Training Manual for Long-term Monitoring with

CAMERA TRAPPING

Wildlife Conservation Society

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Training Manual for Long-term Monitoring with Camera Trapping

Contributors

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With reference to methodologies described by

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CONTENTS

1 INTRODUCTION

Climate change threatens biodiversity by altering the climate conditions under which species have evolved, forcing species to adapt, shift their ranges, or face local extinction[1]. Over the last few decades, climate change has already led to widespread range shifts[2], declines in species abundances[3], and full species-level extinctions[4]. These biodiversity losses have profound impacts on ecosystem structure, processes, and services, as well as multiple aspects of human well-being[5]. Wildlife species with ranges tightly linked to climate variables will be most impacted by climate change, and these species can serve as important indicators of changing climate conditions on the ground. Monitoring these species in the wild, and the habitats on which they depend, is thus essential for optimizing conservation planning to mitigate environmental, economic, and social vulnerabilities to climate change.

Field surveys can be exceptionally challenging for monitoring rare or nocturnal species—many of which are highly threatened by climate change—necessitating the use of methods that can passively detect cryptic wildlife. Camera traps are an invaluable tool for monitoring these elusive and sensitive species while reducing human effort in the field. Modern camera traps consist of a digital camera connected to an infrared sensor, which can detect the warmth of a moving organism, or just any movement (older camera) relative to the background habitat. When wildlife moves past the sensor, it triggers the camera, resulting in an image or short video saved to the memory card that be retrieved later. Camera trap surveys can allow for population abundance and density estimation and therefore can be an effective methodology for tracking changes in wildlife populations over time in response to climate and land use changes.

Survey objectives

The camera trap monitoring protocol in this manual has been developed to track rare or elusive mammals in the wild for the purpose of estimating population abundance and distribution changes in response to climate change. The methodology consists of standardized practices for preparing and installing camera traps and has been designed to ensure reproducibility across survey teams and geographic areas.

Important considerations

When setting up camera traps, it is important to remember that all camera traps are not the same. While the essential functions remain the same, different brands of camera traps will vary in design, capabilities, storage capacity, and camera range or sensitivity. This manual should be used as a general guide only, and teams should always refer to the instructions accompanying their particular brand of camera trap.

[1] Araujo, M. B., Science, C. R. (2006). How does climate change affect biodiversity? Science 313: 1396-1397.
[2] Chen, I., Hill, J., Ohlemüller, R., Roy, D., Thomas, C. (2011). Rapid range shifts of species associated with high levels of climate warming. Science 333: 1024-1026.
[3] Root, T., Price, J., Hall, K., Schneider, S., Rosenzweig, C., Pounds, J. (2003). Fingerprints of global warming on wild animals and plants. Nature 421: 57-60.
[4] Pounds, J., Fogden, M., Campbell, J. (1999). Biological response to climate change on a tropical mountain. Nature 398: 611-615.
[5] Díaz, S., Fargione, J., Chapin, F. S., III, Tilman, D. (2006). Biodiversity loss threatens human well-being. PLoS Biology 4: 1300-1305.

For data recording from camera traps to be reliable, some foundational expertise is required. This training manual is not a replacement for a field guide. It is expected that at least one person on the team is skilled at identifying the species in the study area that may be captured by the camera, as well as their tracks (e.g., footprints, dung), to be able to associate the photos and/or videos captured with an accurate species identification to the highest taxonomic level possible.

Finally, camera traps are most appropriate for monitoring medium to large terrestrial mammals in habitats of dense vegetation. Camera traps are not recommended for monitoring (1) small mammals (e.g., rodents), (2) arboreal, fossorial, aerial, and aquatic species, or (3) species that prefer open areas (e.g., plains, meadows).

How to use this manual

This manual provides step-by-step instructions for using camera traps in the field.

Chapter 2, "Selecting a Site," outlines important considerations for choosing where to set up the camera trap.

Chapter 3, "Preparations," discusses what surveyors should know before going into the field, such as the time and frequency of camera setup/data retrieval and necessary equipment.

Chapter 4, "Field Setup," instructs surveyors on what to do once they arrive to the survey site and set up the camera trap.

Chapter 5, "Field Methodology," provides step-by-step instructions for starting the camera trap and retrieving the data.

Chapter 6, "Resources," lists some useful data, tools, and other resources available to surveyors for using the camera trap.

Appendix I contains copies of the Camera Trap Checklist that teams should complete prior to deploying the camera traps in the field.

Appendix II contains copies of camera trap datasheets that teams can print and use in the field to record the necessary data in their study area.

2 SELECTING A SITE

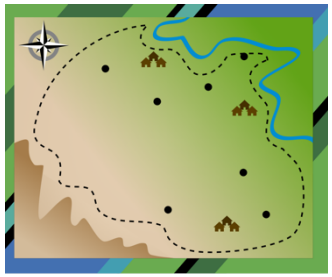
The camera trap locations should be selected based on the species' basic habitat needs.

NOTE: Maps of habitats, land cover, and species distributions are necessary for determining where to establish survey sites. If these resources are unavailable or unknown to the team, it may be useful to refer to data layers included in the Adapt Afghanistan web platform (https://adaptafghanistan.com; see Chapter 6).

1. Generally speaking, camera traps should be deployed at a minimum density of 1 trap per 250 km^2, with a recommended density of at least 1 trap per 75 km^2. The team should first determine the desired density for their study area, and then calculate the total number of traps that will be deployed.

2. Generate random points within your study area (at least double the number of traps you intend to deploy).

The preferred approach would be to create random points using GIS (e.g., using the "Create Random Points" tool in ArcGIS Pro or an equivalent tool in QGIS, R, etc.; see Chapter 6).



