet & sunflower seed (mealworms, where needed).

4 Lumbar bags of bait (1 per person)

Checking Equipment

- Replacement traps
- Trap-sized plastic bags
- Work gloves
- Tree planting bags (1 per person or per 40-50 traps)

B.2 Getting Ready for Small Mammal Sampling

- ☑ Ensure all **traps** and sampling equipment are functioning and sanitized.
- ☑ Ensure safety gear (**PPE**) is available in sufficient quantities, clean, and functioning.
- ☑ Prepare barcodes and materials for handwriting on the sample containers in the field.
- ☑ Ensure pit tag reader and camera batteries are charged. Bring spare batteries for headlamps.
- ☑ Prepare a small vial of **10% sugar** in water to revitalize stressed, hypothermic or heat-stressed captures. Change solution often to prevent mold growth.
- ☑ Sterilize (bake at 205° C for 10 minutes or 150° C for 45-60 minutes) and mix a sufficient amount of millet (65% of **seed** mix) and sunflower seeds (35%).
- ☑ Ensure that all necessary **datasheets, identification keys, permits**, and equipment are packed.
- ☑ Prepare and maintain a **list of individuals already bled** within the current sampling bout to ensure that no individuals are bled twice within a bout. Also note any individuals with missing data that can be collected if recaptured in this bout, and the number of feces, ear, and hair samples taken. Do not rely only on the accuracy of Fulcrum 'lastBled' information – a hard copy list is required in the field to verify accuracy.
- ☑ Prepare **quat**: if necessary, mix a batch of quat stock solution in the lab (follow manufacturer guidelines for dilution). Fill up the spray bottle(s) and field stock bottles.
- ☑ Prepare **isoflurane** or **methoxyflurane**: in a fume hood or well-ventilated outdoor location; fill up the glass bottle with rubber dropper bulb and glass bottle with screw top with isoflurane or methoxyflurane.
- ☑ Pack **supplies**: bring enough supplies for processing at least twice as many individuals as you expect.
- ☑ Obtain **dry ice** or prepare alternative materials (ultra-cold ice packs or aquarium rocks): this should be done as close to departure for the field as possible and stored in a cooler prior to use.

Personal Protective Equipment (PPE)

- Eye protection (safety glasses to discourage rubbing of the eyes and protect from extreme splashes)
- Disposable respirators with N95 (HEPA-equivalent) particulate filter and scratch-resistant gloves under nitrile for new handlers
  - Required: all sites in CO, NM, AZ, CA, WA, WY
  - Recommended: all sites in KS, TX, UT, MT, NV, ID, and OR
- Latex and/or nitrile gloves
- Long-sleeved shirt
- Long pants
- Close-toed shoes with socks
- a disposable or reusable (cotton) laboratory coat or apron
- Special cloth gloves with rubber-tipped fingers are recommended to be worn while handling to reduce the incidence of bites (latex/nitrile gloves should be worn over these)

APPENDIX C GUIDELINES FOR BLOOD AND EAR SAMPLE SHIPMENT FOR BARCODING, PATHOGEN ANALYSIS OR ARCHIVE

Shipment of ear and blood samples to either the pathogen testing laboratory, the barcoding laboratory or the biorepository is planned to occur once per year at the end of the field season to allow for strategic selection of samples. Science staff will provide a list of samples and their destinations prior to the scheduled ship date.

Only blood samples with volumes of at least 20 microliters (0.02 mL) should be sent for analysis. The remaining samples should be archived. To avoid sending quantity not sufficient (QNS) samples for testing:

- Use a 'template' cryo-vial marked to denote 20µL to use for comparison
- Flag samples that are likely QNS when collecting in the field since it is easier to estimate volumes prior to freezing samples. A sharpie can be used to mark flagged vials with a dot on the lid.
- Do not use blood smeared on side of vial when making the quantity estimate
- If at the time of sample shipment it is determined that some samples listed for shipment to the pathogen laboratory are actually < 20 microliters (0.02 mL) but not labeled as QNS (quantity not sufficient), those samples should instead be sent to the Biorepository.

Samples that are missing or need to be changed to QNS should be communicated to Science via a Service Now incident so that the data and testing lists can be updated. If more than 5 samples are either missing or QNS, wait for guidance from Science on how to proceed with sample shipment.

APPENDIX D SITE-SPECIFIC INFORMATION

This section includes site-specific information about trapping issues, species lists, and abundance estimates. The species that receive PIT tags instead of ear tags may also vary by site at the discretion of the field teams. PIT tags are used when the length of the external pinnae is insufficient for securing ear tags. PIT tag use is more common for species such as voles (e.g., *Microtus spp., Myodes spp.*) and pocket mice (e.g., *Chaetodipus spp., Perognathus spp.*). Note that PIT tags must be in individual, gas-sterilized, pouches, and that PIT tag pouches expire after a few years. PIT tag expiration dates should be checked at the beginning of each season. If there are too many to use prior to the expiration date, reach out to other domains that might be able to use them before they expire.

The following is a list of species that are commonly PIT tagged to aid in ordering decisions*: Chaetodipus hispidus, Chaetodipus californicus, Chaetodipus baleyi, Chaetodipus penicillatus, Chaetodipus eremicus, Perognathus flavus, Perognathus flavescens, Perognathus fasciatus Perognathus inoratus, Perognathus parvus, Perognathus sp., Microtus ochrogaster, Microtus pinetorum, Microtus pennsylvanicus, Spermophilus (Ictidomys) tridecimlineatus, Spermophilus spilosoma, Callospermophilus lateralis, Ammospermophilus harrisii, Tamias striatus, Tamias townsendii , Tamias sp., Neotamias minimus, Neotamias umbrinus, Neotamias quadrivittatus, Reithrodontomys sp., Synaptomys cooperi, Dicrostonyx groenlandicus,* and *Lemmus trimucronatus*. A full list with estimates of the number of pit-tagged species collected by domain can be found in the Supporting Documents on the sampling support page to support planning and ordering needs.

D.1 D01 – CORE – HARV (Harvard Forest)

Trapping Issues

- Slugs after rainfall events may fill traps
- Large (i.e., bear) and medium sized carnivore (e.g., fishers, raccoons) disturbance

Seed preparation: The bait mixture can be baked at 135°C for 60 minutes due to oven constraints.
Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F.
Dominant vegetation type(s) for bleed grid designation: Deciduous/Evergreen/Mixed Forest
Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Peromyscus leucopus, Peromyscus maniculatus

Species List and Abundance Estimates

This species list is based on Cardoza, Jones, & French, 2009. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported in Degrassi & Ellison, 2013, and updated with NEON data from 2014 through 2016**.** Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 11. Site-specific species list (HARV)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Gapper's Red-backed Vole	50 - 500
Microtus pennsylvanicus	Meadow Vole	0 - 50
Napaeozapus insignis	Woodland Jumping mouse	20 - 100
Peromyscus leucopus	White footed mouse	50 - 500
Peromyscus maniculatus	N. American deer mouse	100 - 500
Microtus pinetorum	Woodland Vole	0 - 20
Synaptomys cooperi	Southern Bog Lemming	0 - 20
Zapus hudsonius	Meadow Jumping Mouse	0 - 20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	50 - 150
Sorex cinereus	Masked Shrew	0 - 50
Sorex fumeus	Smoky Shrew	0 - 30
Tamias striatus	Eastern Chipmunk	50 - 150
Sorex dispar	Long-tailed Shrew	0 - 20
Sorex hoyi	American Pygmy Shrew	0 - 20
Sorex palustris	American Water Shrew	0 - 20
Tamiasciurus hudsonicus	Red Squirrel	0 - 20
NON-TARGET ANIMALS (Scientific and Common Name)		
Parascalops breweri	Hairy-tailed Mole	0 - 20
Scalopus aquaticus	Eastern Mole	0 - 20
Glaucomys volans	Southern Flying Squirrel	0 - 20
Glaucomys sabrinus	Northern Flying Squirrel	0 - 20

D.2 D01 – GRADIENT - BART (Barlett Experimental Forest)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., fishers, raccoons) disturbance

Seed preparation: The bait mixture can be baked at 135°C for 60 minutes due to oven constraints.
Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F.
Dominant vegetation type(s) for bleed grid designation: Mixed/Deciduous/Evergreen Forest
Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Peromyscus leucopus, Peromyscus maniculatus
Species List and Abundance Estimates
This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Ryan B. Stephens (pers. comm.) based on 2013 trapping efforts, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 12. Site-specific species list (BART)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus chrotorrhinus	Rock Vole	0-20
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus pinetorum	Woodland Vole	0-20
Myodes gapperi	Southern Red-backed Vole	10-200
Peromyscus leucopus	White-footed Deermouse	50-200
Peromyscus maniculatus	North American Deermouse	50-500
Synaptomys borealis	Northern Bog Lemming	0-5
Synaptomys cooperi	Southern Bog Lemming	0-5
Napaeozapus insignis	Woodland Jumping Mouse	100-500
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	20-200
Sorex cinereus	Cinereus Shrew	0-50
Sorex dispar	Long-tailed Shrew	0-5
Sorex fumeus	Smoky Shrew	0-50
Sorex hoyi	American Pygmy Shrew	0-5
Sorex palustris	American Water Shrew	0-5
Tamias striatus	Eastern Chipmunk	0-50

Tamiasciurus hudsonicus	Red Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Glaucomys volans	Southern Flying Squirrel	0-50
Martes americana	American Marten	0-5
Martes pennanti	Fisher	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	American Mink	0-5
Parascalops breweri	Hairy-tailed Mole	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sylvilagus transitionalis	New England Cottontail	0-5

D.3 D02 – CORE – SCBI (Smithsonian Conservation Biology Institute)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Neotoma magister, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys humulis, Microtus pinetorum

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by McShea et al. 2003 and Osbourne et al. 2005, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 13. Site-specific species list (SCBI)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	0-50
Microtus pennsylvanicus	Meadow Vole	0-100
Microtus pinetorum	Woodland Vole	0-50
Mus musculus musculus	House mouse	0-150
Neotoma magister	Allegheny Woodrat	0-20
Peromyscus leucopus	Northern white-footed mouse	100-500
Peromyscus maniculatus	North American deer mouse	0-50
Rattus norvegicus	Norway rat	0-5
Rattus rattus	Black rat	0-5
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Synaptomys cooperi	Southern Bog Lemming	0-50
Napaeozapus insignis	Woodland Jumping Mouse	0-200
Zapus hudsonius	Meadow Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	50-200
Cryptotis parva	North American Least Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-20
Sorex fumeus	Smoky shrew	0-20
Sorex hoyi	American Pygmy Shrew	0-50
Sorex longirostris	Southeastern shrew	0-5

Tamias striatus	Eastern Chipmunk	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed weasel	0-5
Mustela nivalis	Least weasel	0-5
Mustela vison	Common mink	0-5
Parascalops breweri	Hairy-tailed Mole	0-5
Scalopus aquaticus	Southern mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5

D.4 D02 – GRADIENT– SERC (Smithsonian Environmental Research Center)

Trapping Issues

- Medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F
Dominant vegetation type(s) for bleed grid designation: Deciduous Forest
Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Neotoma magister, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys humulis
Species List and Abundance Estimates*:* This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Perry et al. 1998 and Gómez et al. 2008, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 14. Site-specific species list (SERC)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	0-20
Microtus pennsylvanicus	Meadow Vole	100-500
Microtus pinetorum	Woodland Vole	0-50
Mus musculus	House mouse	0-50
Neotoma magister	Allegheny Woodrat	0-20
Peromyscus leucopus	Northern white-footed mouse	50-500
Peromyscus maniculatus	North American deer mouse	0-50
Rattus norvegicus	Norway rat	0-5
Rattus rattus	Black rat	0-5
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Synaptomys cooperi	Southern Bog Lemming	0-5
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	20-100
Cryptotis parva	North American Least Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-20
Sorex fumeus	Smoky shrew	0-20
Sorex hoyi	American Pygmy Shrew	0-5

Sorex longirostris	Southeastern shrew	0-5
Tamias striatus	Eastern Chipmunk	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed weasel	0-5
Mustela nivalis	Least weasel	0-5
Mustela vison	Common mink	0-5
Parascalops breweri	Hairy-tailed Mole	0-5
Scalopus aquaticus	Southern mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5

