WildCAM Guide to Camera Trap Set Up

Version 1.2 developed by Alys Granados with input from WildCo Lab, the WildCAM community and Kate McKeown (University of Victoria).

Contact: info@wildcams.ca, alys.granados@ubc.ca, cole.burton@ubc.ca.

February 2021

TABLE OF CONTENTS

INTRODUCTION

There are many factors to consider when setting up camera traps , which will largely depend on your sampling objective(s). For example, do you wish to target a specific species or is your goal to document which species are present in an area? Are your efforts part of a larger camera trap survey? How you position your camera and the specific settings you choose should also be carefully considered in order to maximise animal detections relative to your goals.

This document is meant as a general guide for camera trap users who may have limited experience with formal sampling methods but are interested in having their camera trap photos used in research to support wildlife science and management.

To facilitate the standardization of data collection in camera trap set up, we have also created WildCAM data collection sheets (here and here) for camera trap set up and retrieval to accompany this guide. Our datasheets are consistent with metadata standards developed by Wildlife Insights and the RISC Wildlife Camera Metadata standards. We encourage you to use them and hope they are useful for users when deploying, checking, and retrieving cameras in the field.

Please be sure to visit our website for additional information and resources at https://wildcams.ca/library/. We welcome your feedback and if there are related camera trap topics that you would like to see added to this guide, please let us know. You can contact us at one or all of the following emails: info@wildcams.ca, alys.granados@ubc.ca, cole.burton@ubc.ca;

Opportunistic vs. Scientific Sampling

Scientific camera trap surveys are guided by principles of sampling design, which allow us to make inferences (aka educated guesses or statistical estimates) about larger animal populations. However, camera trap observations that are collected in a more opportunistic manner can still provide valuable scientific information. We recognize that many individuals or groups may have a small number of camera traps, or want to set them in certain areas to gather initial information about a specific species or area. For instance, if your goal is to get photographic evidence of species occurrences in a given area, you may wish to put your camera where you have previously seen your species of interest, or signs of them (e.g. tracks, fur, scat). Or you may be interested in knowing what species use a particular feature of interest, such as a road, stream, or rub tree. If you are targeting your cameras in this way, or just putting them out opportunistically (e.g. on a good tree), it is important to write down your rationale to help with the interpretation of the photos in relation to other cameras.

If you have a large number of camera traps, or are including your survey as part of a larger coordinated set of surveys, we suggest that a scientifically rigorous sampling design be developed. For example, in contrast to targeting certain areas or selecting locations opportunistically, you may consider using a random sampling design. This involves randomly selecting coordinates for camera locations within your target sampling area (e.g. a rural property, a forest, etc). Before you go into the field, you randomly select coordinates for camera stations in your study area using a random number generator (e.g. random.org). Upon arriving within approximately 50 m of your randomly pre-determined coordinates, you would then decide exactly where to place your camera, taking into account signs of wildlife, terrain, slope, etc. Truly random designs place cameras within approximately 5 m of the pre-selected coordinates (Wearn & Glover-Kapfer 2017).

Random sampling methods may be a way to reduce bias in population estimates because you are not preferentially sampling certain areas with your cameras, allowing you to make inferences beyond your collection of camera traps. On the other hand, randomly selecting locations could mean several are not used by any of your focal species. There are several other variations of sampling designs including random and non-random methods and the most appropriate design will depend on your research objectives.

If you have multiple cameras, you will also need to decide how close together they should be placed, which should be influenced by your chosen sampling design, your objectives, and the identity of your focal species (or group of species). In addition, how you will analyze these data will affect camera spacing. For example, if your goal is to estimate grizzly bear occupancy and cameras are placed to close together, detections may not be statistically independent if there's a chance that the same individual is detected at neighbouring camera sites within a short period of time. In the case of medium- to large-bodied mammals, you may wish to select large distance intervals because they tend to be wide-ranging. However, other types of analyses may have fewer requirements about camera spacing, such as for projects studying behaviour or estimating animal density (Wearn & Glover-Kaper 2017). It is important that you understand how your objectives will influence your design and decisions about camera spacing.

