Background

Fishers (*Pekania pennanti*) are medium sized carnivores that were once widely distributed throughout boreal-forested areas in North America (Powell 1993). In Oregon, anthropocentric influences (e.g. trapping and land-use changes) have reduced the indigenous fisher population to single a remnant in the Klamath Mountains in extreme southwest Oregon (Aubry and Lewis 2003). A reintroduction effort from 1961-1981 established a nonnative population in the southern Cascades near Crater Lake and genetic exchange between these two populations appears to be limited (Aubrey and Lewis 2003; Drew et al. 2003). Barriers to connectivity are suspected to be the Interstate 5 corridor, urban development/sprawl, agricultural development and unsuitable fisher habitat (Aubry et al. 2004). While recent detections of indigenous animals near the introduced population show that some individuals are capable of traversing these barriers, the two populations remain functionally isolated. These detections and a lack of contemporary landscape level surveys exemplify that our current understanding of fisher distributions in Oregon incomplete.

In the Pacific states fishers were proposed for Federal listing under the Endangered Species Act as a West Coast Distinct Population Segment in 2014 but were deemed not warranted in 2016. While surrounding states (Washington and California) have placed fishers under state protection, they are not protected by the Oregon Endangered Species Act (Oregon ESA), however, they are listed by ODFW in the Oregon Conservation Strategy as a Strategy Species, and are also considered a Sensitive Species, Critical Category.

Objectives

The primary objective of this study is to determine the distribution of each population and identify potential corridors fisher may be navigating between populations.

The second, and larger objective is to develop a long-term multi-species carnivore monitoring protocol that can be deployed across Oregon and Washington. Establishing species contemporary distributions will be critical to monitoring the long-term viability of a given species as climates shift and/or land-use
patterns change. A standardized regional survey protocol allows for increased data sharing and analytical capabilities.

During 2017, we want to refine focus to quantify the efficacy of a long distance call lure, Gusto (Minnesota Trapline Products). During 2015-2016 our study design was intended to empirically test different aspects of baits, lures, camera set types, and study designs that maximize fisher detectability while allowing for a parsimonious multi-species approach that can be effective at large spatial scales. This season, we aim to standardize techniques to what seemingly worked the best from preliminary summaries of those surveys and vary only olfactory lure.

**2017 season goals:**
- **Collect data with pride, integrity, and safely:** Set cameras in the field safely and effectively – maximize data by checking to ensure the camera is on, operational, and set functionally as well as artistically (you never know where these photos will end up)
- **Establish long term monitoring potential:** We aim to establish the potential for long term surveys at the same location. As such, in addition to prior efforts, we will place a tree tag with the station number engraved on the bait tree (including stations revisited to collect porcupine blocks deployed 2015-2016).
- **Document daily routine:** We need more photographs of stations, crew setting up stations, and field life. You have a digital camera to take photographs – please do so and save/label photos so we can find them later

**Study Design**
The design relies on a coarse camera grid and rotating panels of smaller grids to efficiently sample a large spatial area at multiple scales.

**Terminology**
- **Sample frame:** The spatial and temporal extent to which inference can be made. For example we can make inferences to what percent of an area is used or occupied by fishers during a certain spatial and temporal period (or frame).
- **Primary Sample Unit** (PSU): A discrete cluster of stations at a location. Current pilot work may include 4 stations in formation with prior carnivore monitoring protocols (e.g., Truex et al. 2013), randomizing each set type. The primary sample unit is the level at which a response is observed, which can be selected from the sample frame with a known probability and is representative of a known spatial/temporal extent.
- **Station:** A portion of the sample unit with an individual camera or detection device.
- **Set type** = a characterization combining placement and bait of a station. The set type is determined by a randomized combination of bait and olfactory lure. Possible sets include:
  - Chicken and Gusto™ (Zielinski and Stauffer 1996)
  - Chicken and Mega Musk™
  - Catfood and Gusto™
  - Catfood and Mega Musk™
  - Kitchen sink (chicken, Gusto™, apple, peanut butter, oats, salted wood block [Furnas 2013, California Fish and Wildlife, Ecoregion Biodiversity Monitoring Project]).
- Kitchen sink (chicken, Mega Musk™, apple, peanut butter, oats, salted wood block [Furnas 2013, California Fish and Wildlife, Ecoregion Biodiversity Monitoring Project]).
- No-lure Kitchen sink (above with chicken but without lure)
- Trail, unbaited and no lure

*Check*: the occasion when the cameras are visited, bait replenished, and cameras serviced.

*Check Interval*: number of days between each check. Also referred to as ‘days since last visit’ and ‘interval’.

*Response unit*: This is the smallest level at which a response is observed. This could be a single check of a single camera, where that camera may be nested in cluster of camera stations checked multiple times during the study period within a single sample unit.

*Panel*: A systematic grid of sample units, each with 4 or more stations with each of the set types (design below). For fishers as a focal species, spacing (as of Aug 2015) will be 3km apart, which is approximately the standard deviation of average fisher female home ranges and appropriate for potential spatial capture recapture analysis (Sun et al. 2014).

**Using S1 Mobile and field data collection**

During 2017 we’re going to collect our data using ArcGIS Online and the S1 Mobile field data collector.