D.5 D02 – GRADIENT– BLAN (Blandy Experimental Farm)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F
Dominant vegetation type(s) for bleed grid designation: Pasture/hay
Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Neotoma magister, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys humulis
Species List and Abundance Estimates
This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Matter et al. 1996 and Mitchell et al. 1997, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 15. Site-specific species list (BLAN)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	0-20
Microtus pennsylvanicus	Meadow Vole	0-50
Microtus pinetorum	Woodland Vole	0-50
Mus musculus	House mouse	0-20
Neotoma magister	Allegheny Woodrat	0-20
Peromyscus leucopus	Northern white-footed mouse	50-500
Peromyscus maniculatus	North American deer mouse	0-50
Rattus norvegicus	Norway rat	0-5
Rattus rattus	Black rat	0-5
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Synaptomys cooperi	Southern Bog Lemming	0-50
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-50
Cryptotis parva	North American Least Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-5
Sorex fumeus	Smoky shrew	0-5
Sorex hoyi	American Pygmy Shrew	0-5

Sorex longirostris	Southeastern shrew	0-5
Tamias striatus	Eastern Chipmunk	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed weasel	0-5
Mustela nivalis	Least weasel	0-5
Mustela vison	Common mink	0-5
Parascalops breweri	Hairy-tailed Mole	0-5
Scalopus aquaticus	Southern mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5

D.6 D03 – CORE – OSBS (Ordway-Swisher Biological Station)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Medium sized carnivore (e.g., coyotes, raccoons) disturbance
- Do not trap when traps are in any danger of becoming waterlogged overnight.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: N/A (due to the low capture rates at this site, bleed grids were selected based on capture rates rather than vegetation type)

Priority species for pathogen testing: Neotoma floridana, Ochrotomoys nuttalli, Oryzomys palustris, Peromyscus gossypinus, Peromyscus polionotus, Podomys floridanus, Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on the Annotated Mammal Species List of the Ordway-Swisher Biological Station. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Dr. Bob McCleery at the University of Florida, and updated with NEON data from 2014 through 2016**.** Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 16. Site-specific species list (OSBS)

TARGET species (Scientific and Common Name)		Number to be Used Annually
Mus musculus	House mouse	0 - 20
Neotoma floridana floridana	Florida wood rat	0 - 50
Ochrotomys nuttalli	Golden Mouse	0 - 50
Oryzomys palustris natator	Marsh rice rat	0 - 20
Peromyscus gossypinus gossypinus	Cotton mouse	10 - 100
Peromyscus polionotus subgriseus	Oldfield mouse	100 - 50
Podomys floridanus	Florida Deermouse	10 - 100
Reithrodontomys humulis	Eastern Harvest Mouse	0 - 50
Sigmodon hispidus hispidus	Hispid Cotton Rat	0 - 50

OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina carolinensis	Southern Short-tailed Shrew	0 - 20
Cryptotis parva floridana	Least shrew	0 - 20
Sorex longirostris	Southeastern Shrew	0 - 20
NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys pinetis floridanus	Florida pocket gopher	0 - 5
Scalopus aquaticus australis	Southern mole	0 - 5
Glaucomys volans	Southern Flying Squirrel	0 – 100
Sciurus carolinensis	Eastern grey squirrel	0 - 5

D.7 D03 – GRADIENT – DSNY (Disney Wilderness Preserve)

Trapping Issues

- Fire ants
  - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
  - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
  - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
  - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
- Medium sized carnivore (e.g., coyotes, raccoons) disturbance
- Cattle disturbance
- Do not trap when traps are in any danger of becoming waterlogged overnight.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Woody Wetlands

Priority species for pathogen testing: Neotoma floridana, Ochrotomoys nuttalli, Oryzomys palustris, Peromyscus gossypinus, Peromyscus polionotus, Podomys floridanus, Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on the Mammals of Florida | American Society of Mammalogists. The abundance estimates were based on an average capture rate of 10%, and, in the absence of existing data, estimates of captures are based on data for Ordway Swisher, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 17. Site-specific species list (DSNY)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Neotoma floridana	Eastern Woodrat	0 - 20
Peromyscus gossypinus	Cotton Deermouse	0 - 50
Peromyscus polionotus	Oldfield Deermouse	0 - 20
Podomys floridanus	Florida Deermouse	0 - 50
Sigmodon hispidus	Hispid Cotton Rat	5 - 150
Ochrotomys nuttalli	Golden Mouse	0 - 5
Oryzomys palustris	Marsh Oryzomys	0 - 20
Mus musculus	House mouse	0 - 20
Rattus norvegicus	Norway rat	0 - 20
Rattus rattus	Black rat	0 - 20
Reithrodontomys humulis	Eastern Harvest Mouse	0 - 50

OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina carolinensis	Southern Short-tailed Shrew	0 - 20
Cryptotis parva floridana	Least shrew	0 - 20
Sorex longirostris	Southeastern Shrew	0 - 20
NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys pinetis	Southeastern Pocket Gopher	0 - 5
Scalopus aquaticus	Eastern Mole	0 - 5
Glaucomys volans	Southern Flying Squirrel	0 - 20

D.8 D03 – GRADIENT – JERC (Jones Ecological Research Center)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Medium sized carnivore (e.g., coyotes, raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen/Deciduous/Mixed Forest

Priority species for pathogen testing: Microtus pinetorum, Neotoma floridana, Ochrotomoys nuttalli, Oryzomys palustris, Peromyscus gossypinus, Peromyscus polionotus, Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays & Wilson, 2011 and Smith et al., 2006. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported in Ford et al. 1994, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 18. Site-specific species list (JERC)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus pinetorum	Woodland Vole	0-50
Mus musculus	House mouse	0-50
Neotoma floridana	Eastern Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-20
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus gossypinus	Cotton Deermouse	100-500
Peromyscus polionotus	Oldfield Deermouse	20-100
Rattus norvegicus	Norway rat	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	20-200
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		

Blarina carolinensis	Southern Short-tailed Shrew	0-5
Cryptotis parva	North American Least Shrew	0-5
Sorex longirostris	Southeastern Shrew	0-5
Tamias striatus	Eastern Chipmunk	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys pinetis	Southeastern Pocket Gopher	0-5
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger shermani	Sherman's fox squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sylvilagus palustris	Marsh Rabbit	0-5

D.9 D04 – CORE – GUAN (Guanica Forest)

Small mammal trapping is not planned to occur at this site.

D.11 D04 – GRADIENT – LAJA (Lajas Experimental Station)

Small mammal trapping is not planned to occur at this site.

D.12 D05 – CORE – UNDE (University of Notre Dame Environmental Research Center)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance
- Due to the high mortality rates of shrews during April and October sampling bouts in 2014 and 2015, it is recommended that these bouts be dropped from the sampling schedule for this site.
- Flying squirrels (*Glaucomys spp*.) are relatively abundant and so are to be treated as opportunistic species, including species identifications when possible.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Woody Wetlands

Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Peromyscus leucopus, Peromyscus maniculatus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Kilcline 2003 and data collected by NEON, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 19. Site-specific species list (UNDE)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	20-200
Microtus pennsylvanicus	Meadow Vole	0-50
Mus musculus	House mouse	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	50-500
Synaptomys cooperi	Southern Bog Lemming	0-50
Napaeozapus insignis	Woodland Jumping Mouse	20-200
Zapus hudsonius	Meadow Jumping Mouse	0-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	10-250
Glaucomys sabrinus	Northern Flying Squirrel	10-100
Glaucomys volans	Southern Flying Squirrel	10-100
Sorex arcticus	Arctic Shrew	0-50
Sorex cinereus	Cinereus Shrew	20-200
Sorex hoyi	American Pygmy Shrew	0-5
Sorex palustris	American Water Shrew	0-5
Tamias minimus	Least Chipmunk	0-10

Tamias striatus	Eastern Chipmunk	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-10
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Lepus americanus	Snowshoe Hare	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Martes pennanti	Fisher	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.13 D05 – GRADIENT – STEI (Steigerwaldt)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance
- Due to the high mortality rates of shrews during April and October sampling bouts at UNDE in 2014 and 2015, it is recommended that these bouts be dropped from the sampling schedule for this site.
- Flying squirrels (*Glaucomys spp*.) are relatively abundant and so are to be treated as opportunistic species, including species identifications when possible.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Peromyscus leucopus, Peromyscus maniculatus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Kilcline 2003, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 20. Site-specific species list (STEI)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	20-200
Microtus pennsylvanicus	Meadow Vole	0-50
Mus musculus	House mouse	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	100-500
Synaptomys cooperi	Southern Bog Lemming	0-50
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	10-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	20-100
Glaucomys sabrinus	Northern Flying Squirrel	5-50
Glaucomys volans	Southern Flying Squirrel	5-50
Sorex arcticus	Arctic Shrew	0-10
Sorex cinereus	Cinereus Shrew	10-100
Sorex hoyi	American Pygmy Shrew	0-5

Sorex palustris	American Water Shrew	0-5
Tamias minimus	Least Chipmunk	0-50
Tamias striatus	Eastern Chipmunk	0-20
Tamiasciurus hudsonicus	Red Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Lepus americanus	Snowshoe Hare	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Martes pennanti	Fisher	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.14 D05 – GRADIENT – TREE (Treehaven)

Trapping Issues

- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance
- Due to the high mortality rates of shrews during April and October sampling bouts at UNDE in 2014 and 2015, it is recommended that these bouts be dropped from the sampling schedule for this site.
- Flying squirrels (*Glaucomys spp*.) are relatively abundant and so are to be treated as opportunistic species, including species identifications when possible.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Woody Wetlands/Evergreen Forest

Priority species for pathogen testing: Microtus pennsylvanicus, Myodes gapperi, Peromyscus leucopus, Peromyscus maniculatus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Kilcline 2003, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 21. Site-specific species list (TREE)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Southern Red-backed Vole	20-100
Microtus pennsylvanicus	Meadow Vole	0-50
Mus musculus	House mouse	0-20
Peromyscus leucopus	White-footed Deermouse	20-200
Peromyscus maniculatus	North American Deermouse	20-200
Synaptomys cooperi	Southern Bog Lemming	0-50
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-50
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Glaucomys volans	Southern Flying Squirrel	0-5
Sorex arcticus	Arctic Shrew	0-50
Sorex cinereus	Cinereus Shrew	0-50
Sorex hoyi	American Pygmy Shrew	0-5

Sorex palustris	American Water Shrew	0-5
Tamias minimus	Least Chipmunk	0-50
Tamias striatus	Eastern Chipmunk	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Lepus americanus	Snowshoe Hare	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Martes pennanti	Fisher	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.15 D06 – CORE – KONZ (Konza Prairie Biological Station)

Trapping Issues

- Medium sized carnivore (e.g., raccoons, coyotes) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Microtus spp., Neotoma floridana, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by McMillan et al. 1997, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 22. Site-specific species list (KONZ)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	20-200
Microtus ochrogaster	Prairie Vole	100-500
Microtus pinetorum	Woodland Vole	0-20
Mus musculus	House mouse	0-20
Neotoma floridana	Eastern Woodrat	20-100
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	50-300
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Reithrodontomys montanus	Plains Harvest Mouse	100-500
Sigmodon hispidus	Hispid Cotton Rat	20-200
Synaptomys cooperi	Southern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-20
Blarina hylophaga	Elliot's Short-tailed Shrew	0-50
Cryptotis parva	North American Least Shrew	0-50
Tamias striatus	Eastern Chipmunk	0-20
Spermophilus franklinii	Franklin's Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5

NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.16 D06 – GRADIENT – UKFS (University of Kansas Field Station)

Trapping Issues

- Medium sized carnivore (e.g., raccoons, coyotes) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus spp., Neotoma floridana, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Fitch and Slade 2014, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 23. Site-specific species list (UKFS)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	0-20
Microtus ochrogaster	Prairie Vole	0-100
Microtus pinetorum	Woodland Vole	0-20
Mus musculus	House mouse	0-20
Neotoma floridana	Eastern Woodrat	20-200
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	100-300
Peromyscus maniculatus	North American Deermouse	0-50
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Reithrodontomys montanus	Plains Harvest Mouse	0-50
Sigmodon hispidus	Hispid Cotton Rat	100-300
Synaptomys cooperi	Southern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-20
Blarina hylophaga	Elliot's Short-tailed Shrew	0-50
Cryptotis parva	North American Least Shrew	0-50
Tamias striatus	Eastern Chipmunk	0-20
Spermophilus franklinii	Franklin's Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5

NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.17 D06 – GRADIENT – KONA (Konza Prairie Biological Station - Agriculture)

Trapping Issues

- Medium sized carnivore (e.g., raccoons, coyotes) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Agriculture

