National Park Service
U.S. Department of the Interior

"Pikas in Peril" Research Project

2010 Survey Manual

Draft document – please do not distribute

Change History

We must keep track of changes to this document.

1. Be sure to get approval for proposed changes to this document from the project PIs (i.e., Ray, Jeffress, Wolff, Epps) and field crew leaders (i.e., Gunther, etc.) before implementing the change. The best way to do this is via basecamp.

2. Version numbers increase incrementally by tenths (e.g., version 1.1, version 1.2, …etc) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 …). Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.

3. Notify all project PIs and field crew leaders when a new version is available.

Version #	Date	Revised By	Changes	Justification
1.0	**10 Jun 2010**	**Jessica Castillo**	**Page 16-19**	**Changes to genetics protocol.**
1.1	**10 Jun 2010**	**Mackenzie Jeffress**	**Page 25**	**Converted image so it would print properly**
1.2	**19 Jun 2010**	**Mackenzie Jeffress**	**Pages 4 (7 line deletion), 14 (bullet 10 v talus depth and 3 word deletion for bullet 14), 15 (bullets 14 and 15), 16 (bullet 21), and 23 (data form; bottom of page)**	**Added % forb cover to the data form; added clarification for GPS datum, accessible forage variable, streams and riparian vegation, talus depth near sign, and definition of overcast.**

Contents

Field Preparation

1. Assemble all necessary equipment (see “Equipment List”).

2. Pre-load all plot points to the GPS units using UTM Datum NAD83. Follow SOP # 3 “Finding GPS Waypoints” in the UCBN Pika Monitoring Protocol (Shardlow et al. 2009) for instructions on pre-loading sampling point coordinates for field navigation with Trimble GeoXT units. The UCBN also has an SOP for use with Garmin Map76 units (look in the

3. If available on your GPS, make sure the unit is operating in WAAS-enabled mode, which improves position accuracy. Refer to your owner’s manual for specific guidance.

4. Also if available on your GPS, enable points averaging. This will allow for more accurate UTM coordinates when recording locations. This is particularly important for sites scheduled for revisit and coordinates of genetics samples collected. We recommend setting the unit to average 100 points. Again, please refer to your owner’s manual for specific guidance.

5. Devote a day for training and calibrating all surveyors (see “Field Crew Training and Calibration”).

6. Prior to entry into the field, survey points should be organized into routes for each field surveyor. For example, points should be organized into efficient clusters of 8-10 such that one cluster can be completed in one day by one person. Plans for rugged areas with extensive travel should include fewer sites surveyed per day. Teams of 2 persons should be assembled for safety and logistics where necessary, particularly for large parks or when working in remote areas.

7. Arrange a debriefing meeting with the project lead, park points-of-contact, such as the park chief of resources or resource biologist, and/or crew leader (one project lead may have multiple crew leaders). Project leads and park contacts are listed in Table 1. Review the survey plan and discuss daily schedules and check-in/check-out procedures. Discuss park and project safety procedures and any emerging concerns, such as inclement weather, road conditions, potential wildlife in the area such as bears and moose, snow conditions, and fire hazards. Also, don’t forget to clean vehicles, boots, and clothing of weeds before heading into a new park area. Be sure to address park-specific emergency procedures and contingency plans in the event of injuries requiring medical attention.

Table 1. Contact information for the project leads and park contacts.

Park	Project Lead	Park Point-of-Contact
CRLA	Mackenzie Jeffress (208) 661-9658 jeffress@uidaho.edu	Gregory Holm (541) 594-3074 Gregory_Holm@nps.gov
CRMO	Mackenzie Jeffress (208) 661-9658 jeffress@uidaho.edu	John Apel (208) 527-1350 John_Apel@nps.gov
GRSA	Chris Ray (303) 735-1495 Chris.Ray@colorado.edu	Fred Bunch (719) 378-6361 Fred_Bunch@nps.gov
GRTE	Susan Wolff (307)739-3464 Susan_Wolff@nps.gov	Susan Wolff (307)739-3464 Susan_Wolff@nps.gov or Chris Paige (307)739-3491 Chris_Paige@nps.gov
LABE	Mackenzie Jeffress (208) 661-9658 jeffress@uidaho.edu	David Larson (530) 667-8106 David_Larson@nps.gov
LAVO	Mackenzie Jeffress (208) 661-9658 jeffress@uidaho.edu	Nancy Nordensten (530) 595-4444 ext. 5172 Nancy_Nordensten@nps.gov
ROMO	Chris Ray (303) 735-1495 Chris.Ray@colorado.edu	Judy Visty (970) 586-1302 Judy_Visty@nps.gov
YELL	Susan Wolff (307) 739-3464 Susan_Wolff@nps.gov	Kerry Gunther (307) 344-2162 Kerry_Gunther@nps.gov

Equipment List

The following equipment should be assembled each spring, and sufficient time must be allowed to order replacement equipment. Much of the miscellaneous equipment is optional and may need to be provided by the surveyor. The amounts of individual items required are not included here, as they may change according to the number of field surveyors available.

Navigation, Observation, and Recording Equipment

- GPS unit(s) with plot locations loaded
- Vegetation cover estimation sheets (see Appendix A)
- Survey data sheets
- Maps of survey site locations
- Park map
- Backup copies of data entry forms
- Mechanical pencils and clip boards

- Two 25-m, 30-m or 50-m (or 100') measuring tapes
    - If preferred, can we use pin flags instead of carrying 2 tapes (distances still measured using the measuring tape)
- Compass with inclinometer for estimating slope and aspect
- Sign field guide or cheatsheet (particularly for other species)
- Rangefinder (preferred method to measure distances)
- Digital camera (for accurate relocation of specific site and to document odd bits)
- Thermometer (preferred method for measuring temperature; little backpack keychain versions are fine and cost approx. $5-$10)
- Spare batteries for the GPS unit, rangefinder, and camera

Genetic Sample Materials

Kits will be mailed to each PI containing coin envelopes, tape, forceps, bleach bottle (but not the bleach), wooden sticks, and forceps. Pen, gloves, and additional tape or envelopes if needed will be the responsibility of the PI/field crews- we can send additional supplies if needed. PIs should provide mailing addresses for kits or groups of kits to Jessica Castillo/Clint Epps.