We are currently developing a separate WildCAM guide for sampling design recommendations. In the meantime, we ***strongly*** recommend reviewing the scientific literature on sampling design and effort, including but not limited to the following papers: Cusack et al (2015), Kolowski and Forrester (2017), Meek et al. (2014), Rovero et al. (2014), and Wearn & Glover-Kapfer (2017). For an introduction to analysis of camera trap data, see Sollmann (2018).

CAMERA DEPLOYMENT

How you set your camera can influence the quantity and quality of detections. Below, we provide recommendations regarding camera placement. We also specifically highlight which information should be recorded on the WildCAM data collection sheets accompanying this guide for camera deployment and retrieval.

Targeting specific features

Once you have navigated to the location where you wish to set a camera trap, you will need to find a suitable tree (or post, fence, or some other object) on which to attach it. Cameras are often placed to target particular features expected to be used by animals, such as game trails, human trails, water holes, feeding areas, rub trees, nest sites etc. The decision of where exactly to place the camera will be influenced by the feature that you want to target, which will also depend on the habitat type or your objectives, such as whether you want to target a single or multiple species. In general, we recommend that cameras be placed at a target distance of approximately 3 to 5 m away from the feature you want to target (Figure 1). If cameras are placed too close to the target feature, it is likely that many species will be missed and not detected. On the other hand, animals detected at night may not be visible in photos if the targeted area is too far (e.g. > 5 m) from the camera to be illuminated by the infrared flash. Make sure that you record what feature you are targeting on the datasheet (under *What feature is the camera targeting*), along with the distance from the camera to that feature.

Once you have decided how you want to aim the camera, you will need to properly position it to maximize animal detections. Generally, cameras should be placed perpendicular to the expected direction of animal travel (e.g. along a game trail or human trail). Once the animal enters the camera's detection zone (the area in which the motion sensor can detect an animal), there is a delay before the camera actually takes a photograph (typically <1s, depending on the trigger speed for a particular camera make and settings -- the faster the better!). By placing the camera perpendicular to the trail, there is a greater chance that the animal will be in the frame once the camera is triggered to take photos (Apps & McNutt 2018). The size of the detection zone will depend on the camera model you are using. Trailcampro has a useful guide where you can compare specifications for a number of camera models.

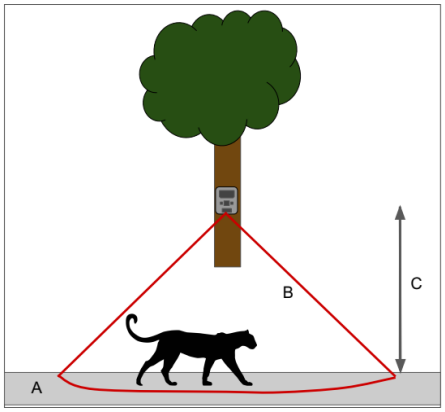

Figure 1. Illustration of a camera trap set to detect animals on a trail (i.e. the target feature) (A), the camera's detection zone (B, everything inside the red outline), and the distance of the camera to the feature being targeted (C). Note that the covered area by the detection zone will vary according to camera make and model. We recommend placing cameras 3 to 5 m from target features, and 50 cm to 1 m from the ground.

Camera height

The height of the camera from the ground (at base of tree) should be noted in centimetres on the *Camera deployment* datasheet. The camera's height and orientation will influence the detection zone, and hence what species are likely to be detected and where. In general, cameras should be secured to a tree or post approximately 50 cm to 1 m off the ground (Meek et al 2014), but this should be used as a rough guideline and not a hard rule. The most appropriate height will be affected by the terrain at your site (e.g. slope), the angle of the tree, as well as your focal species of interest. The closer your camera is to the ground, the less likely that large animals (e.g. moose) will be fully in frame in the photos. Similarly, if your camera is too high, only larger animals will trigger the motion detector and smaller species may be missed (e.g. hares, squirrels, marten) (Meek et al 2016). We generally recommend keeping cameras relatively low and angled slightly downward, such that they should be able to detect both small and large species at a target distance of approximately 3 to 5 m from the camera. Cameras should not be angled upwards, as upward facing angles will result in fewer detections, especially of smaller species (Glen et al 2013).