**Equipment:**
- Samsung Galaxy Tab A 8BG with 1.5GB ram, 1.3GHz quad core processor & 64GB SD card
- Garmin Glo Bluetooth GPS (for set up specifically)
- S1 Mobile (downloaded and tested)

**Before going to the field in area with WIFI:**
- Download basemaps by going to settings (gear icon), Download data, then either Download ESRI Basemap or Agency Basemap.
  - Download the World topo base for the whole area, from Corvallis to California
    - Label: “Topo_Base”, Level of detail 9 or so (this will give a driving map”
  - Zoom to extent desired by Region – during 2017 we’ll have 3 overlapping regions. Set Level of Detail to 14-15 (you want the download size to be <400MB)
    - Regions = Coast, Applegate, CascadesSo, CascadesAubry, CascadesNo
    - ESRI USA TOPO maps for study area, by region
      - Label = “Region_Topo”
    - ESRI Imagery in tiles by region – you’ll likely want 6-8 regions within our zones (Applegate, Coast, Cascades)
      - This requires even smaller Regions, broken up by direction (e.g., NE, NW, SE, SW, E, W)
        - Label = “RegionZone_Aerial” e.g., ApplegateE_Aerial, ApplegateW_Aerial
    - Agency BLM ORWA Carto by region (3-4 maps)
      - Label = “PLSS_Region”
- Make sure all basemaps, reference maps, and geodatabases work functionally. Select each separately using the 3 dot-dash icon. See if you can zoom in to read roads, streams. The BLM layers are especially important for Public Land System information.
- Download our reference map with point locations and sample units (note it takes ~4 hours to upload from the office if changes are made).
- Download the geodatabase, take test points and testing each field, sync data
  - Ensure sync data is uploaded (Moriarty)

Calibrating S1 Mobile:
- Coordinate system: Click on your GPS (bottom left circle) and wait for your location to appear on the top of the screen. Change to **UTM WGS84** (note that your form will still collect lat/long, but this will show up on all geotagged photos)

Photos: regular, within S1 Mobile: Geophoto or attachment?
- We have the option to embed photos within the data frame OR take them using a different geodatabase
- Station photos - please use Geophoto and relabel (see below in set up section)
  - Our regular cameras are also geotagged and could be substituted and labeled later
- Waypoints, please use an attachment (scat, roadkill, etc).
- Check photos (e.g., bait unusual), please use attachment

Forms fields
- Please fill out all fields.
  - Setup and check form **required** fields = county, sample unit, station
  - Waypoint **required** field = Type
  - GPS locations are also required
- Time needs to be filled out in military, no spaces: 1524, 1321, etc.

**Study Design Types**

- **Standard**

**Large geographic scale (distribution):**
We deemed it important to sample a large geographic area, ensure crews could access sample units, and not duplicate prior efforts. We created a systematic grid throughout the defined study area(s) with 3-km spacing. It would be unlikely to survey all stations within a season, so we randomly sampled from the available sample units. Similarly, Zielinski et al. (2013) surveyed a portion of the study area each summer and would re-sample a certain number of stations each year. Selected initial survey areas (for 2015 and 2016) included these criteria:
  - Minimum of 6-km spacing between points using Geospatial Modeling Environment (GME, genrandpts)
  - Within 1000-m of a road or highway (BLM OR roads layer, downloaded 2014) or
  - Within 250-m of a trail
  - Not located in non-forested environments (e.g., Willamette Valley, lakes)

**Intermediate geographic scale (detectability):**
Randomized large-scale surveys have uncertainty associated with not detecting animals even when present. For fisher, per-visit detectability can be low, even less than 25% when animals are present (Popescu et al. 2014). As such, additional resolution in survey design is desired to better understand the scope of our inferences.

A panel will be an area where all stations within the grid are surveyed, not merely a sample of units. A panel will minimally consist of a 4x4 grid (16 sample units) with 3km spacing between units. We anticipate a maximum of 6 panels deployed across the study area(s) as permitted by logistical constraints (e.g., camera availability, vehicles, technicians). We surveyed a panel in the Medford-Klamath Falls study area both with detection dog teams and cameras during summer 2016. This area had fishers with GPS collars collecting movement data. We also surveyed a panel in fall 2015 in the Ashland watershed to describe potential biases with camera distances and lure types. Ashland watershed also has a history of known, radio collared fishers.

2016 Distributional Surveys- Based on the results from the distributional surveys in winter 2016, and concurrent with objectives identified within the Oregon CCAA community, surveys in the summer of 2016 focused on two areas in the southern Cascades, the southeastern block (SE Block) and northeastern (NE Block). Objectives for the SE Block were to elucidate the area where the introduced and indigenous populations appear to be interacting. 23 stations detected fisher, but genetic results have not been completed.

Surveys during winter 2016 detected one individual from the reintroduced population. The survey failed to detect the population of reintroduced fisher studied by Aubry and Raley (2006). We began surveys in this region during summer 2016, detecting fishers at 7 stations. Much of summer 2017 will be in the Aubry and Raley study area and to the north with the goal of identifying the population extent.

Deviation from the Standard sampling protocol

Sample unit placement will differ from the main protocol by modifying the current Sierra Nevada Forest Carnivore Phase 2 protocol (Truex et al. 2013, Zielinski et al. 2017). Stations will instead be set apart from each other in the shape of an equilateral triangle. This amounts to a repositioning of stations 4 and 5 by 294m so that all three baited stations are 1000m apart. One trail set camera will be placed on the best available trail found en route to the three baited stations and placed >50m to another station.

Additional deviations from the standard sampling protocol are the use of longsets, or units that are not be checked regularly.