- Collecting envelopes (paper coin envelopes)
- Pen for recording data on envelopes and data sheet (permanent or archival ink preferred)
- Tape for sealing envelopes
- Wooden applicator sticks, plastic spoon straws, disposable glove, and/or forceps*
    - *Small Nalgene bottle with 10% household bleach solution and a lighter (to ensure that the bleach has evaporated) if using forceps.
        - Bleach wipes are also an option but due to their expense, will not be provided to all crews by the genetics team. If they are preferred, the park crews must provide them.

Plot Marking Equipment

Note: Site marking is only necessary for sites planned for resurvey.

- Aluminum tree tag markers
- Bailing wire
- Wire cutters
- Tag etcher (e.g., pen or pencil)
- Optional: hole puncher for the tags if extra holes are needed (i.e., for additional wiring)

Temperature Sensor Equipment

Note: Temperature sensors are not required for the project but their use is encouraged if funds and equipment are available.

- Temperature sensors
- Protective cases (e.g., cheap plastic cosmetic cases)

Miscellaneous Equipment

- Headlamp or flashlight and spare light batteries
- Daypack
- Sunscreen, hat
- Water bottles, food
- First aid kits
- Leather gloves and good boots
- 2-way handheld radios or park radio and spare radio batteries
- Binoculars
- Bear pepper spray
- Watches for each crew member (don't rely on GPS units)

Field Crew Training and Calibration

Each field surveyor should be provided with a complete set of observation equipment, a hard copy of the survey manual for reference during training and field operations, a hard copy map of the park as well as map indicating the sites to be surveyed.

If there are any questions or issues encountered during field crew training that the individual crew leader cannot address, that person should contact all of the project leads (best by a group message via basecamp) for answers and advice. This manual should also be revised as necessary. This will encourage consistency across all field crews.

1. The crew leader will be in charge of training surveyors, coordinating survey efforts and collecting completed data forms each day. This person should be available to troubleshoot and reassign new equipment as needed.

2. Definitions for key field terms are presented in the following table (Table 2) and should be reviewed during training.

3. Training can be accomplished in one day. The survey crew should be assembled at the beginning for a review of concepts and techniques. Basic pika and pika sign identification

should be reviewed as well as proper GPS use, habitat measurement, and data recording procedures.

4. Following group introductory material, surveyors should practice locating survey sites with GPS and maps. The field crew should practice making observations and performing data entry. To facilitate this, extra field data entry sheets should be made available and training should occur where there is ample opportunity for pika detections (at non-survey sites only).

5. The field crew should also calibrate habitat measurements, such as vegetation cover estimates (see below) and measurements of slope (° = degrees) and aspect (° = degrees). Repeatability is an important issue and needs to be assessed throughout the field season. Evaluation of repeatability should be done as part of the training and calibration in cover estimation.

6. Once this portion of training is complete, reassemble into the full group and review questions and concerns. Each surveyor must be comfortable and confident in the methods.

Table 2. Important field definitions for monitoring pika.

Term	Definition
Aural Detection	Observer heard a pika call.
Scat	Animal excrement (see description and photos for further details).
Haypile	Cuttings of forbs, shrubs, grass, or other vegetation piled near or within a rock cavity/burrow by a pika. Used as a winter food source.
Target Population	The predetermined pika population within the park for which statistical inference is desired.
Sampling Frame	The physical representation of the target population. This is always imperfect and sampling frame errors and procedures for addressing them must be addressed in training.

Vegetation cover

Vegetation cover will be visually estimated and recorded in percent of the total 12-m radius circle for each of six categories: rock (including all lava), bare ground (including dirt, mineral soil, and litter), forb (all non-graminoid flowering herbaceous plants), grass (graminoids [grasses, reeds and sedges]), shrub (woody plants), and trees. Cover estimates within each category will not exceed 100% but total estimates summed across all categories may exceed 100%. Table 3 presents the modified Daubenmire cover classes to be used for each category. Modification was done so that the sparsely vegetated pika habitat could be more appropriately characterized.

Table 3. Daubenmire's cover classes (modified with 'trace' and '100%' classes added) used for estimating vegetation cover in 12-m radius circular plots surrounding pika sample point centers.

Cover Class	Range	Midpoint
0	0%	0%
T	Trace <1%	0.5%
1	<5%	2.50%
2	5-25%	15%
3	25-50%	37.50%
4	50-75%	62.50%
5	75-95%	85%
6	95-100%	97.50%
7	100%	100%

The recommended steps for estimating cover visually are as follows:

1. First, select one of the indicators for estimation; usually it is best to select one of the indicators which have obvious and fairly high cover values. For pika surveys, this is most often rock.

2. Decide whether cover is > or <50% cover.

3. If cover is less than 50%, then determine whether cover is > or <25%. If cover is > 25% then the cover rank is 3.

4. If cover is <25% then determine whether cover is >5% or <5%. If cover is >5% then cover rank is 2.

5. If cover is <5%, then determine whether cover is >1% or <1%. If cover is >1% then cover rank is 1.

6. If cover is <1%, then determine whether the cover is present at all. If it is present, the rank is T (trace). If not present, the rank is 0.

7. In a similar fashion, if cover is >50%, keep splitting between the largest next cover division until a rank is assigned.

8. The visual cover estimation guide (Appendix A) also can be used to aid cover class determination.

Plot Establishment

1. To locate a survey plot, go through the steps outlined in SOP # 3 "Finding GPS Waypoints" (Shardlow et al. 2009) to initiate navigation to a waypoint. Ensure that you are navigating to the correct point, according to the Plot ID #, and that your GPS is set to WAAS-enabled and point averaging mode if available. Once the GPS unit registers the lowest error possible, you should stop immediately and establish the plot center. Ideally, horizontal error should be less than 3 m, and accuracy settings outlined in Shardlow et al. 2009 and standards (e.g., PDOP < 6) should be used. Be sure to record the coordinates of the actual plot center on the data form (i.e., this may differ from the pre-loaded coordinates due to a more accurate reading from points averaging or due to offsetting the plot).

    a. Note: when recording coordinates using points averaging, do not move the GPS and allow enough time for the averaging procedure to run.

2. Once the plot center has been established, lay out two 24-m measuring tapes in a right-angled cross centered on the plot center. This will establish the search area for the 12-m radius plot (Figure 1). Another option for marking the plot is to use one tape to pin flag the plot edges; this method might reduce the weight of equipment to carry.