Depending on the time of year or your geographic region, you might also need to account for snow when considering how high to place your camera and you may need to place it higher on the tree or post than the level of expected snowfall (or plan to revisit seasonally to adjust as needed, being sure to record any adjustments that could affect detectability). This will increase the chance of your camera remaining active over the winter.

Camera direction

The compass direction that the camera is facing should also be considered when deploying camera traps as this will affect the amount of light reaching the area. We recommend cameras face north if possible, or south as a second choice, as the glare of the sun can affect photo quality (most problematic for cameras facing due east or west, unless there is thick tree cover blocking the sun). The direction of the camera trap should be noted on the datasheet under *Camera trap direction*.

Using bait or lure to attract animals to camera stations

Bait or scent lure are sometimes used to attract animals to camera traps and increase detection rates, particularly for carnivores because they are elusive, difficult to monitor and occur at low densities. A recent study by WildCAM members did not find the use of bait at camera stations to repel non-target (i.e. prey) animals, but predators showed varied responses to the presence of bait. Camera trap users should carefully consider their goals and whether bait or scent lure is necessary to provide sufficient detections of their focal species. The use of such attractants will lead to detection bias which could be important, depending on your objectives. If bait or lure are used, this must be recorded on your data sheet (under *Attractant Used*), along with type (e.g. bobcat urine, animal carcass), as well as the quantity and frequency at which it was applied. Olfactory, audio and visual lures are also considered attractants and if used, should be noted on the datasheet in this section.

Where attractants are used, it is extremely important that you follow local regulations or bylaws (e.g. BC Wildlife Act, Section 33.1) regarding animal attractants. Before you deploy any cameras in the field, you must also obtain all necessary permits from your institution (e.g. animal care permits), the province, and from your particular study area (e.g. you must obtain permission from BC Parks to use bait if your research takes place in an area under their jurisdiction). Further, you must follow all additional regulations associated with those permits regarding where and how attractants can be used within study areas (e.g. there may be rules about when and where bait is prohibited within a given protected area).

In general, we recommend against the use of bait or lure for projects focused on unbiased detection of as many species as possible. In particular, we advise against the use of bait in or near urban areas as this can lead to increased human-wildlife conflict.

Visibility

Once you have positioned the camera trap on a tree or post aimed at a trail or some other feature of your choosing, you will want to minimize the chance of getting false triggers (when photos are taken but not because an animal is present) caused by vegetation, as this will drain your battery and fill your SD card with photos of leaves or branches moving in the wind and no animals. To avoid this, make sure that

your camera's lens and motion detector are not obstructed. If you need to, you can cut or remove the vegetation immediately in front of the camera (watching particularly for branches or shrubs that could blow in front of the camera on a windy day), but if you find that the area has a large amount of thick vegetation, consider placing your camera somewhere else. If you make multiple visits to the camera station, you may need to clear some of the fast-growing plants at each visit.

It is also worth making sure that there are no large objects directly in front of the camera that could also obstruct the motion detector, such as large rocks, or logs. These will not cause false triggers but might limit the camera's ability to detect animals in the proximity of the camera. They may also reflect the flash and make it more difficult to detect animals at night

We recommend estimating and recording the visibility at your camera trap station, as the distance in metres that you can see before the view becomes obstructed (record this estimated distance under *visibility* on the Deployment datasheet). This will also provide valuable insight into how the camera's ability to detect animals is affected by the surrounding environment. To provide a visual record of the site (which could be archived and reviewed), we recommend taking photos with a handheld camera (e.g. phone) facing each of the four cardinal directions while standing in the centre of the detection target zone (be sure to label the photos so they can be linked to the camera site!)