Priority species for pathogen testing: Microtus spp., Neotoma floridana, Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by McMillan et al. 1997, and updated with NEON data from nearby Konza Biological Stations from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 24. Site-specific species list (KONA)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	20-200
Microtus ochrogaster	Prairie Vole	100-500
Microtus pinetorum	Woodland Vole	0-20
Mus musculus	House mouse	0-20
Neotoma floridana	Eastern Woodrat	20-100
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	50-300
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Reithrodontomys montanus	Plains Harvest Mouse	100-500
Sigmodon hispidus	Hispid Cotton Rat	20-200
Synaptomys cooperi	Southern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-20
Blarina hylophaga	Elliot's Short-tailed Shrew	0-50
Cryptotis parva	North American Least Shrew	0-50
Tamias striatus	Eastern Chipmunk	0-20
Spermophilus franklinii	Franklin's Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5

NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.18 D07 – CORE – ORNL (Oak Ridge National Laboratory)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus leucopus, Peromyscus maniculatus, Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Giffen et al. 2011, and updated with NEON data from 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 25. Site-specific species list (ORNL)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus chrotorrhinus	Rock Vole	0-20
Microtus ochrogaster	Prairie Vole	0-20
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus pinetorum	Woodland Vole	0-20
Mus musculus	House mouse	0-20
Neotoma floridana	Eastern Woodrat	0-20
Neotoma magister	Allegheny Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-20
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	20-200
Rattus norvegicus	Norway rat	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	10-100

Synaptomys cooperi	Southern Bog Lemming	0-5
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	10-100
Cryptotis parva	North American Least Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-5
Sorex dispar	Long-tailed Shrew	0-5
Sorex fumeus	Smoky Shrew	0-5
Sorex hoyi	American Pygmy Shrew	0-5
Sorex longirostris	Southeastern Shrew	0-5
Tamias striatus	Eastern Chipmunk	10-100
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys volans	Southern Flying Squirrel	0-50
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Didelphis virginiana	Virginia Opossum	0-5

D.19 D07 – GRADIENT – GRSM (Great Smoky Mountains National Park)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons, coyotes) disturbance
    - Due to the high density of bears in the Park, if **ONE** or more traps are disturbed, traps must be removed from the disturbed grid and any other grid within one mile. The sampling bout must be terminated prematurely for these grids; trapping can resume after a month.
    - If bears disturb the same grid twice, then trapping cannot recur for one year.
    - The Park and the Field Operations Manager shall be informed as soon as possible, and a problem ticket should be issued.
    - To reduce the probability of bear disturbance, every effort should be made to collect all seed for disposal off site.
- Do not intentionally collect vouchers at this site. It is not permitted by the Park.
- **Contingency plot guidelines**: Preferably trap the original 6 designated mammal plots each year. If one of those locations is closed to trapping due to repeated bear disturbance, in accordance with the Park rules, trap one of the 3 contingent mammal plots as a replacement, according to the assigned priority. That contingent plot will be either a bleed or diversity plot, depending on which plot is dropped. Contingent plots will be used as needed and can change grid type (bleed or diversity) from season to season.

Animal Care

- When performing maxio-facial bleeding of small mammals, it is important that the lancet be applied in alignment with the muscle fibers of the animal's jaw line to avoid undue trauma by severing muscles associated with mastication.
- A maximum 2-attempt rule to the facial bleeding of animals in the field should be observed.

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F
Dominant vegetation type(s) for bleed grid designation: Deciduous Forest
Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma spp., Peromyscus spp., Reithrodontomys humulis, Sigmodon hispidus
Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Discover Life in America - All Taxa Biodiversity Inventory 2008, and updated with NEON data from 2015 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 26. Site-specific species list (GRSM)

TARGET SPECIES (Scientific and Common Name)		**Number to be Used Annually**
Microtus chrotorrhinus	Rock Vole	0-20
Microtus ochrogaster	Prairie Vole	0-20
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus pinetorum	Woodland Vole	0-20
Myodes gapperi	Southern red-backed vole	0-20
Mus musculus	House mouse	0-20
Neotoma floridana	Eastern Woodrat	0-20
Neotoma magister	Allegheny Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-20
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus gossypinus	Cotton Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	20-200
Rattus norvegicus	Norway Rat	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	0-20
Synaptomys cooperi	Southern Bog Lemming	0-5
Napaeozapus insignis	Woodland Jumping Mouse	0-20
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	5-50
Cryptotis parva	North American Least Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-5
Sorex dispar	Long-tailed Shrew	0-5
Sorex fumeus	Smoky Shrew	0-20
Sorex hoyi	American Pygmy Shrew	0-5
Sorex longirostris	Southeastern Shrew	0-5
Sorex palustris	American Water Shrew	0-5

Tamias striatus	Eastern Chipmunk	5-50
Tamiasciurus hudsonicus	Red Squirrel	0 - 20
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Glaucomys volans	Southern Flying Squirrel	0-50
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.20 D07 – GRADIENT – MLBS (Mountain Lake Biological Station)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma spp., Peromyscus spp., Reithrodontomys humulis

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Kaminski et al. 2007. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 27. Site-specific species list (MLBS)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus pennsylvanicus	Meadow Vole	0-50
Microtus pinetorum	Woodland Vole	0-50
Mus musculus	House Mouse	0-50
Myodes gapperi	Southern Red-backed Vole	0-50
Napaeozapus insignis	Woodland Jumping Mouse	50-200
Neotoma floridana	Eastern Woodrat	0-20
Neotoma magister	Allegheny Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-50
Peromyscus leucopus	White-footed Deermouse	50-200
Peromyscus maniculatus	North American Deermouse	50-200
Reithrodontomys humulis	Eastern Harvest Mouse	50-200
Synaptomys cooperi	Southern Bog Lemming	0-50
Zapus hudsonius	Meadow Jumping Mouse	50-200

OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	50-200
Cryptotis parva	North American Least Shrew	0-50
Sorex cinereus	Cinereus Shrew	100-500
Sorex dispar	Long-tailed Shrew	0-50
Sorex fumeus	Smoky Shrew	50-200
Sorex hoyi	American Pygmy Shrew	0-50
Sorex longirostris	Southeastern Shrew	0-50
Sorex palustris	American Water Shrew	0-50
Tamias striatus	Eastern Chipmunk	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Condylura cristata	Star-nosed Mole	0-5
Glaucomys volans	Southern Flying Squirrel	0-20
Mephitis mephitis	Striped Skunk	0
Mustela frenata	Long-tailed Weasel	0-50
Mustela nivalis	Least Weasel	0-50
Neovison vison	American Mink	0-5
Ondatra zibethicus	Common Muskrat	0
Parascalops breweri	Hairy-tailed Mole	0-50
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Spilogale putorius	Eastern Spotted Skunk	0
Sylvilagus floridanus	Eastern Cottontail	0-5
Sylvilagus obscurus	Appalachian Cottontail	0-5

D.21 D08 – CORE – TALL (Talladega National Forest)

Trapping Issues

- Fire ants
  - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
  - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
  - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
  - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Neotoma floridana, Oryzomys palustris, Peromyscus spp., Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Adams et al. 2013 and data collected by NEON in 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 28. Site-specific species list (TALL)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus pinetorum	Woodland Vole	0-20
Neotoma floridana	Eastern Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-20
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus gossypinus	Cotton Deermouse	20-200
Peromyscus leucopus	White-footed Deermouse	20-200
Peromyscus polionotus	Oldfield Deermouse	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-20
Blarina carolinensis	Southern Short-tailed Shrew	10-100
Cryptotis parva	North American Least Shrew	0-5

Sorex longirostris	Southeastern Shrew	0-5
Tamias striatus	Eastern Chipmunk	0-20
Mus musculus	House mouse	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed Weasel	0-5
Geomys pinetis	Southeastern Pocket Gopher	0-5
Neovison vison	American Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus aquaticus	Swamp Rabbit	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.22 D08 – GRADIENT– DELA (Dead Lake)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Woody Wetlands

Priority species for pathogen testing: Neotoma floridana, Oryzomys palustris, Peromyscus spp., Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Adams et al. 2013 and data collected by NEON in 2015 and 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 29. Site-specific species list (DELA)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus pinetorum	Woodland Vole	0-20
Neotoma floridana	Eastern Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	50-200
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus gossypinus	Cotton Deermouse	10-200
Peromyscus leucopus	White-footed Deermouse	0-20
Peromyscus polionotus	Oldfield Deermouse	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina carolinensis	Southern Short-tailed Shrew	0-5
Cryptotis parva	North American Least Shrew	0-5
Sorex longirostris	Southeastern Shrew	0-5

Tamias striatus	Eastern Chipmunk	50-200
Mus musculus	house mouse	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed Weasel	0-5
Geomys pinetis	Southeastern Pocket Gopher	0-5
Neovison vison	American Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus aquaticus	Swamp Rabbit	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.23 D08 – GRADIENT – LENO (Lenoir Landing)

Trapping Issues

- Fire ants
    - If fire ant activity is present in the immediate vicinity of a trapping station, be sure to dust the ground under and around the trap with Talstar granules.
    - Traps can also be set closer to sunset and checked earlier (before sunrise), to minimize traps being open when ants are most active.
    - If a grid-point is heavily infested with fire ants do not set that trap the following evening.
    - Fire ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.
- Large (i.e., bear) and medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Woody Wetlands

Priority species for pathogen testing: Neotoma floridana, Oryzomys palustris, Peromyscus spp., Reithrodontomys humulis, Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Adams et al. 2013 and data collected by NEON in 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 30. Site-specific species list (LENO)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus pinetorum	Woodland Vole	0-20
Neotoma floridana	Eastern Woodrat	0-20
Ochrotomys nuttalli	Golden Mouse	0-20
Oryzomys palustris	Marsh Oryzomys	0-20
Peromyscus gossypinus	Cotton Deermouse	20-200
Peromyscus leucopus	White-footed Deermouse	0-100
Peromyscus polionotus	Oldfield Deermouse	0-20
Reithrodontomys humulis	Eastern Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina carolinensis	Southern Short-tailed Shrew	0-5
Cryptotis parva	North American Least Shrew	0-5

Sorex longirostris	Southeastern Shrew	0-5
Tamias striatus	Eastern Chipmunk	0-20
Mus musculus	house mouse	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys volans	Southern Flying Squirrel	0-5
Mustela frenata	Long-tailed Weasel	0-5
Geomys pinetis	Southeastern Pocket Gopher	0-5
Neovison vison	American Mink	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus aquaticus	Swamp Rabbit	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.24 D09 – CORE – WOOD (Woodworth Field Station)

Trapping Issues

- Medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Peromyscus spp., Reithrodontomys megalotis

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Wiewel et al. 2007 and data collected by NEON in 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 31. Site-specific species list (WOOD)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus ochrogaster	Prairie Vole	0-20
Microtus pennsylvanicus	Meadow Vole	100-1000
Myodes gapperi	Southern Red-backed Vole	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Perognathus fasciatus	Olive-backed Pocket Mouse	0-20
Perognathus flavescens	Plains Pocket Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	0-20
Peromyscus maniculatus	North American Deermouse	50-200
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Zapus hudsonius	Meadow Jumping Mouse	5-50
Zapus princeps	Western Jumping Mouse	50-200
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-200
Sorex arcticus	Arctic Shrew	0-5
Sorex cinereus	Cinereus Shrew	5-50
Spermophilus franklinii	Franklin's Ground Squirrel	0-20
Spermophilus richardsonii	Richardson's Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	10-100
Sorex haydeni	Prairie Shrew	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5

Tamias striatus	Eastern Chipmunk	0-5
Rattus norvegicus	Norway rat	0-5
Mus musculus	House mouse	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5
Mustela vison	Mink	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Thomomys talpoides	Northern Pocket Gopher	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Mustela erminea	Ermine	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5

D.25 D09 – GRADIENT – DCFS (Dakota Coteau Field School)

Trapping Issues

- Medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Peromyscus spp., Reithrodontomys megalotis

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Snyder and Best 1988. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 32. Site-specific species list (DCFS)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus ochrogaster	Prairie Vole	0-20
Microtus pennsylvanicus	Meadow Vole	400-1000
Mus musculus	House Mouse	0-50
Myodes gapperi	Southern Red-backed Vole	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Perognathus fasciatus	Olive-backed Pocket Mouse	0-50
Perognathus flavescens	Plains Pocket Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	0-50
Peromyscus maniculatus	North American Deermouse	50-200
Rattus norvegicus	Norway Rat	0-5
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Zapus hudsonius	Meadow Jumping Mouse	50-200
Zapus princeps	Western Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-50
Sorex arcticus	Arctic Shrew	0-5
Sorex cinereus	Cinereus Shrew	50-200
Sorex haydeni	Prairie Shrew	0-5
Spermophilus franklinii	Franklin's Ground Squirrel	0-5
Spermophilus richardsonii	Richardson's Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5