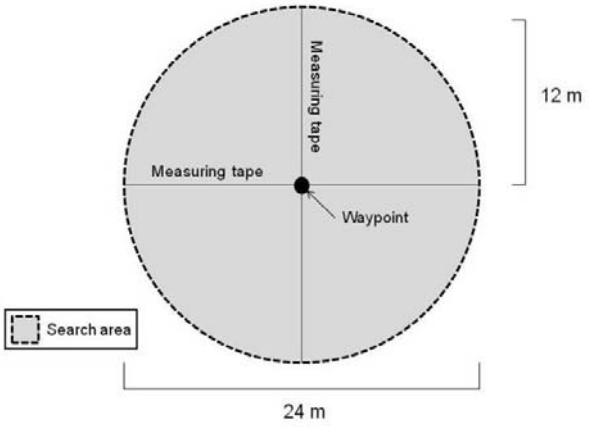


Figure 1. Diagram of the 12-m radius plot setup used for pika monitoring.

Moving/Adding/Dropping Plots

Refer to the following checklist below for determining whether a survey plot should be dropped. If a plot meets one or more of these criteria, it should be dropped.

Rejection criteria:

- Outside park boundary
- Dangerous/prohibitively difficult to work on (e.g., slope >35°, rockfall imminent, or other unsafe conditions)
- The plot contains < 10% target habitat. Target habitat includes talus, lava, outcrops or other forms of creviced rock that can provide shelter for pikas. Note that scree or collections of small rocks (< 6 inches across) do not provide sufficient shelter for pikas. If the proportion of target habitat within the plot can be increased to ≥10% by moving the plot <25 m, see "Moving a plot" (below).
- The plot should also be relatively snow-free (<10% snow cover). If the site has not yet experienced snowmelt (e.g., site is being surveyed early July), the site should be surveyed at a later date.
- There is wildlife disturbance and/or human safety concerns (e.g. moose or bear in the area that will not leave after a short waiting period of 5-10 minutes).

In order to maintain the desirable properties of the GRTS sample (e.g., spatial balance, valid inclusion probabilities), plots need to be included in the sample in the proper sequence. Plots are given an ID # as a feature of the GRTS function output in R (see SOP #6 in Shardlow et al. 2009), and the ID order should be followed. For example, if plot number 3 is inaccessible, then it should be dropped and the next plot on the oversample list should be added. In parks with a variety of target habitat types/map units/strata, the next plot within the same habitat type/map unit/elevational strata should be added. Anticipate that some plots will be dropped, particularly during the first year of implementation when sampling frame errors have not been entirely resolved. Allow time at the end of each survey period to pick up replacement points. Because of

the GRTS spatially-balanced design, replacement points will not necessarily be near dropped plots. Over time, some replacement plots will be necessary, and a larger sample size may become desirable and achievable; whenever plots are added to the study for any reason, each should be added from the oversample in the order given by the Plot ID (and, if applicable, habitat type/map unit/elevational strata).

Moving a plot:

- If a plot contains <10% target habitat, it should be offset or dropped. Target habitat is defined as any rocky substrate with a fractured surface (i.e., talus, lava, outcrops or other forms of creviced rock that can provide shelter for pikas). For example, a slope of scree with small rock (the kind of slope that is hard to walk up because it keeps sliding out; < 6 inches across) is not target habitat.

- Move the plot center a random distance (1-25 m; ≤2x plot radius) in a random direction (azimuth) if sufficient target habitat is available in all directions from the plot center. If target habitat is not available in all distances/directions, try each distance and azimuth combo in order on the list until one of the directions contains target habitat.

- Document the procedure in the notes field, beginning with "offset" so that the notes field can be queried from the database and be sure to record the new plot center coordinates in the coordinates fields.

- If sufficient habitat (insufficient = <10% target habitat) is not available within 25 m in any direction, the plot must be dropped, and replaced from the oversample list. Document drops with the first word "drop" in the notes field on the data form and enter this into the database to enable queries.

Marking Plots

- Each plot identified for resurvey will be marked with aluminum tree tags and photographed to assist in future relocation (Figure 2).

- On the tag, write:
    - Plot ID
    - Date
    - "NPS PIKA PROJECT: PLEASE DO NOT REMOVE"

- Tree tags should be wired to rocks and placed as close to plot center as possible. Additional bailing wire may be used to allow the tag to be secured to a rock located at plot center. If no suitable rock is available, place a rock at plot center and secure the tag with wire. Tags may also be hung between rocks when necessary.

- If a park does not want the markers to be visible, the marker may be offset from plot center. If this is the case, be sure to note this and the distance/direction to plot center on the data form.

- In areas of high human use or plots located near trails, place the tag so it is out of sight from the trail (e.g., hang it in a rock crevice or facing away from the area of human activity).

Figure 2. Image of aluminum tree tag markers (found at http://www.nationalband.com/nbtplant.htm#2702)

- On the data sheet, include a brief description and diagram of the plot and plot center. Describe any trees, vegetation, or other identifying markers in the plot and their distance and direction from plot center. Remember that the plots will be revisited in the future so a good description of the plot will be useful for relocation.

- At least two photos (*four if a temperature sensor is placed) should be taken at every plot scheduled for revisit. For each photo, the observer should record the camera number/ID, the photo name/number assigned by the camera, the distance from plot center, and the azimuth to plot center.

1. A photo of the plot center should be taken that allows an unobstructed view of the tag and a roughly 5-m area around the tag.

2. 1-2 photos of each plot should be taken from a distance or vantage outside the plot toward plot center that will provide a good visual record of the plot, its

habitat features, and any conspicuous features that may assist with relocation in the future.

- For these "out-of-plot" photos coordinates should be collected for the point where the photo was taken.

3. *A photo of the sensor location and a roughly 5-m area around it, with sensor location temporarily indicated by a flag. (Remove flag after photo.)

4. *A photo of the sensor from about 2 m.

- *Additional details about the temperature sensor and its placement should be recorded on a separate temperature sensor data form (see "Temperature Sensors").

- Photos can be difficult to manage so field crew leaders must make sure to stay organized. Initial file names (i.e., photo number assigned by the camera) should be recorded on the data form in the field and the final file name (Park code_Plot ID_Photo number) recorded on the form when renamed and entered into the database. Photos should be downloaded and renamed on a daily basis.

Conducting Surveys

- Single or independent multiple observers may be used, depending on safety and other considerations. The number of observers must be noted in the database. Independent multiple observer surveys should be conducted in the same day and recorded on separate data forms. Detection probabilities with single observers have generally been > 90% (e.g., Rodhouse et al. *in press*) but it is still a priority to estimate detectability this season.