Micro-site placement and camera set up will follow the protocol outlined below in the Detailed Station Setup Section except where noted here. At each bait station within a sample unit, bait set types will be the kitchen sink (Furnas 2013). Gusto applications will be randomized such that sets are either (1) Kitchen sink with gusto, (2) Kitchen sink without gusto, or (3) gusto only – no bait. Due to the potential for a long duration of camera deployment we will nail a film canister with holes drilled into the sides or similar container filled with Gusto to the bait tree or deploy a long duration. Glyercin may be added to the Gusto to combat freezing and desiccation of the lure.

The vertical placement of cameras and bait will be low, at marten/fisher height along a small animal run or log, ideally in an area with high ground cover (>60%). Low sets were based on survey methods in
western Oregon which successfully detected short-tailed weasels (*Mustela erminea*; Linnell 2014), and slightly higher numbers of detections of coastal marten (*Martes caurina* spp.; Moriarty et al, in review).

For Low sets with cameras:
- Identify a log or a tree immediately adjacent to a log to place the bait on. If there is no log, identify a shrub and try to find a gap with a small animal run through it, make sure the gap is >10cm. Place the bait 0.4m above ground height such that a marten can reach it but smaller mammals cannot without climbing, ideally on the side of the log or tree. If placed on a shrub stem, use bailing wire to wrap around the narrow end of the chicken drumstick or cat food can. Place signage and a measure strip as possible within the camera frame.
- Place the remote camera parallel with the log or small animal run using either a strong tie attached to the log or tree or a fence post hammered into the ground with the camera attached. Camera should be placed 3 to 5m from the bait and be placed 0.5—1m above ground level.

**Primary Sample unit placement in the field**
A primary sample unit consists of 4 remote camera stations: three baited stations (labeled 2, 4, 5) and one unbaited trail camera paired with one of the systematically stations arranged around the center point and congruent with the current Sierra Nevada Forest Carnivore Phase 2 protocol (Truex et al. 2013). Station 1 is the center point of the sample unit and each subsequently numbered station is located 500 m from the center point at 72° increments starting with station 2 at 0°:

![Sample unit diagram](image)

Identify the sample unit to be surveyed using the GIS layer, aerial photographs, and maps depicting recent road operability. Create an access plan to get to the location and have appropriate gear.

Every effort should be made to access the sample unit but circumstances may require offsetting stations from their original locations. In only extreme cases should the entire sample unit be abandoned.

**Sample unit abandonment:**
1. If the sample unit occurs entirely on private property that we do not have permission to survey or such private property must be crossed to access the sample unit (e.g., small land owners, pasture).
2. If the sample unit occurs in extreme terrain, >45° slope, or requires crossing a large river or water body.
3. If the closest station to a road or trail is >2 km.

**Moving a station in the sample unit.**

Determining which stations lay on inaccessible private property prior to starting fieldwork saves a lot of time in the field. In most circumstances, access issues will be limited to 1 station. This station may be moved in a random distance and direction in the following way:

1. Offset station 100m in a random direction. Randomize by spinning the dial of the compass for ~10 seconds. Vary spinning using long and short spins. If that is not sufficient:
2. If the station(s) lie on inaccessible property, dangerous terrain, or unsuitable habitat (pasture, lake, etc.) then the stations can be rotated keeping the spacing original. For example if the “2” station is on private property then you sample either stations “5,6,3” or “3,4,6”.
3. Offset 201—560 m in a random direction. Again, use a compass to randomize direction. Randomize distance by spinning compass and adding 200 m to randomized compass bearing.
3. If the station is still located in dangerous terrain, abandon the station. Survey 1 random station from remaining available stations (1, 3, 6).

**Prepare equipment to set 3 sample units each day in the first week if you have the time.**

It will be ideal to have additional sample units set, but driving time or station access may make it difficult. If there are two teams in the field, be prepared to help the other team with any duty at any time.

**Detailed Station Setup**

**Navigation, the form, and data at setup:**

1) Turn on GPS prior to arriving in dense canopy cover. This will improve accuracy of the GPS and facilitate accurate placement of the station.
   a. Use a GPS (e.g., Garmin Glo with Bluetooth) for set up and NOT just the GPS in the phone/tablet. Although the precisions suggest they are similar (the phone says it has 20 satellites and 5m accuracy) several tests suggest the accuracy is higher with the purchased GPS. See also other sources: test1, gpsreview2
2) Test cameras prior to deployment. Make sure date and time are set, SD card is formatted, and batteries are at full capacity.
3) Prepare for camera set up scenarios. Carry all tools and resources required set up of remote cameras (Table 2).
4) Train field personnel to standardize distance measurements with readily available metrics, such as stride length (e.g. measure number of strides to reach 2.5 m), or the measuring strip (it should be one meter + or – a few cms) to estimate the suggested distance between remote camera and bait at baited sets.
5) During set up, please collect “station photos” – 6 in total at minimum using S1GeoTag Photo.
a. Starting with the sign with station information (e.g., JACK-5536-2-150611), then north, east, south, west, up, and the station device (camera facing bait, be able to show folks what that station looked like 5 years later).

b. **Label the station photos in the field after you take them!**
   i. Go to MyFiles
   ii. Click and hold down on photo.
   iii. Rename countyStation-S (copying the base by clicking and )
      1. COOS-1234-Stn (station info)
      2. COOS-1234-N, COOS-1234-E, COOS-1234-S, COOS-1234-W
      3. COOS-1234-U (up, for general canopy measurement if needed)
      4. COOS-1234-Dev (camera facing bait)

c. **Photos might disappear after they are renamed but they should be saved at:** /SDcard/Android/data/gov.s1.s1mobile/S1Photos

**Remote Camera Settings**
For initial set up, we recommend the following settings:
CAMERA MODE: set to camera, not video (although a combination of photo/video may be helpful when fishers are detected)
TIME STAMP: should be **ON** and checked every visit to ensure date/time stamp accuracy.
SENSOR SENSITIVITY: set to "**HIGH**"; set to "NORMAL" if "HIGH" is too sensitive and results in continuous photos with no animal trigger
CAMERA DELAY: set to **30 seconds**
PHOTOS PER EVENT: 3 photo per triggered event.