CAMERA SETTINGS

The settings you choose are important for interpreting the resulting images. It is important to note which settings you select for camera deployment and to note this on the WildCAM data collection sheets.

Video? Photos? Both?

Some camera trap models allow you to record video as well as photos. Videos can reveal interesting animal behaviours that may not be clear from photographs alone, but will take up more memory on your SD card and may also drain your camera batteries sooner. Videos can also be much more difficult to process (i.e. extract data), particularly for large volumes. For most camera models, it is possible to limit the length of video taken when the camera is triggered, and could help slow down how quickly your SD card becomes full. If you have placed your camera in an area frequented by humans you may not want to record videos though this will depend on whether detecting humans is part of your research goal (e.g. human use of hiking trails, etc). Some camera models have hybrid settings, which lets you capture photos and videos for each animal detection. Unless you are interested in monitoring specific animal behaviours, we recommend focusing on recording photos rather than videos. Be sure to note on the datasheet (under *Camera settings*) whether you have set the camera to record videos, photos, or both.

Time-lapse vs motion detector or both?

By default, camera traps are triggered to take photos when an animal is detected by the motion sensor. In addition to this default setting, you can predefine how often you want the camera to take photos or video (e.g. upon detecting an animal, take 1, 3, 5, or more photos one after another or with an interval in between depending on your camera model - check the user manual). Some models can also be set to take photos under a Time-lapse setting. If you set your camera(s) to Time lapse, you can pre-define specific times of the day in which photos will be taken, regardless of whether an animal is present. This is a useful way to ensure that your camera is functioning or could even be a way to study plant phenology in your area. Many camera models allow you to set your camera in both Time-lapse and default motion detector settings. Again, consider your study objectives when deciding which settings to use. We recommend taking 1 timelapse photo per day at 12:00 pm (noon), to create records of camera functionality and local environmental conditions (e.g. snow cover, plant growth). However, we recognize that different projects may have different goals. Whether or not you choose to set your camera in Time-Lapse mode should be reported on the WildCAM datasheet under *Camera settings*.

How many photos per animal detection?

Additional settings will affect how fast and how many photos are taken of individual detections and should be noted on the Data Sheet under *Camera Settings*. For example, it is important to record whether the Passive Infrared (PIR) sensitivity is set to low, medium, or high (some camera models do not allow you to alter the settings) as this describes how easily the camera is triggered once the animal enters the detection zone. The faster the camera is triggered, the more likely it is to photograph approaching animals as they enter the area (Apps & McNutt 2018).

It should also be noted how many photos are taken per photo burst and the quiet period following each burst. When you deploy your camera, you can set the camera in Burst Mode to take, for example, 3 photos once an animal enters the detection zone (number of photos per burst), and then set it to either continue taking photos until they leave the detection zone or wait a specific period of time (e.g. 10 s, 30 s, 60 s, etc) before taking additional photos if the animal is still there. Depending on the camera model used, the interval before the camera takes additional photos may be called the Quiet Period or the Time lag. Refer to the instruction manual for settings corresponding to the model you are using. If the camera is set to continuously take photos with no interruption until the animal leaves the detection zone, this would be recorded as *No delay* on the WildCAM data sheet under *Camera settings*. Setting a time delay will reduce the number of photos taken of the same individuals if they remain in the detection zone. Setting *No Delay* will fill your SD card with more photos per detection but could provide important information about when specific animals leave and enter the detection zone or about animal behaviours through photos.

We recommend using Reconyx brand cameras, with motion detection settings of 1 photo per trigger and no delay between consecutive triggers.

Recording information about fine-scale habitat characteristics

Information about the habitat at the camera trap station should be recorded in the datasheet under *Habitat type*. Researchers typically record information about the environment at camera trap stations to better understand how this might affect animal occurrence or behaviour. If the type of habitat is not listed as one of the options on the data sheet, please describe the area under *Other*.