- Surveys should be conducted for a minimum of 20 minutes and maximum of 30 minutes. Surveys should begin with a 5-minute period (included in 20-30 minute total) of silent observation to allow for visual and aural detection. It is imperative to maintain consistent effort. If pika sign is found after 30 minutes (e.g., a pika calls while packing up), it can be recorded but must be noted as occurring after 30 minutes.

Data Collection

1. Once the plot is established, the surveyor should record the Plot ID, time, plot and weather characteristics on the Pika Survey Data Form (Appendix C).

2. The surveyor can then begin the search for evidence of pika activity. Surveys should begin with a 5-minute period of silent observation to allow for visual and aural detection. Then the surveyor should thoroughly examine the entire plot and record all evidence of pika activity (including the time and types) that he/she encounters. This will involve kneeling down and looking underneath ledges and in crevices. Therefore, leather gloves are strongly encouraged and a flashlight can be used to look in dark crevices.

3. Once the surveyor feels the survey is complete, he/she should collect any genetics samples, deploy a temperature sensor if required, and mark the plot if it is planned for resurvey.
4. A vegetation survey should be conducted at this time.
5. As a final step at the plot, the surveyor should double-check data entry before moving on to the next plot. Care must be taken to not leave any missing fields on the data form.

Pika Site Occupancy Data Sheet Instructions

Each item refers to a field on the data sheet:

1. **Park code** (4-digit code for the National Park Service unit).

2. **Plot ID** (name of selected location or GPS point; should be a 3 digit number).

3. **Name(s) of observers (s)**; first initial. + full last name (e.g., M. Jeffress).

4. **Date** of survey (e.g., 04 Jul 2010).

5. **UTM:** Easting (X) and Northing (Y) (e.g., 625026, 4489884).

    - Record for all plots. This is particularly important when using points averaging for more accurate coordinates or when a plot has been moved (i.e., record the actual surveyed plot center).

6. **GPS accuracy:** Accuracy of reading. Example: ± 2 m

7. Indicate whether or not **points averaging** was used for the recorded coordinates (circle one).

8. **Datum:** Document the datum points are being recorded in Example: WGS84 or NAD83

9. **Times of day** that bracket the survey period.

    - record the arrival time first, and record departure time just before leaving the plot.

    - use military/24 hour (00:00 – 24:00).

    - record multiple start/end times if survey was interrupted (total time should reflect time spent at the plot within detection distance of pikas and pika calls).

    - record the start and end time of a concerted search for scat/haypiles (during which crew members have their heads down and are less likely to see/hear pikas); the time of first scat/haypile detection relative to the start time of this concerted search is an essential datum for modeling detection rates.

10. ***Before recording auxiliary plot data,*** **take 5 minutes to observe the plot, remaining motionless and silent; immediately after this observation period, search for pika sign.**

    - Record **start time for scat/haypile survey.**

- record **details for each pika sign**; details should include:

    i. the exact **time** when the sign was encountered.

    ii. the **type of sign**, using the categories given on the data sheet; note that "fresh" hay or scat would contain at least some visible chlorophyll—some green tint—and some flexibility/plasticity, while "old" hay or scat would contain little (hay) or no (scat) visible chlorophyll and would be brittle; in cases where this judgment is difficult to make, explain the problem in a note (see Appendix F for reference photos).

    iii. if you see or hear a pika, record your best estimate of the **distance between the plot center and the pika**; this field does not need to be filled for haypiles or scat, which you should investigate close-up.

    iv. for any sign encountered, record the size (largest dimension) of the **largest rock** nearby (within about one meter); for example,

        1. if you saw a moving pika, record the size of the largest rock that the pika passed within one meter of.

        2. if you encountered a hay- or scat-pile, record the size of the largest rock within one meter of this sign.

    v. estimate the **depth of the talus** (<0.5 m, >0.5 m, >1.0 m, >1.5 m) within 1 meter of the sign (see bullet #18).

11. Record **end-time for scat/haypile survey**; this is not the same as departure time, except in some cases when there are multiple observers working in tandem on different tasks.

12. Visually estimate and record the percent class of **vegetation cover** of the total 12-m radius circle for each of six categories: rock (including all lava), bare ground (including dirt, mineral soil, and litter), forb (all non-graminoid flowering herbaceous plants), grass (graminoids [grasses and sedges]), shrub (woody plants), and trees.

    - Cover estimates within each category will not exceed 100% but total estimates summed across all categories may exceed 100%.

    - Classes include 0, T, and 1-7 (see Table 3).

13. **Presence of other mammals and birds of prey**; do not attempt to exhaustively search for each type of mammal sign—focus on pikas, but take data on other species opportunistically; if you are unsure about the sign of any animal, record your questions and observations within the "Notes" section and take photos if possible.

    - **Marmot sign** – Record whether or not a marmot(s) was seen or heard (Yes/No), scat piles or scat stations were detected (Yes/No), and/or dens were encountered (marmot dens are usually associated with a fresh mound of dirt amidst talus and

covered with marmot scat; if you are unsure whether the den belongs to a marmot family, explain in your notes).

- **Woodrat sign** – Record the whether or not you detected a woodrat nest(s) (usually associated with a collection of dried twigs and small branches, plus urine-soaked mats of feces), urine stations (usually a thick, very bright, white deposit on the rocks, surrounded closely by bright orange, nitrogen-loving lichen), and/or scat stations (woodrat scat is shaped like a long vitamin or medicine capsule).

- **Other species** – document if any other species were observed (particularly weasels), and provide the species or common name; record only mammals, snakes and potential birds of prey, including ravens, hawks, owls, etc.

14. **Site features**; indicate all features that are visible nearby (within 100 m of the plot):

    - Visible or audible runoff under the rocks in the plot

    - Pools or saturated soils immediately downslope (<100 m)

    - Riparian vegetation (e.g., willows) immediately downslope (<100 m)

        i. Note: If this is due to the presence of a stream, determine whether or not the stream originates from the talus patch. Note the stream origin in the notes field.

    - Snow upslope (<100 m)

15. **Site weather** during the survey, including: qualitative information about the skies (sunny, partly cloudy, or overcast (>65% cloud cover; note: surveys should not be conducted in any sort of precipitation); plot-specific data regarding ambient temperature—use a thermometer, if possible, or record Freezing (<35°F), Cool (<60°F), Warm (60-75°F), or Hot (>75°F); and wind levels—record low (grasses just bend), medium (branches just wave), or high (treetops bend).