**Baited sets**
Navigate to station locations using map, compass, GPS, roads and trails.

**Macro-site placement**
- Do your best to get the exact location as shown by your GPS but stations can be placed within a 100m buffer around the point to accommodate for terrain, minor private property adjustments, small meadows, etc.
- Stations should be located >50 m from any road, including un-maintained roads but still within the 100m buffer.
- Avoid placing stations in areas with little to no airflow (tight draws, slot canyons, etc.). Keep in mind that the smell of the bait will be attracting animals, however, do not stray far from the point.

**Micro-site placement and camera set up**
- Identify a group of trees with a potential bait tree and a camera tree ~2-3m from the bait (9-9’). The grouping should allow the camera to face generally north to reduce false triggers and backlit photos.
- Snags should be avoided when possible.
- Set types include: kitchen sink (Furnas 2013) with gusto (Minnesota Trapline Company), kitchen sink without Gusto™, and Gusto™ (unbaited) as well as an unbaited, unlured, trail set.
To determine which set type is at each station we randomized the combinations for each sample unit and assigned a random number in excel, where within each set the lowest number was assigned to gusto and the highest number to kitchen sink with gusto.

Attach the camera to the selected tree using a cable lock or strap. Use splints (sticks) placed behind the camera to aim the field of view so that the bait is centered and the ground is captured in the frame as well as the sign, measuring strip, and some of the adjacent area. The visual lure, if deployed, should be just outside of the photo frame. These lures are based on movement and could trigger the camera. If an animal walks by – ensure your set can detect it!

Final step: After remote camera and bait are both set, test camera sensitivity and orientation to bait. Turn camera to ON, move to immediately adjacent to bait. Move your hand and forearm (hinge at the elbow) up and down at moderate speed in the area 30 cm above and below the bait. Repeat for 30 seconds. Check images recorded during the 30 second period. If functioning properly, the camera should have triggered 2 times, resulting in 6 images (2 triggers, 3 photos each) should have recorded. All images should have been triggered by the motion of the hand and forearm and not by any other body movement. Move the camera as close as 1.5m from the bait tree if no images were recorded. Repeat camera testing. If no images record, replace the camera.

**Hair Snare** – Use a track plate box with hair snare after a fisher or marten has been detected.

**Measuring strip** – Fishers are sexually dimorphic and males can be distinguished from females by measuring total body length. In remote camera photos, fisher body length can be measured using a measurement strip placed vertically adjacent to the bait. The measuring strip is a 1cm wide piece of yellow polystrapping that is 60-100cm long and has alternating reflective and sharpie bands every 20cm such that it is divided into 10cm increments. Use square U nails or staples to secure the polystrap, covering sharpie lies.

**Signage** - Use a piece of polyboard or write in rain and sharpie to write the station label in BIG letters to be seen by the camera: County (4-letter code) – Sample Unit ID – Station Number – SetUpDate (YYMMDD) – Bait (C = chicken, F = cat food, K = Kitchen Sink, T = trail) - Lure Type (G= Gusto, M= Mega Musk) - Visual Lure (F = Flasher deployed, N= No flasher deployed) (e.g., JACK-5539-2-150611-C-M-F). Place this <20cm above the bait, and make sure it is in the photo frame! This label will carry over to the photo labeling and it is VERY important that everything is exactly the same format for all photos (with the exception that check date will be in the label instead of set up date).
Example of a sign from Douglas County, unit 3245, station 4, with kitchen sink, gusto, and high camera set, and deployed on August 09, 2016.

**Bait**

Kitchen sink (Furnas 2013): Uses an array of different baits. Approximately 500 grams of chicken parts (1 chicken leg) and a can of fish-based cat food are secured to the bait tree in the same manner as described above. Half an apple is attached with a nail beside the measuring strip. A biodegradable 23-centimeter diameter wood or cardboard plate containing 500 ml of peanut butter/oats/sliced mixture is placed at the base on the tree slightly angled towards the camera. Nail the plate to the tree to keep animals or wind from moving it. Approximately, 7 diced pieces of the remaining half apple are arranged in a ring around the oat pile.
Example of a camera station deployed with kitchen sink bait type, measuring strip and sign.

Scent Lure-
One of two possible olfactory lures (Commercial trapping lure GUSTO™ or MEGA MUSK™, Minnesota Trapline Products, Pennock, MN, http://www.minntrappprod.com/) will be used at baited stations and are applied using an identical process. The lure should be placed at an elevated location at each station during set up – think about wind, wind direction, and maximizing distance the scent could extend.