Tamias striatus	Eastern Chipmunk	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5
Mustela vison	Mink	0-5
Ondatra zibethicus	Common Muskrat	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Thomomys talpoides	Northern Pocket Gopher	0-5

D.26 D09 – GRADIENT – NOGP (Northern Great Plains Research Laboratory)

Trapping Issues

- Medium sized carnivore (e.g., raccoons) disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Peromyscus spp., Reithrodontomys megalotis

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Snyder and Best 1988, and updated with NEON data from 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 33. Site-specific species list (NOGP)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus ochrogaster	Prairie Vole	0-20
Microtus pennsylvanicus	Meadow Vole	20-200
Mus musculus	House Mouse	0-50
Myodes gapperi	Southern Red-backed Vole	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	0-20
Perognathus fasciatus	Olive-backed Pocket Mouse	0-50
Perognathus flavescens	Plains Pocket Mouse	0-20
Peromyscus leucopus	White-footed Deermouse	0-50
Peromyscus maniculatus	North American Deermouse	50-300
Rattus norvegicus	Norway Rat	0-5
Reithrodontomys megalotis	Western Harvest Mouse	5-50
Zapus hudsonius	Meadow Jumping Mouse	0-20
Zapus princeps	Western Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Blarina brevicauda	Northern Short-tailed Shrew	0-50
Sorex arcticus	Arctic Shrew	0-5
Sorex cinereus	Cinereus Shrew	0-20
Sorex haydeni	Prairie Shrew	0-5
Spermophilus franklinii	Franklin's Ground Squirrel	0-5
Spermophilus richardsonii	Richardson's Ground Squirrel	0-5

Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	5-50
Tamias striatus	Eastern Chipmunk	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela nivalis	Least Weasel	0-5
Mustela vison	Mink	0-5
Ondatra zibethicus	Common Muskrat	0-5
Sciurus carolinensis	Eastern Gray Squirrel	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Thomomys talpoides	Northern Pocket Gopher	0-5

D.27 D10 – CORE – CPER (Central Plains Experimental Range)

Trapping Issues

- Kangaroo rats require larger traps (12" long rather than 9"), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- Cattle disturbance
- Harvest ant activity can also be mitigated by use of 100% sunflower seeds as bait to avoid spillage of millet that attracts ants to the site.

Use of bedding: NOT recommended under any circumstances.

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Microtus spp., Neotoma cinerea, Peromyscus sp., Reithrodontomys spp.

Species List and Abundance Estimates

This species list is based on the Shortgrass Steppe LTER website (http://www.sgslter.colostate.edu/species_download.aspx?type=Mammals, accessed 2012). Abundance estimates were based on an average capture rate of 10%, and the species-specific abundances reported in Evangelista et al., 2008 and data collected by NEON in 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 34. Site-specific species list (CPER)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	0 - 100
Chaetodipus intermedius	Rock Pocket Mouse	0 - 20
Dipodomys ordii	Ord's Kangaroo Rat	0 - 100
Microtus longicaudus	Long-tailed Vole	0 - 50
Microtus ochrogaster	Prairie Vole	0-100
Microtus pennsylvanicus	Meadow Vole	0 - 50
Neotoma cinerea	Bushy-tailed Woodrat	0 - 50
Onychomys leucogaster	Northern Grasshopper Mouse	5 - 50
Perognathus fasciatus	Olive-backed Pocket Mouse	0 - 20
Perognathus flavescens	Plains Pocket Mouse	0 - 50
Perognathus flavus	Silky Pocket Mouse	5 - 100
Peromyscus maniculatus	N. American Deer Mouse	5 - 100
Reithrodontomys megalotis	Western Harvest Mouse	50 - 300
Reithrodontomys montanus	Plains Harvest Mouse	50 - 300
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		

Cryptotis parva	North American Least Shrew	0 - 20
Spermophilus spilosoma	Spotted Ground Squirrel	0 - 20
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0 - 20
NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0 - 20
Mustela frenata	Long-tailed Weasel	0 -5
Sylvilagus floridanus	Eastern cottontail	0-5

D.28 D10 – GRADIENT – STER (Sterling)

Trapping Issues

- Coyote disturbance

Use of bedding: Recommended only when low temperatures are expected to be <18°C/65°F; depends on the relative abundance (RA) of heteromyid species – stop use if RA of heteromyids exceeds 50%

Dominant vegetation type(s) for bleed grid designation: Cultivated Crops

Priority species for pathogen testing: Microtus spp., Neotoma cinerea, Peromyscus sp., Reithrodontomys spp.

Species List and Abundance Estimates

This species list is based on the North Sterling State Park website (http://www.parks.state.co.us/parks/northsterling/Pages/NorthSterling.aspx, accessed 2012). Abundance estimates were based on an average capture rate of 10%, and relative abundances in data collected by NEON from 2014 through 2016**.** Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 35. Site-specific species list (STER)

TARGET species (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	20 - 200
Dipodomys ordii	Ord's Kangaroo Rat	0 - 50
Microtus ochrogaster	Prairie Vole	0 - 50
Microtus pennsylvanicus	Meadow Vole	0 - 50
Neotoma cinerea	Bushy-tailed Woodrat	0 - 5
Onychomys leucogaster	Northern Grasshopper Mouse	50 - 500
Perognathus flavescens	Plains Pocket Mouse	0 - 50
Perognathus flavus	Silky Pocket Mouse	0 - 50
Peromyscus maniculatus	Deer Mouse	50 - 500
Reithrodontomys megalotis	Western Harvest Mouse	0 - 50
Reithrodontomys montanus	Plains Harvest Mouse	0 - 50
Mus musculus	House Mouse	0 - 5
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Cryptotis parva	Least Shrew	0 - 20
Sorex cinereus	Masked Shrew	0 - 20
Spermophilus spilosoma	Spotted Ground Squirrel	0 - 20
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	5 - 50

NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0 – 20
Mustela frenata	Long-tailed Weasel	0 - 5

D.29 D10 – GRADIENT – RMNP (Rocky Mountain National Park)

Trapping Issues

- Cold temperatures, wind, and snow
- Bear and elk disturbance

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: TBD

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma spp., Peromyscus spp.

Species List and Abundance Estimates

This species list is based on Armstrong, 2008, as well as the NEON 2012 capture data. The abundance estimates were based on an average capture rate of 10%, with declining returns of unique individuals over the consecutive nights of a sampling bout, as well as the species-specific relative abundances reported in Maher, 2010, and data collected by NEON in 2017**.** Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 36. Site-specific species list (RMNP)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Red-backed vole	50 - 200
Lemmiscus curtatus	Sagebrush Vole	20 - 100
Microtus longicaudus	Long-tailed Vole	20 - 100
Microtus montanus	Montane Vole	20 - 100
Neotoma cinerea	Bushy-tailed Woodrat	0 - 50
Neotoma mexicana	Mexican Woodrat	0 - 5
Peromyscus maniculatus	N. American Deermouse	200 - 2000
Peromyscus nasutus	Northern Rock Deermouse	0 - 50
Zapus princeps	Western Jumping Mouse	5 – 100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0 - 25
Sorex hoyi	American Pygmy Shrew	0 - 25
Sorex merriami	Merriam's Shrew	0 - 25
Sorex monticolus	Dusky Shrew	0 - 50
Sorex nanus	Dwarf Shrew	0 - 25
Sorex palustris	American Water Shrew	0 – 10
Spermophilus elegans	Wyoming Ground Squirrel	0 - 50
Callospermophilus lateralis	Golden-mantled Ground Squirrel	5 - 50
Tamias minimus	Least Chipmunk	10 - 500
Tamias quadrivittatus	Colorado Chipmunk	0 - 20
Tamias umbrinus	Uinta Chipmunk	5 - 20
Tamiasciurus hudsonicus	Red Squirrel	5 - 50

NON-TARGET ANIMALS (Scientific and Common Name)		
Thomomys talpoides	Northern Pocket Gopher	0 - 50
Spermophilus variegatus	Rock Squirrel	0 - 10

D.30 D11 – CORE – CLBJ (Caddo/LBJ National Grassland)

Trapping Issues

- Medium sized carnivore (e.g., raccoons, coyotes) disturbance.

Use of bedding: Pending capture rates of heteromyids; Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest/ Grassland/ Herbaceous

Priority species for pathogen testing: Neotoma micropus, Peromyscus sp., Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Vaughn et al. 1993, updated based on NEON data in 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 37. Site-specific species list (CLBJ)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Baiomys taylori	Northern Pygmy Mouse	0-20
Chaetodipus hispidus	Hispid Pocket Mouse	0-50
Dipodomys ordii	Ord's Kangaroo Rat	0-50
Microtus pinetorum	Woodland Vole	0-20
Neotoma micropus	Southern Plains Woodrat	20-100
Onychomys leucogaster	Northern Grasshopper Mouse	0-5
Perognathus flavescens	Plains Pocket Mouse	0-50
Perognathus flavus	Silky Pocket Mouse	0-20
Peromyscus attwateri	Texas Deermouse	0-50
Peromyscus leucopus	White-footed Deermouse	50-300
Peromyscus maniculatus	North American Deermouse	50-300
Reithrodontomys fulvescens	Fulvous Harvest Mouse	0-20
Reithrodontomys montanus	Plains Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	50-300
Neotoma floridana	Eastern Wood Rat	20-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Cryptotis parva	North American Least Shrew	0-50
Notiosorex crawfordi	Crawford's Gray Shrew	0-20
Spermophilus spilosoma	Spotted Ground Squirrel	0-5

Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0-5
Mustela frenata	Long-tailed Weasel	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.31 D11 – GRADIENT – OAES (Klemme Range Research Station)

Trapping Issues

- Medium sized carnivore (e.g., raccoons, coyotes) disturbance

Use of bedding: If capture rates of heteromyids exceed 35% of all capture, do not use; Recommended only when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/Herbaceous

Priority species for pathogen testing: Neotoma micropus, Peromyscus sp., Reithrodontomys spp., Sigmodon hispidus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Leis et al. 2008 and data collected by NEON in 2015 and 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 38. Site-specific species list (OAES)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus hispidus	Hispid Pocket Mouse	20-200
Dipodomys ordii	Ord's Kangaroo Rat	0-20
Microtus ochrogaster	Prairie Vole	0-50
Neotoma micropus	Southern Plains Woodrat	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	20-200
Perognathus flavescens	Plains Pocket Mouse	0-20
Perognathus flavus	Silky Pocket Mouse	0-20
Peromyscus attwateri	Texas Deermouse	0-20
Peromyscus leucopus	White-footed Deermouse	20-200
Peromyscus maniculatus	North American Deermouse	20-200
Reithrodontomys fulvescens	Fulvous Harvest Mouse	0-20
Reithrodontomys montanus	Plains Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	50-500
Neotoma floridana	Eastern Wood Rat	20-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Cryptotis parva	North American Least Shrew	0-5
Spermophilus spilosoma	Spotted Ground Squirrel	0-5
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	0-5
Tamias striatus	Eastern Chipmunk	0-5

NON-TARGET ANIMALS (Scientific and Common Name)		
Geomys bursarius	Plains Pocket Gopher	0-5
Mustela frenata	Long-tailed Weasel	0-5
Scalopus aquaticus	Eastern Mole	0-5
Sciurus niger	Eastern Fox Squirrel	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus floridanus	Eastern Cottontail	0-5

D.32 D12 – CORE – YELL (Yellowstone National Park)

Site-specific protocol modifications: Bleeding of small mammals is not permitted within the Park. As Hantavirus has been detected in small mammals in the Park, the use of a respirator by NEON personnel handling small mammals is required. Finally, all traps, regardless of whether an animal is suspected to have visited the trap, are required to be cleaned prior to use of traps at a different plot within the Park.

Trapping Issues

- Cold temperatures, wind, and snow
- Bear, wolf, and elk disturbance
- Due to the shortness of the warm weather season at this high-elevation core site, it is expected that trapping will only occur for four, rather than six, bouts per year.

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Shrub Scrub

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma cinerea, Peromyscus sp.