16. **Average slope aspect (°)**; standing at the plot center, record the average aspect of the plot to the nearest 5 degrees.

17. **Average slope gradient (°)**; standing at the plot center, determine the average "fall line" of the slope through the plot center; this would be a line passing through the plot center that captures the average rise from the lower portions of the plot to the higher portions; look downhill and uphill along this line, out to the edges of the plot in each direction, and average the two values.

18. **Deepest talus (m)**; after traversing the plot, estimate the minimum depth (e.g., <0.5 m, >0.5 m, >1.0 m, >1.5 m) of the *deepest* cracks/crevices available within the plot.

19. **Size range of largest 10 rocks**; after searching the plot, estimate the size range of the *largest* 10 loose boulders/rocks in the plot; e.g., if the very largest rock w/in is about 2 meters long (in its longest axis) and the 10^{th}-largest rock is about 1 meter long, the size range is 1-2 m; where appropriate, include only loose boulders, and exclude rock outcrops.

20. Document whether **genetics samples** were collected, if a **temperature sensor** was deployed, and if the plot was **marked for revisit**.

21. A visual (or rangefinder) estimate of **distance to accessible forage** from plot center should be recorded to the nearest 5 m. For our purposes, accessible forage is defined as grass/forb/low-shrub/low-tree cover of >25% within 16 square meters (e.g., 4 X 4 m) or more, where 'low' shrubs and trees include leaves/needles accessible from the ground.

22. **Rock shade**; estimate the average rock shade in the plot into 1 of 3 shade categories (light, medium, or dark) using the shade color guide (Appendix D).

23. **Take digital pictures** of the plot if it is being marked for revisit (see "Marking Plots"), a temperature sensor was deployed, or if any sign is questionable, makes for good reference photos, etc. Record the camera #, photo file name/number, coordinates (if taken outside the plot) and a description of the photo including azimuth to plot center and distance to plot center. Be sure to also record the final file name when files are downloaded and entered into the database.

24. **End-time for the survey (departure time)**, after searching the plot completely and recording all auxiliary data; do not end the search until you've looked under every big surface rock (>0.5 m in largest dimension) within the plot; note also that you may continue to see or hear pikas after this time, and you should continue to record details of pika sightings and calls, along with the time(s) of these detections.

Genetics

Rationale for this protocol: *We are hoping to obtain at least one genotype from each sampling area where pikas occur in or near the plot. To ensure this, we'd like at least two high quality samples (can be closely associated with each other). Other samples from the immediate area (<300m) will be useful for population based analyses. Collect them if you have time, and try to avoid multiple samples from the same territory. Finally, opportunistic samples encountered during travel will also be useful, if noted as such.*

- At or near each occupied plot, attempt to collect at least two high-quality fecal-pellet samples within 100 m of the plot center. Record the plot ID. If time permits, collect up to 10 samples within 300 m of plot center.

- "Opportunistic" samples, if high quality, can be collected in transit, especially if not in the vicinity of a sample plot. Make sure you record that they are opportunistic by writing "N" on the data sheet under "Assoc. with sample plot?" and drawing a line through the "Nearest Plot ID" box. Anything >300m from your intended plot is opportunistic.

- Record the date, time, and GPS coordinates on both the envelope and data sheet; write additional info on the data sheet. See accompanying data sheet instructions for details.

- After the first two samples, avoid multiple samples from a single territory (e.g., collect them >50m apart).If you find a higher quality sample within this 50 m, you may collect it but note it on both envelopes and in the "**Comments**" field of the data sheet.

- Only collect fecal pellets that are in discreet piles (a "sample" is a group of pellets clearly resulting from one defecation event) and ideally not in contact with other, older pellets. Collect the freshest pellets possible and avoid old, weathered pellets. Signs of fresh pellets include:

    - Stuck to rocks with urine (but not cemented with dried, whitish urine)

    - On top of fresh hay piles (hay containing chlorophyll, still green)

    - Greenish in color and slightly damp (or at least not powdery) inside

- **Collect as many pellets as possible from a single pile** (we need ≥3 pellets to use a sample, 10+ ideal) and place in a single envelope (i.e., 1 sample of 3-10+ pellets per envelope)

- Collect pellets using one of these four methods (see what works best for you). ***Rationale:*** *avoid the possibility of transferring pika DNA among samples, and minimize human DNA contamination*:

    1. Pick up individual pellets with "chopsticks" and place in coin envelope without touching the pellets with your hands. You may use twigs or wooden applicator sticks as chopsticks, but DISPOSE OF THEM AFTER EACH SAMPLE OF PELLETS. Do not handle the ends of the sticks that will come in contact with the pellets.

    2. Scoop up the pellets with a plastic "spoon straw" by folding over the open end of the straw and pour the pellets into the envelope. Alternatively, you may scoop the pellets directly into the open envelope. USE A NEW SPOON STRAW EVERY TIME.

    3. Pick up individual pellets using forceps. YOU MUST STERILIZE the forceps with a 10% household BLEACH solution in between every sample. Be sure the forceps are dry before collecting the next sample as bleach destroys the DNA. Flame-sterilizing forceps tips with a lighter after bleaching is also a good idea.

    4. Wearing a disposable lab glove, pick up the samples with your fingers, then THROW AWAY the gloves after every sample.

- DO NOT LET THE PELLETS COME IN CONTACT WITH ANY PELLETS FROM ANOTHER PILE/DEFECATION EVENT.

- Be careful not to crush the pellets, especially if you write on the envelope after collecting the sample. Using a fine-point Sharpie requires less pressure; shake pellets to the bottom before writing.

- Seal the envelopes securely with a piece of tape. Wrapping the tape around the edges of the envelope may be more secure than simply placing a small strip on the flap. **Do not lick the envelopes**.

- Once collected, samples should be dried to avoid molding. Place the envelopes in direct sun (i.e., car dashboard) for a few hours. The heat should not affect dry DNA.

- Store envelopes in a cardboard box to avoid crushing. Label box with: name of collector and park/area in which samples were collected.

- Store the box of samples at room temperature if in a dry environment. If in a wet/humid environment, the cardboard box may be stored in a freezer or with desiccant (silica gel, drierite).