We soak 2” pieces of sponges or cotton t-shirts tied to strings or flagging in a bag before the survey. If cotton pieces are unavailable a “tsp of lure can be placed on an elevated branch near the center of the frame. Make sure to place the lure in an area where wind can carry the scent further than the exact proximity of the station. Dab a very small amount of lure, (smaller than an eraser head) just above the bait. If the bait is removed, animals will still be drawn to the center of the frame.

Tree tag -
Etch the station number (e.g., COOS-1567-2-K-G; COOS-1567-2-G) on a tree tag and hang it on the bait tree at breast height (above the bait). If the camera is north facing, then this tag should be approximately south facing. This will be very helpful if the PNW executes a long-term monitoring project as we’ll want to be able to survey at the exact same location.

Unbaited trail set
One unbaited trail set will be placed near station 2.
- 50—150 m from the baited station select a hiking trail, game trail, overgrown road, or drivable dirt road with low traffic volume. This can be along the access station to the trail although caution should be used is set on access trail.
• To attach the remote camera, select a tree immediately adjacent to the trail with an open lower bole. Ideally the tree selected is close to the trail along a straight stretch of the trail such that the sensor is projected as far along the trail as possible. The camera should be angled at ~45° to parallel (0°) with the trail (where 90° is perpendicular to the trail) to best capture images of an animal traveling quickly. Check to make sure that the photo center is ~2.5 m from the camera and parallel to the trail. The camera sensor should be parallel to the ground, adjust to accommodate slope.

• If available, always use a black LED remote camera.

• It is highly suggested to use a locking cable AND security box, especially if the unbaited trail set is placed adjacent to a road.

• Because there is no bait, these cameras do not need to be checked until they are pulled.

Example of un-baited set placed on trail.

Genetic sampling

Genetic samples for rare species (fisher, marten, red fox, wolf, or porcupine) are highly valuable and identifying which population (indigenous or introduced) each detected fisher belongs to is a top priority.

Fisher or marten- Once a fisher or marten is detected, immediately deploy a track plate box or hair tube with a hair snare in addition to the remote camera. Ideally the track plate box would be placed such that the entrance is in the lower picture frame of the remote camera.

Track plates should have 2 snares for fisher or 3 snares for marten, each smeared with mouse glue. Snares are either gun brushes or 3” bolts with glue. See below for additional details on track plate box set up.
Check and re-bait the hair snare track plate box with the remote camera monitoring at least once a week for up to 3 additional weeks. Re-bait the box with the same bait type that is used at the remote camera set but do not rebait the tree! We want to encourage the animal to enter the track plate box.

*Genetic sampling protocol for wolf, red fox and additional rare species to-be-determined after the pilot is complete*

Genetic samples can be ruined such that they can no longer amplify if they are exposed to light, moisture, or a combination of these factors. Please keep all samples in a labeled vial with desiccant stored in a box or bag in a cool climate. Send them to Katie Moriarty, Forestry Sciences Laboratory, 3625 93rd Ave SW, Olympia WA 98512.

**Track Plate Station Design:** Track plate stations consist of a triangular shaped Coroplast cubby that is 32” long and 10” at each side with a 2” extension on one side for clipping or taping the structure together. Mesh hardware cloth block off one end of the cubby and is secured to the cubby using zipties, bailing wire, and duct tape. We often use bailing wire on the top flap so the box can be easily opened and closed during station checks. An aluminum plate slides under the snare and has a section with non-toxic copier toner and contact paper to collect tracks.

**Selecting a Location for the Track Plate Station:** Once a fisher is detected, a suitable site for setting up the track plate station must be selected. Ideally, track plate stations should be established on level terrain and if this is not present, field personnel must create a level surface by digging into the soil or piling debris. A level surface is critical for stability of the station, encouraging animals to enter the box, and for the collection of high quality tracks. Track plate stations should be set against a log, rock, tree, shrub or other ground feature that provide added stability. Once a suitable location has been selected or created, assemble the track plate-snare.

First assemble the hair snare and secure each gun brush/bolt. Add the sticky glue compound to each of the snares by placing device on the flat mouse glue pad snug to the glue. Next, roll slowly and use a razor blade to cut glue from pad along the snare device. The snare should be entirely covered in mouse glue at the end of this process – it’s trickier than it sounds but gets easier with practice. Carefully attach these to the track plate without touching the glue.

Tie in the bait with fishing line by feeding the end of the line through and hole in the bottom of the cubby (near the hardware cloth edge of the cubby) and tie it to a washer on the outside of the cubby. Tying in the bait increases the likelihood for capturing hair as the animal will have to pull on the bait, and come into more contact with brushes in the process, to get the bait out. Assemble the cubby into the triangular structure by securing the 2” flap with a large binder clip and attach the hardware cloth screen with zip ties/bailing wire to the back of the cubby – do not let an animal sneak through the back.

Attach the contact paper sheet by peeling back the wax cover sheet away from corner such that tape and paper are sticky side to sticky side. Attach tape to the underside of the track plate. Place track plate near the entrance of the station, as while as flat as possible, apply a thin layer of toner to the entire entrance portion of the plate using toner (<1 level teaspoon) and a make-up brush to distribute the toner evenly. Experiment with the toner using your finger to see how little you need to apply to get good prints. The layer should look like a thin dusting of toner, not a solid black layer.
Overuse of toner results in poor quality tracks. Good quality tracks can be measured to identify the sex of the fisher or marten that made them.