Species List and Abundance Estimates

This species list is based on Armstrong et al., 2001. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by National Park Service 2006. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 39. Site-specific species list (YELL)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus longicaudus	Long-tailed Vole	50-200
Microtus montanus	Montane Vole	400-1,000
Microtus pennsylvanicus	Meadow Vole	400-1,000
Microtus richardsoni	Richardson Water Vole	0-20
Mus musculus	House Mouse	0-20
Myodes gapperi	Southern Red-backed Vole	400-1,000
Neotoma cinerea	Bushy-tailed Woodrat	50-200
Peromyscus maniculatus	North American Deermouse	400-1,000
Phenacomys intermedius	Western Heather Vole	0-20
Zapus princeps	Western Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0-20
Sorex monticolus	Dusky Shrew	0-20
Sorex nanus	Rocky Mountain Dwarf Shrew	0-20
Sorex palustris	American Water Shrew	0-20
Sorex preblei	Preble's Shrew	0-20
Spermophilus armatus	Uinta Ground Squirrel	0-5
Callospermophilus lateralis	Golden-mantled Ground Squirrel	0-5

Tamias amoenus	Yellow Pine Chipmunk	0-20
Tamias minimus	Least Chipmunk	0-20
Tamias umbrinus	Uinta Chipmunk	0-20
Tamiasciurus hudsonicus	Red Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-20
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Mustela vison	American Mink	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Thomomys talpoides	Northern Pocket Gopher	0-5

D.33 D13 – CORE – NIWO (Niwot Ridge Mountain Research Station)

Trapping Issues

- Cold temperatures, wind, and snow
    - Do not trap when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- Bear and elk disturbance
- Due to the shortness of the warm weather season at this high-elevation core site, it is expected that trapping will only occur for four, rather than six, bouts per year.
- Place an 'N' in front of the 4-digit ear tag code to distinguish it from barcodes used at MOAB due to the potential for duplicate tags between NIWO (ordered from D10/13 office) and MOAB (ordered from D15 office)

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest/ Grassland/ Herbaceous

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma cinerea, Peromyscus sp.

Species List and Abundance Estimates

This species list is based on Armstrong et al., 2001. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Halfpenny 2010, and updated based on NEON data from 2015 and 2016**.** Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 40. Site-specific species list (NIWO)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Myodes gapperi	Red-backed vole	20 - 200
Phenacomys intermedius	Heather Vole	0 - 20
Microtus longicaudus	Long-tailed Vole	0 - 20
Microtus montanus	Montane Vole	0 - 20
Neotoma cinerea	Bushy-tailed Woodrat	0 - 50
Peromyscus maniculatus	N. American Deermouse	50 - 500
Zapus princeps	Western Jumping Mouse	0 – 20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0 - 5
Sorex monticolus	Montane Shrew	0 – 5
Sorex nanus	Dwarf Shrew	0 - 5
Callospermophilus lateralis	Golden-mantled Ground Squirrel	0 - 20
Tamias minimus	Least Chipmunk	5-50

NON-TARGET ANIMALS (Scientific and Common Name)		
Thomomys talpoides	Northern Pocket Gopher	0 - 10
Mustela ermine	Short-tailed weasel	0-5
Mustela frenata	Long-tailed weasel	0-5
Ochotona princeps	American Pika	0-5

D.34 D13 – GRADIENT – MOAB (Moab)

Trapping Issues

- Kangaroo rats require larger traps (12" long rather than 9"), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- Place an 'M' in front of the 4-digit ear tag code to distinguish it from barcodes used at NIWO due to the potential for duplicate tags between NIWO (ordered from D10/13 office) and MOAB (ordered from D15 office)

Use of bedding: NOT recommended under any circumstances.

Target vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus spp., Reithrodontomys sp.

Species List and Abundance Estimates:

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Clevenger 1977 and Sureda and Morrison 1998. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 41. Site-specific species list (MOAB)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Dipodomys ordii	Ord's Kangaroo Rat	20-200
Microtus longicaudus	Long-tailed Vole	0-20
Microtus montanus	Montane Vole	0-50
Neotoma albigula	White-throated Woodrat	0-20
Neotoma cinerea	Bushy-tailed Woodrat	0-20
Neotoma lepida	Desert Woodrat	0-20
Neotoma mexicana	Mexican Woodrat	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	10-100
Perognathus fasciatus	Olive-backed Pocket Mouse	0-20
Perognathus flavescens	Plains Pocket Mouse	0-20
Perognathus parvus	Great Basin Pocket Mouse	0-20
Peromyscus boylii	Brush Deermouse	0-20
Peromyscus crinitus	Canyon Deermouse	0-20
Peromyscus maniculatus	North American Deermouse	5-300

Peromyscus truei	Pinon Deermouse	3-300
Reithrodontomys megalotis	Western Harvest Mouse	0-20
Zapus princeps	Western Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Notiosorex crawfordi	Crawford's Gray Shrew	0-5
Sorex merriami	Merriam's Shrew	0-5
Sorex monticolus	Dusky Shrew	0-5
Sorex nanus	Dwarf Shrew	0-5
Ammospermophilus leucurus	White-tailed Antelope Squirrel	0-5
Callospermophilus lateralis	Golden-mantled Ground Squirrel	0-5
Spermophilus spilosoma	Spotted Ground Squirrel	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
Tamias minimus	Least Chipmunk	0-5
Tamias quadrivittatus	Colorado Chipmunk	0-5
Tamias rufus	Hopi Chipmunk	0-20
NON-TARGET ANIMALS (Scientific and Common Name)		
Spermophilus variegatus	Rock Squirrel	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Thomomys bottae	Botta's Pocket Gopher	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5

D.35 D14 – CORE – SRER (Santa Rita Experimental Range)

Trapping Issues

- Kangaroo rats require larger traps (12” long rather than 9”), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- Due to extremely high capture rates at this site, only 49 traps are set each plot-night instead of 100 (e.g., a 7-by-7 grid).

Use of bedding: NOT recommended under any circumstances.

Dominant vegetation type(s) for bleed grid designation: Shrub Scrub

Priority species for pathogen testing: Neotoma spp., Peromyscus spp., Reithrodontomys spp., Sigmodon spp.

Species List and Abundance Estimates

This species list is based on Martin and Reynolds 1973 and Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Reynolds 1950, Price 1978, and Bock and Bock 1978, and from data collected by NEON in 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 42. Site-specific species list (SRER)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Baiomys taylori	Northern Pygmy Mouse	0-20
Chaetodipus baileyi	Bailey's Pocket Mouse	50-200
Chaetodipus hispidus	Hispid Pocket Mouse	0-20
Chaetodipus intermedius	Rock Pocket Mouse	0-50
Chaetodipus penicillatus	Desert Pocket Mouse	100-500
Dipodomys merriami	Merriam's Kangaroo Rat	100-500
Dipodomys ordii	Ord's Kangaroo Rat	20-100
Dipodomys spectabilis	Banner-tailed Kangaroo Rat	0-50
Neotoma albigula	White-throated Woodrat	20-200
Neotoma mexicana	Mexican Woodrat	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	0-50
Onychomys torridus	Southern Grasshopper Mouse	20-200
Perognathus amplus	Arizona Pocket Mouse	0-20
Perognathus flavus	Silky Pocket Mouse	0-20
Peromyscus boylii	Brush Deermouse	0-20

Peromyscus eremicus	Cactus Deermouse	5-100
Peromyscus leucopus	White-footed Deermouse	0-20
Peromyscus maniculatus	North American Deermouse	0-20
Peromyscus truei	Pinon Deermouse	0-50
Reithrodontomys megalotis	Western Harvest Mouse	0-20
Peromyscus merriami	Merriam's Deermouse	0-20
Reithrodontomys fulvescens	Fulvous Harvest Mouse	5-50
Reithrodontomys megalotis	Western Harvest Mouse	0-20
Reithrodontomys montanus	Plains Harvest Mouse	0-20
Sigmodon arizonae	Arizona Cotton Rat	0-20
Sigmodon fulviventer	Tawny-bellied Cotton Rat	0-20
Sigmodon ochrognathus	Yellow-nosed Cotton Rat	20-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Notiosorex crawfordi	Crawford's Gray Shrew	0-5
Sorex arizonae	Arizona Shrew	0-5
Sorex monticolus	Dusky Shrew	0-5
Ammospermophilus harrisii	Harris's Antelope Squirrel	0-20
Spermophilus tereticaudus	Round-tailed Ground Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Sylvilagus audubonii	Desert Cottontail	0-5
Thomomys bottae	Botta's Pocket Gopher	0-5
Thomomys umbrinus	Southern Pocket Gopher	0-5

D.36 D14 – GRADIENT – JORN (Jornada Experimental Range)

Trapping Issues

- Kangaroo rats require larger traps (12” long rather than 9”), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: NOT recommended under any circumstances.

Dominant vegetation type(s) for bleed grid designation: Shrub scrub

Priority species for pathogen testing: Neotoma spp., Peromyscus spp.

Species List and Abundance Estimates

Data sets were provided by the Jornada Basin Long-Term Ecological Research (LTER) project. Funding for these data was provided by the U.S. National Science Foundation (Grant DEB-1235828). The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Bestelmeyer and Lightfoot (http://jornada-www.nmsu.edu/studies/lter/projects/smlmamex.prj, accessed 5 March 2015) and data collected by NEON in 2015 and 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 43. Site-specific species list (JORN)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus intermedius	Rock pocket mouse	0-20
Chaetodipus penicillatus	Desert pocket mouse	100-600
Dipodomys merriami	Merriam's kangaroo rat	100-500
Dipodomys ordii	Ord's kangaroo rat	50-200
Dipodomys spectabilis	Banner-tailed kangaroo rat	0-100
Mus musculus	House mouse	0-5
Neotoma albigula	White-throated woodrat	0-50
Neotoma micropus	Southern plains woodrat	0-20
Onychomys arenicola	Mearns' grasshopper mouse	5-200
Onychomys leucogaster	Northern grasshopper mouse	5-200
Perognathus fasciatus	Olive-backed Pocket Mouse	0-20
Perognathus flavus	Silky pocket mouse	5-200
Peromyscus boylii	Brush mouse	0-20
Peromyscus eremicus	Cactus mouse	0-20
Peromyscus leucopus	White-footed mouse	0-50
Peromyscus maniculatus	Deer mouse	0-20

Reithrodontomys megalotis	Western Harvest Mouse	0-20
Sigmodon hispidus	Hispid Cotton Rat	0 - 50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Notiosorex crawfordi	Desert shrew	0-5
Spermophilus spilosoma	Spotted ground squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Lepus californicus	Black-tailed jackrabbit	0-5
Sylvilagus audubonii	Desert cottontail	0-5
Thomomys bottae	Botta's pocket gopher	0-5
Spermophilus variegatus	Rock squirrel	0-5

D.37 D15 – CORE – ONAQ (Onaqui-Ault)

Trapping Issues

- Kangaroo rats require larger traps (12” long rather than 9”), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- Capture rates at all grids tend to be high (> 25 captures per grid). Technicians should use the prioritization scheme outlined in C.4, but do not need to issue a problem ticket when all data cannot be collected (since it is expected that this will occur during most bouts).

Use of bedding: Not recommended, as the relative abundance of heteromyids at the site is ~50%

Dominant vegetation type(s) for bleed grid designation: Shrub scrub

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus spp., Reithrodontomys spp.

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Baker and Frischknecht 1973 and Smith and Urness 1984 and data collected by NEON in 2014 through 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 44. Site-specific species list (ONAQ)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus formosus	Long-tailed Pocket Mouse	0-20
Dipodomys microps	Chisel-toothed Kangaroo Rat	5-200
Dipodomys ordii	Ord's Kangaroo Rat	20-300
Dipodomys spectabilis	Banner-tailed kangaroo rat	0-20
Lemmiscus curtatus	Sagebrush Vole	0-20
Microdipodops megacephalus	Dark Kangaroo Mouse	0-20
Microtus longicaudus	Long-tailed Vole	0-20
Microtus montanus	Montane Vole	0-20
Microtus pennsylvanicus	Meadow Vole	0-20
Neotoma cinerea	Bushy-tailed Woodrat	0-20
Neotoma lepida	Desert Woodrat	0-20
Onychomys leucogaster	Northern Grasshopper Mouse	0-50
Perognathus parvus	Great Basin Pocket Mouse	100-500
Peromyscus boylii	Brush Deermouse	0-20

Peromyscus crinitus	Canyon Deermouse	0-20
Peromyscus maniculatus	North American Deermouse	100-500
Peromyscus truei	Pinon Deermouse	0-50
Reithrodontomys megalotis	Western Harvest Mouse	5-100
Zapus princeps	Western Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0-5
Sorex palustris	American Water Shrew	0-5
Sorex vagrans	Vagrant Shrew	0-5
Sorex merriami	Merriam's Shrew	0-5
Ammospermophilus leucurus	White-tailed Antelope Squirrel	0-5
Tamiasciurus hudsonicus	Red Squirrel	0-5
Tamias alpinus	Alpine Chipmunk	0-5
Tamias dorsalis	Cliff Chipmunk	0-20
Tamias minimus	Least Chipmunk	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Spermophilus variegatus	Rock Squirrel	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus nuttallii	Mountain Cottontail	0-5
Brachylagus idahoensis	Pygmy Rabbit	0-5

D.38 D16 – CORE – WREF (Wind River Experimental Forest)

Trapping Issues

- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Microtus spp., Myodes gapperi, Neotoma cinerea, Peromyscus sp., Reithrodontomys sp.