- Samples may be stored until the end of the field season, then mailed to:

  Jessica Castillo

  Dept. of Fisheries and Wildlife

  104 Nash Hall

  Corvallis, OR 97331

Genetic samples for this project are a priority. However, when convenient please collect any additional fresh samples even if you are not sure they will be used by Clint Epps and his Oregon State University lab (i.e., samples <50 m apart). Dr. Epps will provide any extra samples to Jennifer Wilkening at the University of Colorado – Boulder for a fecal corticosterone study.

Pika Fecal Pellet Collection Data Sheet Instructions

An image of the pika fecal pellet collection data sheet can be found in Appendix E and a PDF version for printing can be found on basecamp (file name: Pike Genetic Sampling Data Sheet.pdf).

Also note, if previous fields are the same for multiple samples on the same data sheet, the data collector can write quotations (“ ”) in the boxes to indicate that it is the same as the field directly above.

1. **Park Code:** 4-digit code for the National Park Service unit.

2. **Collected by:** first initial. + full last name (e.g., M. Jeffress).

3. **Date** sample was collected (e.g., 04 Jul 2010).

4. **Time:** Military/24 hour (00:00 – 24:00).

5. **UTM:** Easting (X) and Northing (Y) (e.g., 625026, 4489884). Use points averaging when possible.

6. **Datum:** Document the datum points are being recorded in Example: WGS84

7. **GPS accuracy:** Accuracy of reading. Example: ± 2 m

8. **Assoc. w/ sample plot? (Y/N):** If collected while within 300 m of a sample plot write "Y", otherwise write "N"

9. **Nearest Plot ID:** Name of nearest occupancy survey plot, if within ~300 m. Otherwise leave blank.

10. **Sample Age:** estimate sample age category according to the following:

    1 -Greenish in color, perched in little piles often stuck together with fresh urine, moist when crushed between fingers (note: It is OK to test/sacrifice a pellet with your fingers, but do not collect it and DO NOT touch any other pellets).

    2 -Green or reddish in color, loosely perched but still in piles, dry and hard

    3 -Blackish in color, scattered or not perched, dry

    4 -White in color, scattered or fallen into cracks

    Note: Try to only collect (**1**) or (**2**) and DO NOT collect (**4**).

11. **Condition:** exposed, under rock shelter, on top of hay pile, stuck to rock, etc.

12. **Comments:** Any other remarks you think relevant such as evidence of rain, etc.

Temperature Sensors

Although temperature sensors were not explicitly included in the project proposal and implementation plan, data from their use could be very informative. PI Chris Ray has extensive experience deploying temperature sensors and should be contacted if anyone is considering deploying sensors for this project (contact information in Table 1).

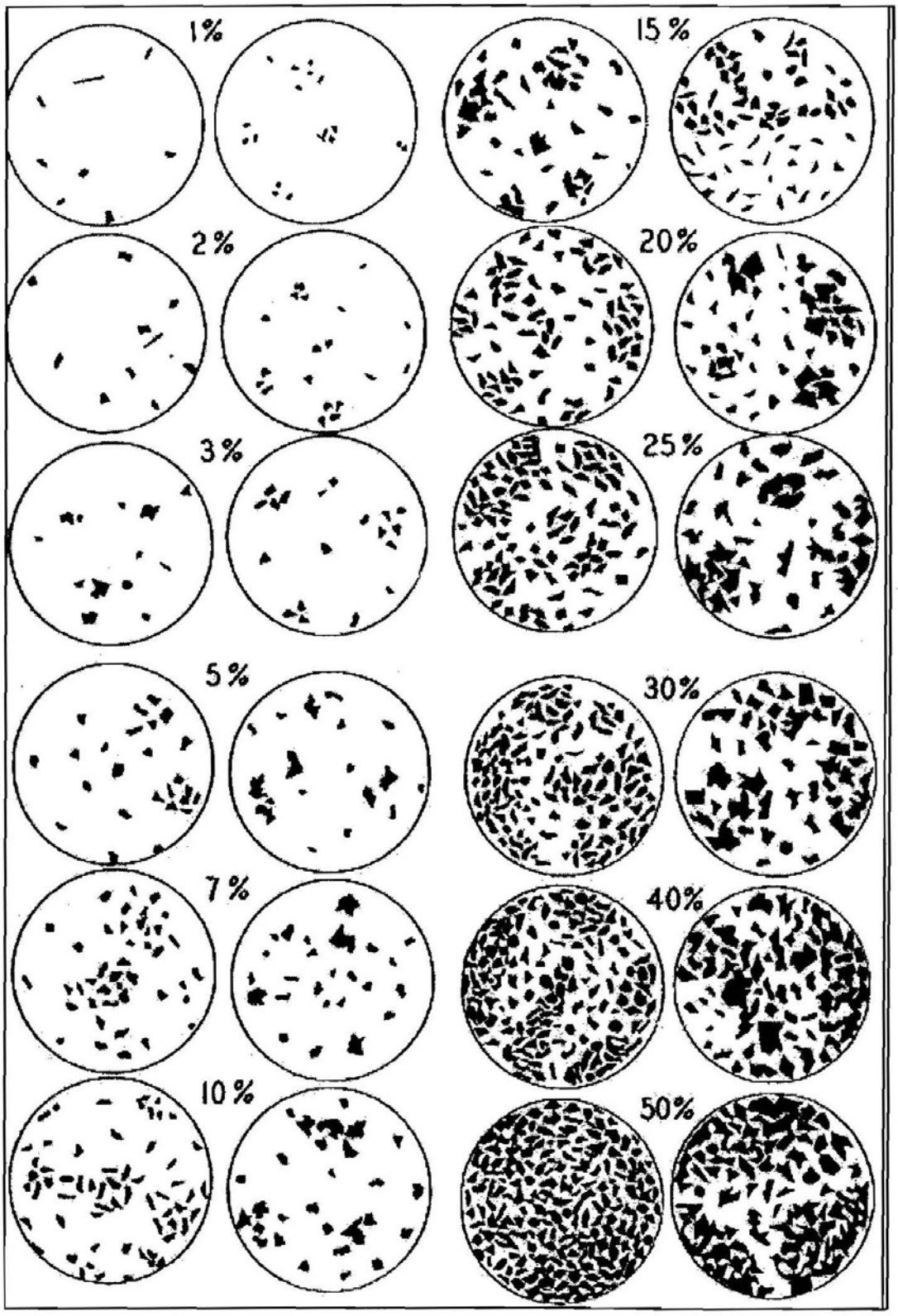
Literature Cited

Rodhouse, T. J., L. K. Garrett, K. Irvine, M. Shardlow, M. Munts, E. A. Beever, and C. Ray. *In press*. Distribution of American pikas in a low-elevation lava landscape: conservation implications from the range periphery. Journal of Mammalogy.