After toner is applied, remove the wax cover sheet from the contact paper (exposing the sticky surface) and gently slide the plate into the box and under the internal snare collar. Check that the bait is located on the center of the non-tonered portion of the plate at the rear of the box. Check that the track plate is flat and stable; failure to position the track plate in a stable, level position may discourage animals from entering the box. Finally, check that the track plate set such that it is tilted slightly to the rear to prevent any bait drippings from soaking the Con-tact paper.

The last step is to further stabilize by adding forest debris (e.g., branches, bark) on the sides of the box to lessen movement by wind or animals.

Digital Photo Storage and Management: Management of digital photos is recommended using a hierarchical file structure to maintain linkage of photos to each year’s survey effort, survey unit, and station. Dates for digital storage are in the format YearMonthDay (YMMDD). These folders match the file structure in your Upload folder.

There will be thousands of photos and terabytes of data. If you label EXACTLY, then we can use programs to extract the data and upload the labeled data into a database (e.g., excel).

We suggest the overall hierarchical file structure of:

Fisher_SWOR_Survey_Photographs (folder – for southern Oregon)
Fisher_NorthernCascades_Photographs (folder – for the north Cascades of Oregon)
RemoteCamera_RawPhotographs (folder)
    CURR-0548-2-150531-CHECK1-C-G-V-N (folder)
        County – Sample unit – station – date checked – check – bait – lure – flasher (N if otherwise) – proximity (F for far is more common)
        Contains: Unedited photographs from the first check, at sample unit 0548 in Curry county at the 2nd station with chicken (C), collected 31May2015, Gusto (G), Flasher deployed (V), and near camera placement (N).
    CURR-0548-5-150603-CHECK2-F-M-N-F (folder)
        Contains: Unedited photographs from the second check, at sample unit 0548 in Curry county at the 5th station collected 03June2015, with catfood (F), Mega Musk (M), no flasher (N) and with a far camera placement (F).
RemoteCamera_LabelledImages (folder)
    Contains: Labeled photographs that contain a reference photograph of each visit (1 photograph of the person checking the camera upon arrival and departure) and EVERY animal detected. Label = CURR-0548-2-140603-CHECK1-K-G-V-N-C-Species1-Species2-Species3 (order)
        Species1 will always be the species of interest if it’s detected (e.g., PEPE, MACA) From there, go in order of body size.
        Species in NOT necessary for this folder name or individual photos – the tags will be appropriate. However, if we’re quickly going to stations with PEPE detections, then it is helpful to label the folder after the photos are edited
RemoteCamera_FisherPhotos (folder)
Contains: Labeled photographs with a fisher or suspected fisher. Photos copied, and not relabeled, from the RemoteCameraPhotographs CURR-0548-2-140603-CHECK1-C-G-V-N- (order). This way we can go back to the RemoteCameraPhotographs and RawPhotographs to see visits before and after

TrackPlate_Tracks (folder)
Contains: Labeled photographs of tracks and scanned tracks on Con-Tact paper from track plates (labeled contact paper with a ruler) Label = CURR-0548-2-K-140603-CHECK1-K-G-V-N-Species1-Species2
Species 1 always PEPE if present

StationPhotographs(folder)
Contains: Labeled photographs of station photographs (cardinal directions)
Label = CURR-0548-B-140603-SetUp (order)

FieldPhotos(folder), contains the following subfolders: Animals, Crew, Scat, Landscape, etc. Contains: Labeled photographs taken in the field that you want to share for powerpoints.
These are quite important for later. Please take pictures of the crew, setting up stations, and some of the cool things you see. Then, for the really good photos, please copy them into the Favorites folder.

Favorites (folder)
Contains special photos that are so incredibly awesome that they need to be shared.

Remote Camera Photos--(all remote camera pictures): All photos should be downloaded from SD cards and stored in individual folders that indicate the station where they came from and the date the card was removed, or downloaded in the field, from each remote camera. In the office, all the photos can be batch relabeled using the following steps to ensure consistent labeling of all raw photos:

CREATE SUB-FOLDER in RawPhotographs: Make a folder for the raw data and copy pictures in this folder
LABEL FOLDER: County-SurvNumLoc-Station-YYMMDD-Check#
COPY RAW PHOTOGRAPHS to TEMP FOLDER, RE-LABEL ALL PHOTOS using the following steps, and COPY REMAINING PHOTOGRAPHS (not the folder) to RemoteCameraPhotographs:

1. Either plug in your camera and open the folder with photos or remove the SD card and open the folder
2. Create a folder for the unedited images in the RawPhotograph folder
3. Copy all photographs into this folder – DO NOT EDIT unless there are >5 observer photographs during set up/arrival. You may delete some observer/set up photographs but leave at least one so others can know when you visited the station.
4. Create a temporary folder and copy all raw photographs to the temporary folder
5. Highlight from the bottom up of that group and hit F2 to rename label. This will allow you to label multiple photos at once.
   i. Label: County-Survey Location Number-Station-Date (YYMMDD)_Check#
   ii. DOUG-1455-2-140625-Check1
6. This should create a numeric order at the end (1), (2), etc.
7. Carefully go through photographs and delete images without a biologically relevant object (Relevant = any animal or human visit, not relevant = grass moving). YOU MUST BE CONFIDENT THERE IS NOT AN ANIMAL IN A PHOTO BEFORE DELETING IT!!!
8. Do not relabel the photographs, the number represents the order in the RawPhotograph folder
9. Copy all edited photographs into the RemoteCamera_LabelledImages folder. Because you labelled the county, site, and date correctly, these will sort automatically.
10. Copy all fisher images into the RemoteCamera_FisherPhotos folder.