We also suggest that you record the dominant type of vegetation around the camera trap during your initial visit, as this could provide important information about habitat structure or for example, forest growth stage. An easy way to do this is to take photos of any species you see within a 30 m (about 100 foot) radius of the camera trap, and upload these photos to the free smartphone app, iNaturalist (or iNaturalist.ca on your computer). We recommend you take about 30 photos (more is better!) within the area around the camera trap as this will give a snapshot of the local dominant vegetation.

When you upload photos to iNaturalist, the software's artificial intelligence will automatically suggest an identification for the species in your photos. This can help you narrow down the identification if you are unsure what species you are looking at. After you have uploaded your observations, naturalists from around the world can confirm your identification or suggest a different identification to set you on the right track. At the same time, you are contributing to citizen science by uploading valuable data that gives researchers an insight into biodiversity in a remote area.

Using your smartphone (with Location Services switched ON for your camera app) or handheld camera, take photos of the overall shape of the tree, shrub, moss, etc., and close-ups of the leaves, bark, buds, flowers, or fruit. If you take photos of multiple features (e.g., bark, leaves, tree shape) you can combine all these photos into one observation on iNaturalist. If you see lichen or fungi, try to photograph both sides of the individual, and what it is growing on. If you are interested in how forest cover or habitat structure affects detections, we recommend taking photos of the canopy by standing next to the camera trap and aiming your handheld camera towards the sky. By turning on Location Services prior to taking photos, your photos will be sorted by location when you upload them to iNaturalist, allowing you to easily reference what vegetation cover is present at each of your camera trap locations. If you do not want to divulge the exact location of your camera trap, you can change the location of your observations from "public" to "obscured". If you have a code for your Camera Trap, please include this in the "Notes" section of each iNaturalist observation.

More resources for how to use iNaturalist can be found at https://www.inaturalist.org/guides

Before you leave the camera trap station...

The most critical instruction related to camera trap deployment is to ensure that the camera is active when you leave the camera trap station. This can be confirmed through a walk test and with test photos. A walk test can be performed once you have positioned the camera, but before you deploy (i.e. activate) it and involves walking in front of it to ensure that it is working and is indeed aimed at your chosen target. Instructions for how to perform a walk test vary among camera makes and models. You should review the user manual of your camera trap make and model for instructions on how to perform a walk test. Be sure to note on the WildCAM datasheet whether a walk test was performed. We also suggest taking a test photo of a member of your field team holding up a white board or paper with the Station ID, date (DD-MMM-YY), and time (use 24 hour clock), while standing in front of the camera. This is important in case of the situation that the camera does not properly record the deployment date and time.

Finally, before you leave, make sure that the camera has been set with the correct date and time. Enter this information on the data sheet under *Deployment Date and Time* using the following format: DD-MMM-YY (e.g. 02-FEB-20).

CHECKING OR RETRIEVING YOUR CAMERA

If you have found a good spot for your camera trap, or depending on your study objectives, you may wish to leave it deployed for an extended period of time. In this case, it may be necessary to visit the camera station and replace the batteries and / or the SD card.

When re-visiting the camera station, you must record the date and time of your visit under *Visit date and time*. You should also note whether the camera was active or not and note any camera damage as this can provide context if there are no photos taken after a certain date. We recommend approaching the camera from the front so that you test its functionality -- if it is active, you will get a picture of yourself! Be sure to record the new SD card ID in the data sheet along with whether the batteries were replaced. If you are replacing the actual camera it is very important to record the ID of the new camera along with the new camera's make and model. Note that if you are using lithium batteries, the battery level indicator on the camera may not decline evenly (but rather indicate full battery until a sudden drop-off). If you expect to leave your camera for a long period of time before checking it again, it is often a good idea to put in fresh batteries (you can always use the partially used batteries for other purposes, or cameras closer to home that can be checked frequently). Check Y on the datasheet if batteries were changed under *Batteries replaced?*.
If you are retrieving your camera (i.e. that particular camera station will no longer be used and cameras, SD cards, batteries are not being replaced), note this under *Purpose of visit* on the data sheet. Make sure you collect whatever material you used to attach the camera with to the tree, post, etc and any other equipment you brought.