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Carey and Wilson 2001. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 45. Site-specific species list (WREF)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus longicaudus	Long-tailed Vole	0-20
Microtus oregoni	Creeping Vole	0-50
Microtus richardsoni	North American Water Vole	0-20
Microtus townsendii	Townsend's Vole	0-20
Myodes gapperi	Southern Red-backed Vole	50-200
Neotoma cinerea	Bushy-tailed Woodrat	0-20
Peromyscus keeni	Forest Deer Mouse	0-20
Peromyscus maniculatus bairdii	North American Deermouse	0-50
Phenacomys intermedius	Heather Vole	0-20
Reithrodontomys megalotis	Western Harvest Mouse	0-20
Zapus trinotatus	Pacific Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Neurotrichus gibbsii	Shrew-mole	0-50
Scapanus orarius	Coast Mole	0-50
Sorex bairdi	Baird's Shrew	0-20
Sorex bendirii	Marsh Shrew	0-50
Sorex cinereus	Cinereus Shrew	0-20
Sorex monticolus	Dusky Shrew	50-200
Sorex palustris punctulatus	American Water Shrew	0-20
Sorex trowbridgii	Trowbridge's Shrew	100-500

Sorex vagrans	Vagrant Shrew	50-200
Spermophilus saturatus	Cascade Golden-mantled Ground Squirrel	0-5
Tamias amoenus	Yellow-pine Chipmunk	0-5
Tamias townsendii	Townsend's Chipmunk	0-5
Tamiasciurus douglasii	Douglas's Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	American Mink	0-5
Thomomys talpoides	Northern Pocket Gopher	0-5

D.39 D16 – GRADIENT – ABBY (Abby Road)

Trapping Issues

- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: *Microtus spp., Myodes gapperi, Neotoma cinerea, Peromyscus sp., Reithrodontomys sp.*

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Bury and Corn 1987 and data collected by NEON in 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 46. Site-specific species list (ABBY)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Microtus longicaudus	Long-tailed Vole	0-20
Microtus oregoni	Creeping Vole	0-50
Microtus richardsoni	North American Water Vole	0-20
Microtus townsendii	Townsend's Vole	0-20
Myodes gapperi	Southern Red-backed Vole	0-50
Neotoma cinerea	Bushy-tailed Woodrat	0-20
Peromyscus keeni	Northwestern Deermouse	0-50
Peromyscus maniculatus	North American Deermouse	50-500
Phenacomys intermedius	Western Heather Vole	0-50
Zapus trinotatus	Pacific Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Neurotrichus gibbsii	Shrew-mole	0-50
Sorex bairdi	Baird's Shrew	0-20
Sorex bendirii	Marsh Shrew	0-50
Sorex cinereus	Cinereus Shrew	0-20
Sorex monticolus	Dusky Shrew	0-20
Sorex palustris	American Water Shrew	0-20
Sorex trowbridgii	Trowbridge's Shrew	0-20
Sorex vagrans	Vagrant Shrew	0-20

Tamias amoenus	Yellow-pine Chipmunk	0-5
Tamias townsendii	Townsend's Chipmunk	0-5
Tamiasciurus douglasii	Douglas's Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Mustela erminea	Ermine	0-5
Mustela frenata	Long-tailed Weasel	0-5
Neovison vison	American Mink	0-5
Scapanus orarius	Coast Mole	0-50
Scapanus townsendii	Townsend's Mole	0-20

D.40 D17 – CORE – SJER (San Joaquin Experimental Range)

Trapping Issues

- Kangaroo rats require larger traps (12” long rather than 9”), to minimize trap-related injuries to their long tails.
- Coyote disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

***Use of bedding*:** Not recommended

Dominant vegetation type(s) for bleed grid designation: Grassland/ Herbaceous

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus spp., Reithrodontomys sp.

Species List and Abundance Estimates:

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Purcell et al. 2007. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 47. Site-specific species list (SJER)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus californicus	California pocket mouse	50-200
Dipodomys heermanni	Heermann's Kangaroo Rat	0-50
Microtus californicus	California Vole	0-20
Microtus longicaudus	Long-tailed Vole	50-200
Microtus montanus	Montane Vole	50-200
Mus musculus	house mouse	0-20
Neotoma cinerea	Bushy-tailed Woodrat	0-20
Neotoma fuscipes	Dusky-footed Woodrat	0-50
Neotoma macrotis	big-eared woodrat	0-20
Onychomys torridus	Southern Grasshopper Mouse	0-50
Perognathus inornatus	San Joaquin pocket mouse	0-50
Peromyscus boylii	brush deermouse	100-500
Peromyscus californicus	California Deermouse	0-20
Peromyscus maniculatus	North American Deermouse	100-500
Peromyscus truei	Pinon Deermouse	100-500
Reithrodontomys megalotis	Western Harvest Mouse	50-200
Zapus princeps	Western Jumping Mouse	0-20

OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Scapanus latimanus	Broad-footed Mole	0-5
Sorex lyelli	Mt. Lyell Shrew	0-5
Sorex ornatus	Ornate Shrew	0-5
Sorex palustris	American Water Shrew	0-5
Spermophilus beecheyi	California Ground Squirrel	0-5
Callospermophilus lateralis	Golden-mantled Ground Squirrel	0-5
Tamias merriami	Merriam's chipmunk	0-5
Tamiasciurus douglasii	Douglas's Squirrel	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-5
Mustela frenata	Long-tailed Weasel	0-5
Sciurus griseus	Western Gray Squirrel	0-5
Sylvilagus audubonii	Desert Cottontail	0-5
Sylvilagus bachmani	Brush Rabbit	0-5
Thomomys bottae	Botta's Pocket Gopher	0-5

D.41 D17 – GRADIENT – SOAP (Soaproot Saddle)

Trapping Issues

- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus spp., Reithrodontomys sp.

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Roberts et al. 2015. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 48. Site-specific species list (SOAP)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus californicus	California pocket mouse	0-50
Microtus californicus	California Vole	0-20
Microtus longicaudus	Long-tailed Vole	0-20
Microtus montanus	Montane Vole	0-20
Onychomys torridus	Southern Grasshopper Mouse	0-50
Neotoma macrotis	Large-eared woodrat	0-50
Peromyscus boylii	Brush Deermouse	10-100
Peromyscus californicus	California Deermouse	0-50
Peromyscus maniculatus	North American Deermouse	400-1,000
Peromyscus truei	Pinon Deermouse	0-50
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Zapus princeps	Western Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Callospermophilus lateralis	Golden-mantled ground squirrel	0 - 50
Otospermophilus beecheyi	California ground squirrel	0 - 50
Sorex lyelli	Mt. Lyell Shrew	0-20
Sorex ornatus	Ornate Shrew	0-20
Sorex palustris	American Water Shrew	0-20
Sorex trowbridgii	Trowbridge's Shrew	0-20
Sorex vagrans	Vagrant Shrew	0-20

Tamias quadrimaculatus	Long-eared chipmunk	50 - 200
Tamias speciosus	Lodgepole chipmunk	0 - 50
Tamiasciurus douglasii	Douglas squirrel	0 - 50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern flying squirrel	0 - 50
Scapanus latimanus	Broad-footed Mole	0 - 50
Sciurus griseus	Western gray squirrel	0 - 50
Thomomys monticola	Montane pocket gopher	0 - 50

D.42 D17 – GRADIENT – TEAK (Teakettle Experimental Forest)

Trapping Issues

- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Microtus spp., Neotoma spp., Peromyscus spp., Reithrodontomys sp.

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Roberts et al. 2015. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 49. Site-specific species list (TEAK)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Chaetodipus californicus	California pocket mouse	0-50
Microtus californicus	California Vole	0-20
Microtus longicaudus	Long-tailed Vole	0-20
Microtus montanus	Montane Vole	0-20
Onychomys torridus	Southern Grasshopper Mouse	0-50
Neotoma macrotis	Large-eared woodrat	0-50
Peromyscus boylii	Brush Deermouse	10-100
Peromyscus californicus	California Deermouse	0-50
Peromyscus maniculatus	North American Deermouse	400-1,000
Peromyscus truei	Pinon Deermouse	0-50
Reithrodontomys megalotis	Western Harvest Mouse	0-50
Zapus princeps	Western Jumping Mouse	0-50
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Callospermophilus lateralis	Golden-mantled ground squirrel	0 - 50
Otospermophilus beecheyi	California ground squirrel	0 - 50
Sorex lyelli	Mt. Lyell Shrew	0-20
Sorex ornatus	Ornate Shrew	0-20
Sorex palustris	American Water Shrew	0-20
Sorex trowbridgii	Trowbridge's Shrew	0-20
Sorex vagrans	Vagrant Shrew	0-20

Tamias quadrimaculatus	Long-eared chipmunk	50 - 200
Tamias speciosus	Lodgepole chipmunk	0 - 50
Tamiasciurus douglasii	Douglas squirrel	0 - 50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern flying squirrel	0 - 50
Scapanus latimanus	Broad-footed Mole	0 - 50
Sciurus griseus	Western gray squirrel	0 - 50
Thomomys monticola	Montane pocket gopher	0 - 50

D.43 D18 – CORE – TOOL (Toolik Lake)

Timing of sampling

- Due to the very short season, a minimum of 3 bouts per year is expected.
- Given the presumed minimal influence of moonlight, bouts do not need to be scheduled within 10 days of the new moon but should be scheduled consistently across months with respect to the new moon.
- Due to high sensitivity of tundra voles, the time between trap setting and trap checking at TOOL should be 6-8 hours. Trapping should occur overnight with traps set between 9-11PM. The shortest time interval is particularly recommended when weather conditions are expected to be near the minimum for trapping (e.g., if there is a 20% or greater chance of precipitation or if temperatures are expected to be < 7 °C / 45 °F).
- When weather conditions warrant it, tar paper trap covers such as those described for BARR can also be used at TOOL.
- Small mammal pathogen grids at TOOL will alternate yearly between pathogen sampling (3 nights per bout) and diversity sampling (1 night per bout) with the exception of TOOL-002 and TOOL-007 that will remain diversity-only due to low capture rates. In odd sampling years (e.g., 2023, 2025 etc.), TOOL-073, TOOL-076, and TOOL-078 will be pathogen grids while TOOL-031, TOOL-071, and TOOL-077 will be diversity grids. By contrast in even sampling years (e.g., 2024, 2026 etc.) TOOL-073, TOOL-076, and TOOL-078 will be diversity grids while TOOL-031, TOOL-071, and TOOL-077 will be pathogen grids.

Trapping Issues

- Summers are cool and humid with 24 hours of daylight from mid-May through early August. NEON will set traps for a 6-8-hour period. If the weather allows, set traps overnight (between 9-11PM). If overnight lows are too cold, traps may be set during the day for a 6-8-hr period.
- Caribou disturbance
- **Do not trap** when very cold temperatures (< 1.7°C (35°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/ Herbaceous

Priority species for pathogen testing: Microtus spp., Myodes rutilus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Batzli and Henttonen 1990. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 50. Site-specific species list (TOOL)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Dicrostonyx groenlandicus	Nearctic Collared Lemming	0-5
Lemmus trimucronatus	Nearctic Brown Lemming	0-5
Microtus miurus	Singing Vole	50-200
Microtus oeconomus	Tundra Vole	50-200
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus xanthognathus	Taiga Vole	0-50
Myodes rutilus	Northern Red-backed Vole	0-50
Synaptomys borealis	Northern Bog Lemming	0-5
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0-50
Sorex hoyi	Pygmy Shrew	0-5
Sorex monticolus	Dusky Shrew	0-50
Sorex tundrensis	Tundra Shrew	0-5
Sorex ugyunak	Barren Ground Shrew	0-5
Sorex yukonicus	Tiny Shrew	0-5
Spermophilus parryii	Arctic Ground Squirrel	0-20
Tamiasciurus hudsonicus	Red Squirrel	0-20
Sorex ugyunak	Barren Ground Shrew	0-5
NON-TARGET ANIMALS (Scientific and Common Name)		
Mustela erminea	Short-tailed weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.44 D18 – GRADIENT – BARR (Barrow Environmental Observatory)

Site-specific trapping modification:

Sherman traps should be covered by a 12"x12" piece of water-proof roofing (tar) paper and then the paper and trap should be secured to the ground with two metal tent stakes. Two holes should be pre-punched into the tar paper to allow for the addition and removal of the metal tent stakes. This design is from Ott 2012 (2011 Report: Estimation of Lemming Abundance and Distribution Near Barrow, Alaska; www.north-slope.org/assets/images/uploads/2011_Lemming_report_FINAL.pdf; accessed 30 September 2018).