Remote Camera Photos—Tagging (an optional step for collaborators, we can do this otherwise)

Tagging allows all the animals to be searchable in Windows Explorer. We can also export the data from tagged photos (including the date, time, label, etc) into an excel sheet. We’re using Google Picasa, a free photo viewing platform. However, this is no longer available. We still have copies for new computers but we will be switching to a new platform in 2017.

To begin tagging, open one of the folders within “RemoteCamera_UntaggedLabelled” and click on the tag icon at the bottom right of the screen, opening the tags panel on the right. Tags are applied by typing the appropriate tag into the tags box. There is a “Quick tags” feature at the bottom of the panel that can be used for animals seen often, up to ten unique phrases. Each photograph should be tagged with the following:

- 4-letter species code (e.g., PEPE, MACA, LYRU, SCGR, see end of protocol)
- Camera type (BUSHNELL, BROWNING, MOULTRIE, CUDDEBACK)
- Flash type (IR, BLACK)
- Approximate shrub or sapling percent cover of the station (LOWSHRUB (<10%), MODSHRUB, DENSESHRUB (>60%)
- station type (HIGH, LOW, NEAR, FAR, GAMETRAIL, HIKEARAIL, DRIVEROAD, OLDROAD, REST, DEN)
- Date camera setup (SET160531)
- Phototagger initials (e.g., JEE)
- bait status (BAITPRESENT, BAITCHEWED, BAITABSENT, BAITNA)

With the exception of the species and behavior, the above tags will be the same for an entire folder and can be applied at the start of the folder by ensuring that the entire folder is selected when the tag is added.

Note behaviors for fisher, marten, or their potential predators (bobcat, lion, raptors) if known:
Behavior:  * new tags must be approved by Moriarty before use. Please write Moriarty an email with explanation of behavior so all protocols can be modified. Also note, there is a different and more specific tagging protocol for rest/den monitoring.

- INTERESTEDBAIT, NOTINTERESTEDBAIT (is the animal eating or just passing by)
- BAITCONSUMED (this would be used for future detection rates)
- CLIMB TREE, GROUND (maybe a factor of predation risk)
- PREYCARRY (any species carrying any prey, add additional tags for the species)
- PREYCONSUME (any species consuming any prey, add additional tags for the species)
- PREY=xxxx (4 letter code of prey item, e.g., VOLE, FROG)
- KITCARRY
- KIT (kit present but not being carried)
- ENTERING (entering or leaving site/rest site, again – any species)
- LEAVING
• INTRXN (two animals of any species interacting)

• RESTING (animal is sleeping on camera)

Images where the animal cannot be identified can be tagged with “UNKN” and images where there does not appear to be a subject NONE. There is one case in which two animals share a 4 letter code, coyote (*Canis latrans*) and golden mantled ground squirrel (*Callospermophilus lateralis*); coyotes should be referred to as CALA and golden mantled ground squirrels as CALL.

All tags should be all capital letters.

Note the amount of shrub or sapling cover in the image. Either low shrub (not really notable, <30%) or dense shrub (extremely notable, >70%). Moderate shrub is anything in between. Keep these all one word please (i.e., lowshrub, modshrub, denseshrub).

Station type refers to whether the station was a “near” or “far” (should have N or F on the label near bait) or trail. Differentiate to the best of your ability whether trail sets were on a game trail, hiking trail, drivable road, or unused old road but cars couldn’t drive on it. Keep these to one word (i.e., gametrail, hikingtrail, driveroad, oldroad).

Bait status if present and unknown if chewed should just be ‘BAITPRESENT’. If it’s just a bone, that’s chewed (BAITCHEWED). If bait was present then removed use absent (BAITABSENT). Nobait should be tagged only on trail/road/rest site sets that never were baited (BAITNA).

Once a folder has been completed, it can be exported with the tags into a new temporary folder, which should be labeled as tagged and saved. Then copy all labeled tagged photos into the “RemoteCamera_LabelledTagged”. You should be able to verify that the tags have been applied by right-clicking on a selected image, selecting properties, and any tags should be displayed in the “details” tab in the “description” box.

**Please copy all fantastic remote camera photos into a folder titled: FAVORITES_Best_of_the_Best**

**Summarizing and Sharing Data**

Data contributed to this project will be housed in a to-be-determined location. All data contributed to this project will be subject to the use restrictions and conditions listed in the forthcoming Data Sharing Agreement, to be developed in the near future. Our goal is to streamline the data summary and sharing process to be user friendly. For now, contact Brent Barry (brent.barry@oregonstate.edu) and Katie Moriarty (kmoriarty02@fs.fed.us).

**Literature Cited**


Aubry, K. B., and C. M. Raley. 2006. Ecological characteristics of fishers (Martes pennanti) in the southern Oregon Cascade range. USDA Forest Service, Pacific Northwest Research Station.