Good luck! We hope you get some great photos, and that you will consider sharing them with the WildCAM network to support wildlife science, conservation, and public education!

FIELD CHECKLIST

Below is a list of general items you will need when setting up or visiting camera trap stations in the field. Please note that individual project needs and items will vary, but if there is anything you think should be included here, please let us know.

Safety-related

- ❏ Appropriate personal equipment for weather and safety
- ❏ Bear spray
- ❏ First aid kit (ensure contents are complete)

Camera equipment

- ❏ Reconyx (or equivalent make and model) camera unit with lithium AA batteries and SD memory card. Make sure you have sufficient number of batteries before you head out, as this may vary with camera make or model.
    - ❏ bring copy of user manual for your camera make and model for reference (if necessary)

Camera security

- ❏ To secure your camera, bring a Python cable **lock (or equivalent) with keys**, with adjustable straps in case extra support is needed
- ❏ Camera security box (*optional*)

Additional electronics

- ❏ GPS unit - note the UTM Zone and set the unit in NAD 83
- ❏ Tablet with SD card reader to view photos OR a cell phone with a camera and/or Digital camera that reads SD cards (for viewing test photos; check that – ensure it will read the cards used)

Recording data

- ❏ WildCAM Field Data collection sheets for deployment or retrieval
    - ❏ Should be printed on Write-in-the-rain paper; pencils, clipboard
- ❏ Whiteboard and dry erase marker (for test photos)
    - ❏ Alternatively, can you can use blank white paper with thick sharpie pen

Misc. (but important!) equipment

- ❏ Measuring tape (to set the camera height)
- ❏ Compass (to set the camera direction)
- ❏ Machete to clear vegetation or branches if you're going off trail (optional)
- ❏ Knife or saw (to trim branches/vegetation; gloves also useful

- **In the winter**- Bring a Lighter for de-icing locks

REFERENCES

Apps, P.J. & J.W. McNutt. 2018. How camera traps work and how to work them. *African Journal of Ecology*, *56*, 702-709.

Burton, A.C., E. Neilson, D. Moreira, A. Ladle, R. Steenweg, R., J.T. Fisher, ... & S. Boutin. 2015. Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes. *Journal of Applied Ecology*, *52*, 675-685.

Cusack, J.J., A.J. Dickman, J.M. Rowcliffe, C. Carbone, D.W. Macdonald, & T. Coulson. 2015. Random versus game trail-based camera trap placement strategy for monitoring terrestrial mammal communities. *PloS one*, *10*.

Glen, A.S., S. Cockburn, M. Nichols, J. Ekanayake, & B. Warburton. 2013. Optimising camera traps for monitoring small mammals. *PloS one*, *8*.

Kolowski, J.M. & T.D. Forrester. 2017. Camera trap placement and the potential for bias due to trails and other features. *PLoS One*, *12*.

Holinda, D., J. Burgar, & A.C. Burton. 2020. Effects of scent lure on camera trap detections vary across mammalian predator and prey species. *bioRxiv*.

Meek, P.D., G.A. Ballard, A. Claridge, R. Kays, K. Moseby, T. O'Brien., ... & S. Townsend. 2014. Recommended guiding principles for reporting on camera trapping research. *Biodiversity and conservation*, *23*, 2321-2343.

Meek, P.D., G.A. Ballard, & G. Falzon. 2016. The higher you go the less you will know: placing camera traps high to avoid theft will affect detection. *Remote Sensing in Ecology and Conservation*, *2*, 204-211.

Sollmann, R. 2018. A gentle introduction to camera-trap data analysis. *African Journal of Ecology*, 56: 740-749.

Rovero, F., F. Zimmermann, D. Berzi, & P. Meek. 2013. " Which camera trap type and how many do I need?" A review of camera features and study designs for a range of wildlife research applications. *Hystrix*, *24*.

Wearn, O.R. & P. Glover-Kapfer. 2017. Camera-trapping for conservation: a guide to best-practices. *WWF conservation technology series*, *1*, 181.