Shardlow, M. R., J. Apel, L.K. Garret, G. Holm, D. Larson, N. Nordensten, and T. J. Rodhouse. 2009. Upper Columbia Basin Network American pika monitoring protocol. Narrative version 1.0. Natural Resource Report NPS/UCBN/NRR-2009/XXX. National Park Service, Fort Collins,

CO.

Appendix A. Ocular Cover Estimation Guide for Circular Plots



Appendix B. 150 Random Distances and Azimuths for Moving Plot Center.

This is an example sheet. Feel free to use this for your park or generate your own from the website: http://www.randomizer.org/form.htm

PARK UNIT

* Start at the top left; cross them off as you use them.

Allowable distance: 1-25 m Azimuth: 1-360 (°)

Distance (m)	Azimuth (°)	Distance (m)	Azimuth (°)	Distance (m)	Azimuth (°)
2	70	22	204	4	242
23	337	3	131	14	117
7	196	19	42	24	137
24	91	7	337	5	261
16	126	12	6	17	289
10	210	1	335	12	74
8	46	6	66	15	103
10	148	24	74	18	188
11	237	11	65	15	178
5	317	21	91	3	231
9	118	16	180	16	102
12	223	12	128	1	203
9	41	10	61	7	11
19	227	2	22	8	322
18	82	6	137	12	21
5	96	18	286	12	261
23	187	16	67	23	247
8	52	12	198	7	140
23	323	14	259	15	217
5	344	8	246	14	96
9	78	5	112	3	153
14	174	19	348	12	229
12	20	1	86	24	2
21	76	13	99	20	107
6	275	19	86	3	287
22	221	20	342	2	299
14	138	23	304	5	260
14	175	25	72	4	311
4	265	17	6	24	34
8	22	4	152	18	94

14	244	16	131	20	170
25	357	15	101	25	6
Distance (m)	Azimuth (°)	Distance (m)	Azimuth (°)	Distance (m)	Azimuth (°)
13	216	6	247	18	8
1	152	18	260	19	17
25	9	7	110	6	305
12	11	7	299	24	143
14	68	13	305	13	33
17	285	23	32	2	54
18	157	19	102	14	298
7	349	2	18	15	186
21	137	11	138	7	179
22	288	20	161	24	281
9	255	14	177	18	246
17	16	8	143	20	45
22	156	1	349	4	150
1	128	25	211	22	193
19	281	18	312	17	50
6	133	24	40	8	142
24	322	21	181	15	213
1	268	24	187	5	237

Appendix C. Pika Survey Data Form

Park:	Plot ID:	Observer/s:	Date:	Arrival time:
GPS acc. (m):	UTM Zone:	Easting:	Northing:	Points Averaged? YES NO
Datum:	Begin time for scat/hay search:	End time for scat/hay search:		Departure time:

Pika sign (types = **P**ika **S**ighting, **P**ika **C**all, **F**resh **H**aypile, **O**ld **H**aypile, **F**resh **S**cat, **O**ld **S**cat)

	Time (24-hr)	Sign type (PS, PC, FH, OH, FS, OS)	If PS or PC, distance (m) from plot center	Largest rock (m) w/in 1 meter of sign	Crevice depth w/in 1 meter of sign	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Vegetation cover (% class) in plot	Rock:	Bare:	Grass:	Forb:	Shrub:	Tree:

Marmot sign: *marmot/s seen:* YES NO *marmot/s heard:* YES NO *scat station/s:* YES NO *den/s:* YES NO Woodrat sign: *nest/s:* YES NO *urine station/s:* YES NO *scat station/s:* YES NO	Weasel: YES NO Other Species *species:*_____ *species:*_____ Rock shade (circle one): *Light* *Medium* *Dark*	Site feature/s (circle all that apply): *runoff under rocks in plot* *pools/wet soil downslope* *riparian veg. downslope* *snow upslope* Temperature sensor deployed? YES NO Genetics sample(s) collected? YES NO # collected:	Skies (circle one): *sunny* *partly cloudy* *overcast* Wind (circle one): *low* *medium* *high* Temp (°F): Distance to forage (m): Depth (m) of deepest talus: *<0.5* *>0.5* *>1.0* *>1.5*
Site aspect (°):	Site slope (°):	Size range (m) of largest 10 rocks w/in plot:	Plot marked? YES NO

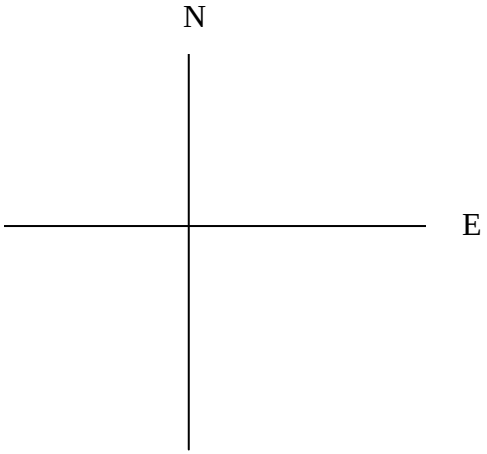
Notes:

Photos: *(coordinates only necessary if taken outside the plot. Also, if need space for additional photos, use the notes section or the edge of the data form.)*