Figure 1. Potential survey points for Pacific fisher and carnivore monitoring summer 2017.
### Table 1. **Station Set Up** Equipment Checklist

**General Equipment Needed for Station Set Up:**
- GPS unit and station coordinates/shapefile
- Field maps, air photos, etc.
- Compass
- Digital camera (viewing test shots, station photos)
- Card viewer (charged; optional if above is not available or working with camera format)
- Bait: *chicken* ~ .5kg (approx. .25kg at kitchen sink and chicken station, check package weight for approximate weight of drumsticks), *catfood* - 2 cans (1 at catfood and 1 at kitchen sink), *peanut butter* and oat mixture ~ 500ml for kitchen sink, *apple* - for kitchen sink.
- Lure: Gusto and gusto cloth(1/station)
- Spare snare hardware (washers, bolts, nuts)
- Flagging
- Sharpies
- Multi-tool

**Personal Equipment**
- First aid
- Radio/cell phone/SPOT
- Latex gloves
- Hand sanitizer
- Water, electrolytes, food

**Equipment Needed for Remote Camera Station Set Up:**
- Remote camera (camera unit, bear box, cable lock)
- 4-8 AA batteries per camera
- 1-SD card per camera
- Camera mounting brackets, washers, aluminum nails
- Scent blocker spray (e.g., White Lighting)

**Equipment Needed for Track Plate Station Set Up:**
- Sticky mouse trap paper (1 strip/snare)
- Toner & makeup brush
- Zip-ties (many)
- Duct tape
- Fishing line, bait
- Gun brushes or 3" 8-32 bolts (3-4/station)
- Sticky mouse trap paper
- Contact paper
- Hardware cloth backing
Table 2. **Station Check** Equipment Checklists

### General Equipment Needed for Station Checks:
- Digital camera
- Hair sample vials with desiccant
- Gun Brushes/bolts
- Sticky mouse trap paper, box cutter
  - Bait: *chicken* ~ .5kg (aprox. .25kg at kitchen sink and chicken station, check package weight for approximate weight of drumsticks), *catfood*- 2 cans (1 at catfood and 1 at kitchen sink), *peanut butter* and oat mixture ~ 500ml for kitchen sink, *apple*- for kitchen sink.
  - Lure: Gusto and gusto cloth(1/station)
- Garbage/Old Bait Bags
- Sharpie
- Flagging
- Field maps, GPS, Compass

### Personal Equipment
- First aid
- Radio/cell phone/SPOT
- Latex gloves
- Hand sanitizer
- Water, electrolites, food

### Equipment Needed for Remote Camera Station Checks:
- Cleared SD cards for swapping into cameras
- Scent blocker spray (e.g., White Lighting)
- Extra AA Batteries
- Keys/codes for cable Locks
- Hammer, nails
- Bailing wire
- Card viewer (if marten detected, set out track plate-snare)

### Equipment Needed for Track Plate Station Set Up/Check:
- Document protectors (Acetate)
- Contact paper (cut for track plate & lifting toner prints)
- Toner & makeup brush
- Zip-ties
- Duct tape
- Fishing Line
- Spare metal washers
- Gun brushes/bolts
- Box cutter/utility knife to cut the tracks and fit in document protector
<table>
<thead>
<tr>
<th>Group</th>
<th>4-letter</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustelids</td>
<td>GUGU</td>
<td>wolverine (Gulo gulo)</td>
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<td>Mustelids</td>
<td>LUCA</td>
<td>river otter (Lutra canadensis)</td>
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<tr>
<td>Mustelids</td>
<td>MACA</td>
<td>Pacific marten (Martes caurina)</td>
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<td>MASP</td>
<td>fisher or marten</td>
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<td>MUER</td>
<td>ermine (Mustela erminea)</td>
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<td>long-tailed weasel (Mustela frenata)</td>
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<td>mink (Neovison vison)</td>
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<td>domestic (house) cat (Felis cattus)</td>
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<td>URAM</td>
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<td>LEAM</td>
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<td>SYSP</td>
<td>Sylvilagus species (cottontails)</td>
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<td>SYBA</td>
<td>brush rabbit (Sylvilagus bachmani)</td>
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<td>DIVI</td>
<td>Virginia opossum (Didelphis virginiana)</td>
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<td>APRU</td>
<td>Mountain beaver (Aplodontia rufa)</td>
</tr>
<tr>
<td>Sciurids and rodents</td>
<td>CACA</td>
<td>American beaver (Castor canadensis)</td>
</tr>
<tr>
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<td>CALL</td>
<td>golden-mantled ground squirrel (Callospermophilus lateralis)</td>
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<td>ERDO</td>
<td>Porcupine (Erithizon dorsatum)</td>
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<td>GLSA</td>
<td>northern flying squirrel (Glaucous sabrinus)</td>
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<td>MICE</td>
<td>unknown very small rodents including voles</td>
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<td>Bushy-tailed woodrat (Neotoma cinerea)</td>
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<td>Dusky footed woodrat (Neotoma fuscipes)</td>
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<td>Unknown woodrat</td>
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<td>California ground squirrel (<em>Otospermophilus beecheyi</em>)</td>
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<td>RANO</td>
<td>Norway rat (<em>Rattus norvegicus</em>)</td>
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<td>RARA</td>
<td>black rat (<em>Rattus rattus</em>)</td>
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<td>unknown chipmunk (<em>Tamias sp</em>)</td>
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<tr>
<td>Ungulates</td>
<td>ODHE</td>
<td>black-tailed deer (<em>Odocoileus hemionus</em>)</td>
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<tr>
<td>Ungulates</td>
<td>ODVI</td>
<td>white-tailed deer (<em>Odocoileus virginianus</em>)</td>
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<td>CEEL</td>
<td>Elk (<em>Cervus elaphus</em>)</td>
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<tr>
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<td>BIRD</td>
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<tr>
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