Figure 16. Folding Sherman trap (3"x3.5"x9") covered with 12"x12" tar paper cover in Barrow, AK - from Ott 2012. Credit: Kaithryn Ott.

Timing of sampling

- Due to the very short season, a minimum of 3 bouts per year is expected.
- Given the presumed minimal influence of moonlight, bouts do not need to be scheduled within 10 days of the new moon.
- Due to high sensitivity of tundra voles, the time between trap setting and trap checking at BARR can be 6-10 hours depending on weather conditions. The shortest time interval is particularly recommended when weather conditions are expected to be near the minimum for trapping (e.g., if there is a 20% or greater chance of precipitation or if temperatures are expected to be < 7 °C / 45 °F).
- Small mammal pathogen grids at BARR will alternate yearly between pathogen sampling (3 nights per bout) and diversity sampling (1 night per bout). In odd sampling years (e.g., 2023, 2025 etc. BARR-030, BARR-036, and BAR-083 will be pathogen grids while BARR-037, BARR-044, and BARR-084 will be diversity grids. By contrast in even sampling years (e.g., 2024, 2026 etc.) BARR-030, BARR-036, and BAR-083 will be diversity grids while BARR-037, BARR-044, and BARR-084 will be pathogen grids.

Trapping Issues

- Summers are cool and humid with 24 hours of daylight from mid-May through early August. Trapping can be done continuously, but, due to logistical constraints, NEON will set traps for a 6-10-hour period. If the weather allows, set traps by 2000h and check and close traps at 0600h. If overnight lows are too cold, traps may be set during the day for a 6-10-hr period
- Large mammal disturbance
- **Do not trap** when very cold temperatures (< 1.7°C (35°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended when low temperatures are expected to be <18°C/65°F

Dominant vegetation type(s) for bleed grid designation: Grassland/ Herbaceous

Priority species for pathogen testing: Microtus oeconomus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported by Batzli and Henttonen 1990. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 51. Site-specific species list (BARR)

TARGET SPECIES (Scientific and Common Name)		**Number to be Used Annually**
Dicrostonyx groenlandicus	Nearctic Collared Lemming	0-5
Lemmus trimucronatus	Nearctic Brown Lemming	0-5
Microtus oeconomus	Tundra Vole	10-100
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex tundrensis	Tundra Shrew	0-5
Sorex ugyunak	Barren Ground Shrew	0-5
Spermophilus parryii	Arctic Ground Squirrel	0-20
NON-TARGET ANIMALS (Scientific and Common Name)		
Mustela erminea	Short-tailed weasel	0-5
Mustela nivalis	Least Weasel	0-5
Neovison vison	American Mink	0-5

D.45 D19 – CORE – BONA (Caribou Creek - Poker Flats Watershed)

Timing of sampling

- Due to the very short season, a minimum of 3 bouts per year is expected.
- Given the presumed minimal influence of moonlight, bouts do not need to be scheduled within 10 days of the new moon but should be scheduled consistently across months with respect to the new moon.

Trapping Issues

- Summers are cool and humid with 24 hours of daylight from mid-May through early August. Trapping can be done continuously, but, due to logistical constraints, NEON will set traps by 2000h and check and close traps at 0600h during these times of year. During the spring and fall, trapping hours can be shifted earlier in the evening or later in the morning to reflect shifts in the timing of civil twilight.
- Large mammal disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- **Shrews are particularly abundant**; mealworms should be added to the bait. Shrew mortality that exceeds the 5 individuals per night rule may lead to early closure of grids.

Use of bedding: Recommended under all conditions

Dominant vegetation type(s) for bleed grid designation: Deciduous Forest

Priority species for pathogen testing: Microtus spp.

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011 and Cook et al. 2002. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported for Denali National Park by Rexstad and Debevec n.d, and updated with NEON data from Healy in 2015 and 2016. Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 52. Site-specific species list (BONA)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Lemmus trimucronatus	Nearctic Brown Lemming	0-5
Microtus miurus	Singing Vole	0-50
Microtus oeconomus	Root Vole	0-50
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus xanthognathus	Taiga Vole	0-20
Myodes rutilus	Northern Red-backed Vole	20-200
Synaptomys borealis	Northern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		

Sorex cinereus	Cinereus Shrew	0-50
Sorex hoyi	American Pygmy Shrew	0-20
Sorex monticolus	Dusky Shrew	0-50
Sorex palustris	American Water Shrew	0-50
Sorex tundrensis	Tundra Shrew	0-50
Sorex yukonicus	Tiny shrew	0-50
Spermophilus parryii	Arctic Ground Squirrel	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-20
Mustela erminea	Short-tailed weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.46 D19 – GRADIENT – HEAL (Healy)

Timing of sampling

- Due to the very short season, a minimum of 3 bouts per year is expected.
- Given the presumed minimal influence of moonlight, bouts do not need to be scheduled within 10 days of the new moon but should be scheduled consistently across months with respect to the new moon.
- Due to the potential for cold and rainy weather during the trapping season at HEAL, the time between trap setting and trap checking can be 6-10 hours depending on weather conditions. The shorter time intervals are recommended when weather conditions are near the minimum acceptable for trapping (e.g., if there is a 20% or greater chance of precipitation or if temperatures are expected to be < 7 °C / 45 °F).
- Small mammal pathogen grids at HEAL will alternate yearly between pathogen sampling (3 nights per bout) and diversity sampling (1 night per bout) with the exception of HEAL-031 which will remain at diversity-only sampling every year due to extensive plot damage. In odd sampling years (e.g., 2023, 2025 etc.) HEAL-032 and HEAL-033 will be pathogen grids while HEAL-010, HEAL-014, and HEAL-034 will be diversity grids. By contrast in even sampling years (e.g., 2024, 2026 etc.) HEAL-032 and HEAL-033 will be diversity grids while HEAL-010, HEAL-014, and HEAL-034will be pathogen grids.

Trapping Issues

- Summers are cool and humid with 24 hours of daylight from mid-May through early August. Trapping can be done continuously, but, due to logistical constraints, NEON will set traps by 2000h and check and close traps at 0600h during these times of year. During the spring and fall, trapping hours can be shifted earlier in the evening or later in the morning to reflect shifts in the timing of civil twilight.
- When weather conditions warrant it, tar paper trap covers such as those described for BARR can also be used at HEAL.
- Adding one-inch peanut butter squares (prepared by placing peanut butter between two unbleached paper towels to reduce the mess) is an additional option in cold weather.
- Large mammal disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).
- **Shrews are particularly abundant**; mealworms should be added to the bait. Shrew mortality may become prohibitively high at certain sites.

Use of bedding: Recommended under all conditions

Dominant vegetation type(s) for bleed grid designation: Shrub scrub

Priority species for pathogen testing: Microtus spp., Myodes rutilus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011 and Cook et al. 2002. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported for Denali National Park by Rexstad and Debevec n.d, and updated with NEON data from 2015 and 2016.

Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 53. Site-specific species list (HEAL)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Lemmus trimucronatus	Nearctic Brown Lemming	0-5
Microtus miurus	Singing Vole	0-50
Microtus oeconomus	Root Vole	0-50
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus xanthognathus	Taiga Vole	0-20
Myodes rutilus	Northern Red-backed Vole	20-200
Synaptomys borealis	Northern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	0-50
Sorex hoyi	American Pygmy Shrew	0-20
Sorex monticolus	Dusky Shrew	0-50
Sorex palustris	American Water Shrew	0-50
Sorex tundrensis	Tundra Shrew	0-50
Sorex yukonicus	Tiny shrew	0-50
Spermophilus parryii	Arctic Ground Squirrel	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-20
Mustela erminea	Short-tailed weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.47 D19 – GRADIENT – DEJU (Delta Junction)

Timing of sampling

- Due to the very short season, a minimum of 3 bouts per year is expected.
- Given the presumed minimal influence of moonlight, bouts do not need to be scheduled within 10 days of the new moon but should be scheduled consistently across months with respect to the new moon.

Trapping Issues

- Summers are cool and humid with 24 hours of daylight from mid-May through early August. Trapping can be done continuously, but, due to logistical constraints, NEON will set traps by 2000h and check and close traps at 0600h during these times of year. During the spring and fall, trapping hours can be shifted earlier in the evening or later in the morning to reflect shifts in the timing of civil twilight.
- Large mammal disturbance
- **Do not trap** when very cold temperatures (< 5.5°C (42°F)) are coupled with precipitation, or when there is sufficient snow on the ground (i.e., > 15 cm (6 inches)).

Use of bedding: Recommended under all conditions

Dominant vegetation type(s) for bleed grid designation: Evergreen Forest

Priority species for pathogen testing: Microtus spp., Myodes rutilus

Species List and Abundance Estimates

This species list is based on Kays and Wilson 2011 and Cook et al. 2002. The abundance estimates were based on an average capture rate of 10%, as well as the species-specific relative abundances reported for Denali National Park by Rexstad and Debevec (n.d.). Domain staff must refer to the current state collection permit for the permitted list of species and associated capture numbers to ensure permit compliance, as these tables may differ.

Table 54. Site-specific species list (DEJU)

TARGET SPECIES (Scientific and Common Name)		Number to be Used Annually
Lemmus trimucronatus	Nearctic Brown Lemming	0-5
Microtus miurus	Singing Vole	0-100
Microtus oeconomus	Root Vole	0-50
Microtus pennsylvanicus	Meadow Vole	0-20
Microtus xanthognathus	Taiga Vole	0-20
Myodes rutilus	Northern Red-backed Vole	0-200
Synaptomys borealis	Northern Bog Lemming	0-5
Zapus hudsonius	Meadow Jumping Mouse	0-20
OPPORTUNISTIC ANIMALS (Scientific and Common Name)		
Sorex cinereus	Cinereus Shrew	50-200
Sorex hoyi	American Pygmy Shrew	0-20

Sorex monticolus	Dusky Shrew	0-50
Sorex palustris	American Water Shrew	0-50
Sorex tundrensis	Tundra Shrew	0-50
Sorex yukonicus	Tiny shrew	0-50
Spermophilus parryii	Arctic Ground Squirrel	0-50
Tamiasciurus hudsonicus	Red Squirrel	0-50
NON-TARGET ANIMALS (Scientific and Common Name)		
Glaucomys sabrinus	Northern Flying Squirrel	0-20
Mustela erminea	Short-tailed weasel	0-5
Mustela nivalis	Least Weasel	0-5

D.48 D20 – CORE – PUUM (Pu'u Maka'ala Natural Area Reserve)

Small mammal trapping is not permitted to occur at this site.

APPENDIX E EQUIPMENT

The following equipment is needed to implement the procedures in this document. Equipment lists are organized by task. They do not include standard field and laboratory supplies such as charging stations, first aid kits, drying ovens, ultra-low refrigerators, etc. A significant amount of specialized equipment is required to conduct surveys of small mammals. Therefore, all field personnel must be familiar and comfortable with using all the equipment before heading into the field. Please note that the use of 'All domains' in the Conditions Used field of the following equipment tables does not include D04 or D20, as no small mammal sampling is permitted to occur there.