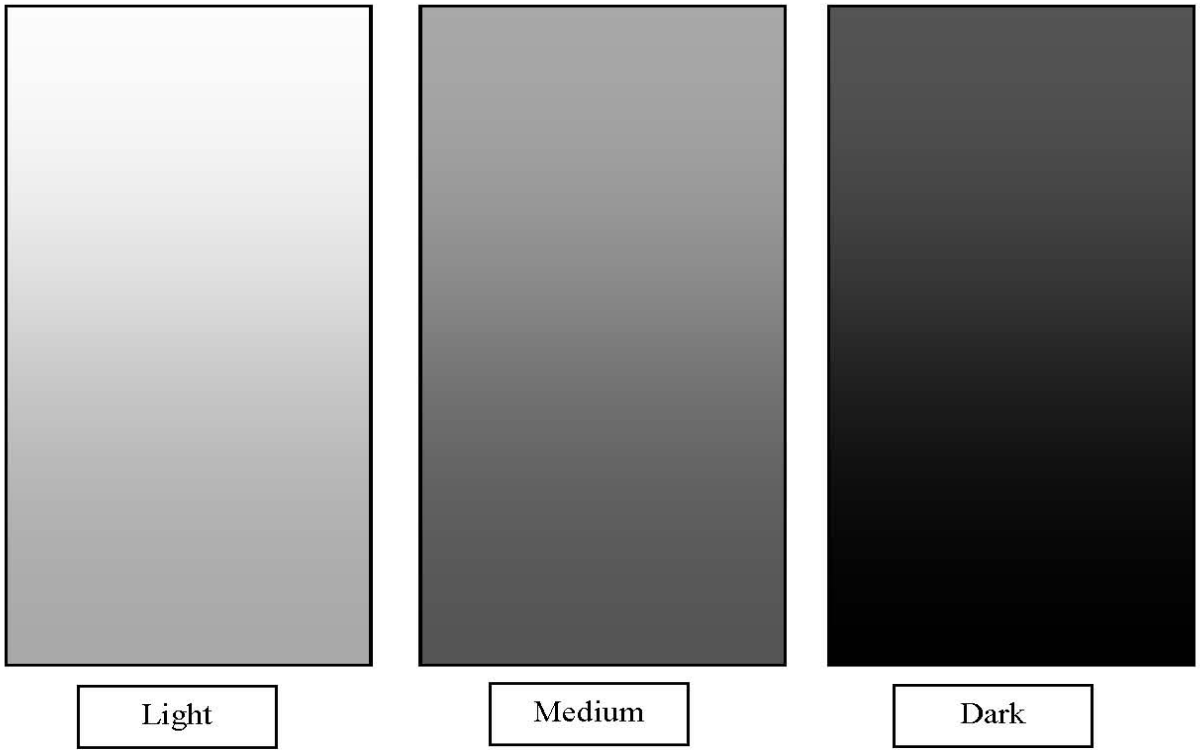
1. Camera: Initial name: .jpg
   Dist. to center (m): Azimuth to center (°):
   Easting: Northing:
   Description: Final name: .jpg
2. Camera: Initial name: .jpg
   Dist. to center (m): Azimuth to center (°):
   Easting: Northing:
   Description: Final name: .jpg

Plot diagram:

Sketch sign locations (w/# from opposite page) and other useful information (e.g., landmarks, marker location,etc



Appendix D. Rock Shade Chart



Appendix E. Genetic Sample Data Form

A PDF version of this data form is also available on basecamp (Pike Genetic Sampling Data Sheet.pdf posted by Jessica Castillo).

Park/Site Name:							Collected by:				
Date	Time	Latitude / UTM N	Longitude / UTM W	Zone (if UTM)	Datum	GPS accuracy	Assoc. w/ sample plot? (Y/N)	Nearest Plot ID	Sample Age	Condition	Comments

Key to Sample Age:

1: Greenish in color, perched in little piles often stuck together with fresh urine, moist when crushed between fingers

2: Green or reddish in color, loosely perched but still in piles, dry and hard

3: Blackish in color, scattered or not perched, dry

Date: 04 Jul 2010 **Time:** Military/24 hour

Nearest Plot ID: Name of nearest occupancy survey plot, if within ~300m. Otherwise cross out box.

Condition: exposed, under rock shelter, on top of hay pile, stuck to rock, etc.

Comments: Any other remarks you think relevant such as evidence of rain, etc.

Note: If the data fields are the same as the field directly above, quotation marks (") can be used to indicate that they are the same. Do not leave any field blank (except Comments).

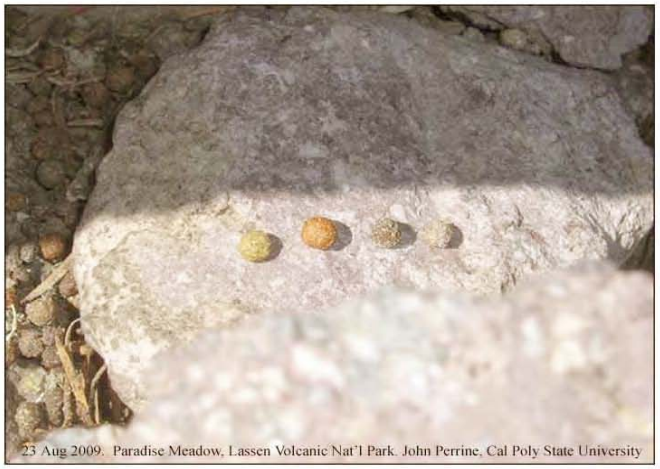
Appendix F. Photo Guide to Haypile and Scat Age and Pellet Collection

Photo of a pika above a fresh haypile (Note: Haypiles may not always be this obvious; photo source unknown).

Photo of fresh pika scat (and urine) and an old haypile with some new material added (Note: this would be ranked as a “fresh haypile” because of the new material; Photo from Craters of the Moon NM&P).

Photo of an old pika haypile (Photo source unknown).

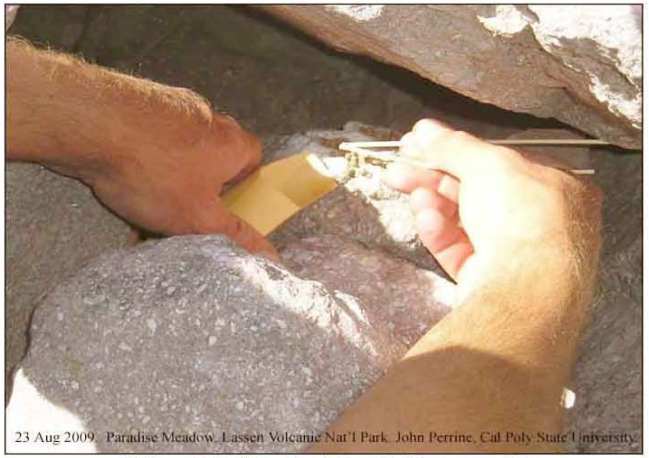
Photo Guide to Pika Pellet Collection



Pellets aged from fresh (left) to old (right). Note both color and size. Only collect if in the 2 left categories. Notice pellets in cracks: we do not want pellets collected if they are in contact with older pellets of questionable origin.

Example of fresh pellets stuck to rocks with urine.

Fresh pika scat, less than 8 days old.



"Chopsticks" method for picking up pellets.