Table 55. Equipment list – Flagging the grid, one bout.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Laser Rangefinder, ½ foot accuracy	Set Traplines	1
	N	Compass with mirror and declination adjustment	Set and Follow Traplines	6
	N	Measuring tape, 100 m	Set Traplines	4
	N	Survey marking flag, wire, PVC or fiberglass stake	Set Traplines	100+
	N	GPS receiver, recreational accuracy (Garmin eTrex20x)	Navigate to Traplines	2
	N	Chaining pins or another suitable anchor	Anchor measuring tapes	10
	N	AA battery	Spare battery for GPS receiver	4
	N	CR123A battery	Spare battery for laser rangefinder	
	N	Permanent marker, chisel tip	Label flags	6

Table 56. Equipment list – Trapping, one bout.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Compass with mirror and declination adjustment	Follow traplines	6
	N	GPS receiver, recreational accuracy	Navigate to traplines	2
	N	2-way radio	Communication	6

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
H.B. Sherman Traps, LFATDG	Y	Sherman trap, small folding, 3"x3.5"x9"	Trap rodents (D01, D02, D03, D05, D06, D07, D08, D09*, D12, D18, D19)	1200
H.B. Sherman Traps, XLK	Y	Sherman trap, x-large folding, 3"x3.75"x12"	Trap rodents (D09*, D10, D11, D13, D14, D15, D16, D17)	1200
	N	Headlamp	Hands-free lighting at dusk and dawn	6
	N	Storage bin, 26 gal rolling	Store seed	1
	N	Tree planting bag	Carry traps	8
	N	Lumbar bag	Carry bait	8
	N	Storage bin	Store extra supplies in truck	2
	N	Seed, black oil sunflower	Bait traps	20 lb
	N	Seed, whole millet	Bait traps	2 lb
	N	Freeze-dried mealworms	Supplement bait for shrews	25 lb
	N	Batting, polyester	Nesting material	500
	N	Gusseted plastic bag, 2 gal	Contain traps during collection	1 lb
	N	Talstar EZ or SevinDust	Control fire ants	1
	N	Biohazard warning sticker	Label traps	1200
	N	Resealable plastic bag, minimum 1 gal	Carry batting, secure to lumbar bag with carabiner	6
	N	Permanent marker, chisel tip	Label traps	6
	N	Wet erase markers, fine tip	Label traps	6
	N	Field notebook	Record field notes	1
	N	Pencils - #3	Label traps	6
	N	AA battery	Spare battery for GPS	4
	N	Battery, AAA, Rechargeable	Headlamp or GPS	12
	N	Bathtub crayons	Marking traps	6
	N	Adhesive barcode labels (type IV for cryo storage, type I for hair/whisker envelopes)	Labeling sample containers	1 roll

Table 57. Equipment list – Checking traps and processing captures, one bout.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Amber bottle, 30 ml with dropper	Administer isoflurane	2
Fisher 19-152-304 or Avantor / VWR MM-11BK	Y	Scratch-resistant gloves for new handlers	Reduce risk of bites	Variable
	N	Latex / Nitrile gloves	Hand protection during handling	Variable
	N	Tea infuser spoon	Administer isoflurane	2
	N	Tube, Centrifuge, Sterile, Conical, 50mL (30 mm diameter)	Administer isoflurane	2
	N	Tube, Centrifuge, Sterile, Conical, 15mL (17 mm diameter)	Administer isoflurane	2
National Band & Tag Company, 1005S1	Y	Ear tag applicator, size monel #1	Affix ear tag	4
	N	Proximity Reader. PIT tag portable reader capable of reading ISO 11784/11787 FDX-B PIT tags, simple data retrieval via USB port, Bluetooth	Read PIT tag number	2
	N	Ruler, 12" plastic, mm gradation	Measure	2
	N	Ruler, 6", flexible clear plastic	Measure	2
Forestry Supplier, 93010	N	Spring scale, tareable, capacity 30 g max Pesola LightLine or Micro-Line	Weigh individuals	2
Forestry Supplier, 93051	N	Spring scale, tareable, capacity 50 g max, Pesola LightLine	Weight individuals	2
Forestry Supplier, 93011	N	Spring scale, tareable, capacity 100 g maximum Pesola LightLine or Micro-Line	Weigh individuals	2

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
Forestry Supplier, 93053	N	Spring scale, tareable, capacity 1000 g maximum Pesola LightLine or Micro-Line	Weigh individuals	2
	N	Cardboard storage box, 81 positions with lid	Organize cryovials during blood collection. Note only cardboard is acceptable, no plastic	4
	N	Cardboard cryovial freezer storage box with dividers	Organize samples. Note only cardboard is acceptable, no plastic	10
	N	Ear tissue punch	Collect ear tissue	2
	N	Cooler, 16qt	Chill perishable samples in field	2
	N	Digital camera, 12 megapixels	Capture images of rodents for species identification	2
	N	Camera bag	Protect digital camera	2
	N	Ventilated tupperware or cardboard container	Care for hypothermic animals	5
	N	Bottle, 250 mL wide-mouth HDPE	Store sugar/water solution for animal care	2
	N	Shelter/tent	Shade collected traps, provide shelter while processing	2
	N	Backpack	Transport field equipment	2
	N	Organizer boxes with lid	Organize equipment	4
	N	Mesh wash bag	Restrain larger species	20
	N	Restraint bag	Restrain larger species	20
	N	Multi-tool	Marking	2
	N	Diagonal plier, 4 in	Remove ear tags	2
	N	Short (< 6 inches) piece of rope (550 paracord works well) for 1000 g scale	Attaching to scale, in place of alligator clip, to weigh larger animals in plastic bags	2
	N	Iris scissors	Collect ear tissue	2
	N	Forceps, cushing dissecting	Collect sample	4
	N	Forceps, dissecting microforceps	Collect sample, check for ticks	4
	N	Cuticle clippers	Remove ear tags	2
	N	Magnifier hand-lens, 10X	Aid in species identification	2
	N	Plastic tray 25”x19x1”	Alternative or additional mammal processing surface	2

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Thermohygrometer	Monitor weather conditions	2
	N	All weather copy paper	Print datasheets	25 sheet
	N	Cotton ball	Administer isoflurane	150
MWI Veterinary Supply Bromorganics, 502017 2,2-dichloro-1,1-difluoro-1-methoxyethane	Y	Isoflurane or Methoxyflurane	Anesthesia/euthanasia	25 mL
	N	Hand warmer	Care for hypothermic animals	2
	N	Sugar	Care for hypothermic animals	2
	N	Freeze-dried mealworms	Care for stressed animals	2 lb
	N	Styptic Powder	Slow/stop bleeding (in case of open wound)	1 pack, 42 g
	N	Cotton swab	Apply styptic powder	50
National Band & Tag Company, 10051L2	Y	Ear tag, numbered. To avoid duplicating tag numbers: after a domain reaches tag 9999 order 5-numeric-digit tags beginning with 10000.	Tag captured individuals	200
Biomark, Inc., Mini HPT8 PL.SY - pre-load sterile syringe	Y	Pre-Loaded **Sterile** FDX PIT Tag 1.4mm x 8.5mm. This item is a PIT tag pre-loaded in a single use syringe and packaged in a gas sterilized pouch. Be aware that there are several other non-sterile HPT8 tags that are not acceptable for purchase	Tag captured individuals	Variable (see Appendix D)
	N	Veterinary tissue adhesive	Gluing tissue at PIT tag implant location	3 mL
	N	Permanent marker (>1/2 inch), red, blue, or green preferred	Mark–captured shrews	4
Fisher, NC9922361 NC9891620	N	Lancet, 4mm and 5mm	Collect blood	1000

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
Fisher, NC0600941	N	Lancet, 6mm	Collect blood	300
Amazon, B005TM1HJM	N	Sterile artificial tears ointment	Aid in blood collection	7 grams
Cole-Parmer, UX-06226-42	N	Sterile disposable individually-wrapped pipette (1-3 mL)	Add DNA/RNA shield to blood samples < 0.01 mL	200
Zymo Research, R1100-50	Y	DNA/RNA Shield	Add 2-3 drops to smallest blood samples to increase utility of sample	50 mL
	N	Eye wash bottle	Rinse eyes in case of contact with DNA/RNA shield	1
	N	Alcohol wipe	Collect ear punches	1000
	N	Gauze pad	Apply pressure to bleeding	1000
Thomas, 1236C14	N	1.5 mL centrifuge tube	Contain blood, fecal samples, ear punches	1000
	N	Artifact identification tag	Label vouchers	10
	N	Thread	Attach tags to voucher specimens	2 rolls
ULINE, S7798	N	Coin envelope, small (no larger than 3.5” x 2.25”)	Contain whisker and hair samples	150
Simport, 2310-2A	N	Self-standing 1.5-2 mL cryovials rated for storage in liquid nitrogen (-196°C) with an o-ring and external threads	Contain fecal, blood and ear samples	800
	N	Dry ice, pelletized	Freeze blood samples	50 lbs
	N	Resealable plastic bag, 1 gal, 2 mil	Restrain captured individuals	200
	N	Ultra-cold ice packs or aquarium rocks	Alternative to dry ice for field storage of samples	
	N	Resealable plastic bag, 1 gal, 4 mil	Restrain captured individuals	100
	N	Freezer safe voucher bags	Freezer safe bags to contain voucher specimens	
	N	Heat shrink tubing	Cover clamp teeth on spring scales	1 package
	N	Cryogenic label	Label sample	1000
	N	Resealable plastic bag, 1 qt, 4 mil	Organize collected samples (coin envelopes, filled vials, and voucher specimens)	20

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Battery for thermohygrometer	Spare battery for thermo-hygrometer	2
	N	Digital camera battery	Spare battery	2
	N	Plastic sheeting, 3 x 50ft, 4 mil, clear	Provide mammal processing surface	10
	N	Permanent marker, ultra-fine tip	Label sample	2
	N	Permanent marker, archival ethanol-safe	Label sample	2
	N	Preserved mice	Cervical dislocation training	1 per handler
	N	Field guide, regional, dichotomous key	Identify unknown species	2
	N	Field guide, mammals	Identify unknown species	2
RD[05]	N	Small mammal field datasheets	Record data	10

Table 58. Equipment list – Cleaning and sterilization, one bout.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Butane lighter	Sterilize tools	2
	N	Spray bottle	Disinfect tools and work area	2
	N	Portable Sharps container.	Contain Sharps waste	2
	N	Narrow mouth jug, 1 gal	Transport quaternary ammonia	2
	N	3 cup container	Contain quaternary ammonia for disinfecting tools	2
	N	Mason jar	Transport used quaternary ammonia	2
	N	Alcohol wipe	Disinfect tools	50
	N	Quaternary Ammonia 5% solution	Disinfect tools, gloves and work surfaces	10 L
	N	Trash bag, large	Contain and transport waste	20
	N	Resealable plastic bag	Contain Sharps container	2
	N	Paper towels	Dry tools	2 rolls

* Quantities are generous estimates per bout per site

Table 59. Equipment list – Cleaning traps, per bout.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Spray bottle	Wash traps	1 pack, 6
	N	Scrub brush, long and short handle	Scrub traps	6
	N	Bottle brush, 19"	Scrub traps	1
	N	Chemical-resistant glove	Protect hands	1
	N	Graduated cylinder, 25 ml, plastic	Measuring quaternary ammonium for dilution	2
	N	Plastic bucket, 5 gal	Wash traps	6
	N	Carboy, 20 L	Wash traps	1
	N	Quaternary disinfectant	Disinfect traps	1 bottle, 1 gal

Table 60. Equipment list – Preparing blood samples.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Cryovial freezer storage box with dividers	Organize samples	5
	N	Cryogenic gloves	Protect hands while handling dry ice	1 pair
	N	All weather copy paper	Print datasheets	5 sheets
RD[05]	N	Small mammal datasheet (shipping manifest)	Datasheets	5 sheets

Table 61. Equipment list – Genetic analysis.

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Forceps, jewelers	Remove tissue	3
	N	Butane lighter	Sterilize ear tissue punch	1
	N	Chill block and microplate cooler	Prepare well plates	1
Lab supplied	N	96-well microwell plates	Store tissue to be barcoded	3
Lab supplied	N	96-well microwell caps	Cover microwell plates	285

Supplier/ Item No.	Exact Brand	Description	Purpose	Quantity
	N	Spray bottle for ethanol	Disinfect bench space and gloves	1
	N	Cryogenic gloves	Protect hands while handling dry ice	1 pair
	N	Ethanol, 190 proof (95%) (55 gallons)	Disinfect bench space and gloves	1 L
	N	Ethanol, 190 proof (95%) (5 gallons)	As above, for domains that cannot store 55 gallons of ethanol. (D05)	
	N	Corrugated fiberboard or insulated shipper, UN packing group III	Package samples for shipment	1
	N	Watertight inner shipping container, certified for UN3373	Package samples for shipment	Variable
	N	Biological Substance Category B shipping label	Label shipments containing diagnostic specimens	Variable
	N	Packaging tape	Package samples for shipment	1 roll
	N	Nitrile gloves, powderless	Prevent contamination of samples	Variable
	N	Address labels	Address shipments	1
	N	Dry ice, pelletized	Preserve samples during shipment	2 lbs