3. Randomly select the necessary number of points within your study area to deploy cameras, keeping the requirements below in mind:

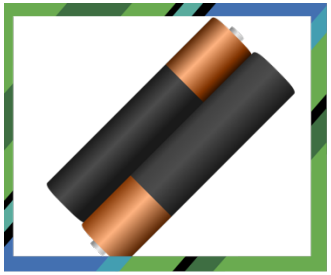
Selected points should be at least 3 km from any villages but no further than 10 km from a village.

Selected points should not be located on bare land, agricultural land, or urban areas (consult a land cover or appropriate base map to determine what type of land cover the points are on).

Selected points should be optimized for (1) species richness, (2) areas within the target species' range, and (3) a variety of elevations below 4,000 m.

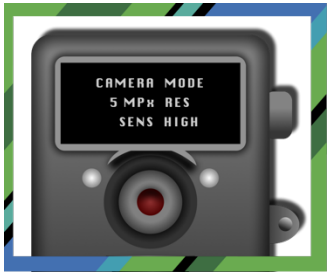
The preferred approach would be to select random points using the Create Random Points tool in ArcGIS Pro (using the randomly created points from step 2 as inputs or an equivalent tool in QGIS, R, etc.; see Chapter 6).

3 PREPARATIONS



Batteries

Install new, fully charged batteries and an empty formatted memory card (> 8 GB) in the trap. Use the 'Advanced' function on the trap to ensure that the "battery type" matches the batteries installed (i.e., "lithium" for non-rechargeable batteries, "NiMH" for rechargeable batteries).



Camera settings

Set the camera to "camera mode" if it isn't already set. Set the image resolution to 5 megapixels. Set the sensor sensitivity to "high". Select at least 3 photos to be taken in sequence per trigger. The more photos taken in sequence, the higher the likelihood of correctly identifying the species, but more memory storage is used.

Duration

It is recommended that camera traps be deployed and left in operation for at least 90 trap nights. If deploying traps for more than 90 nights, retrieve and replace the SD card after 90 nights.

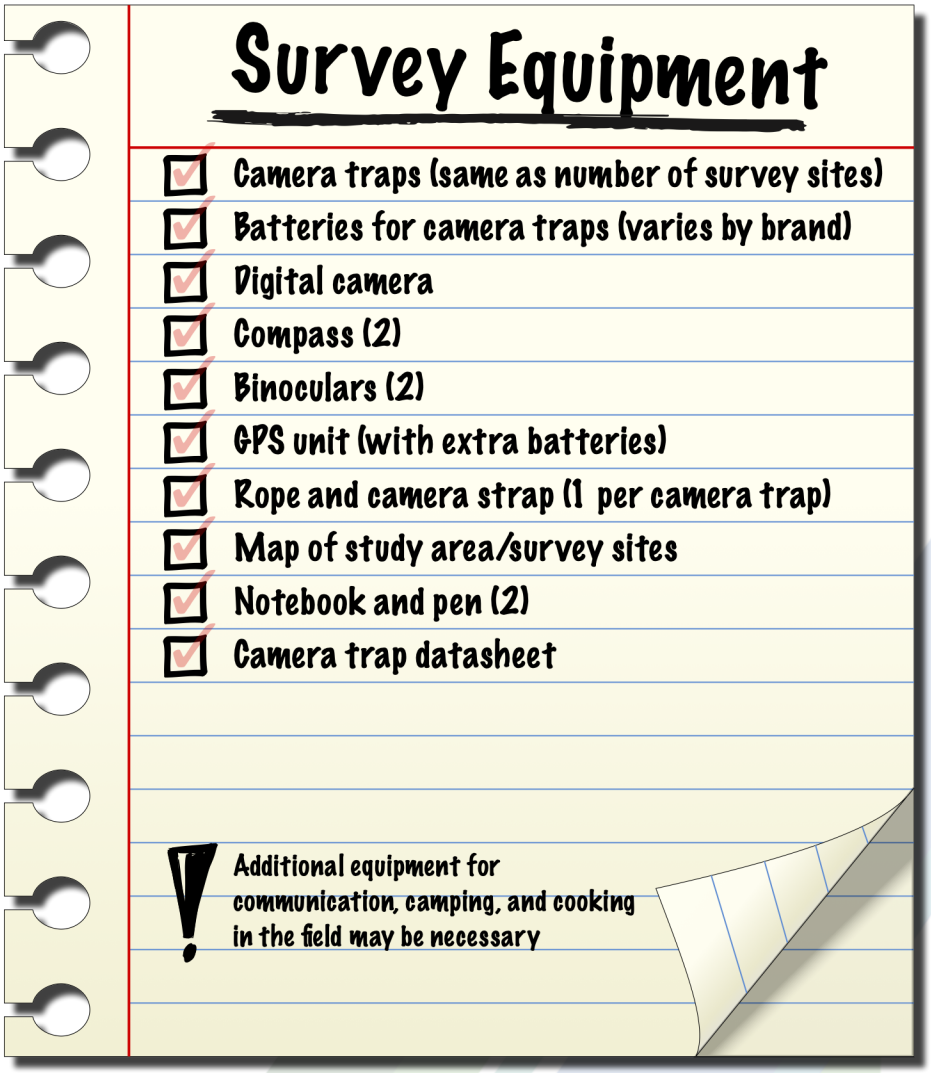
Security

Given the risk of camera traps being stolen or damaged, it is recommended to visit the traps at least every two months to ensure the trap is still present and functional (you can replace the SD card at this time, if the trap will continue to run). To reduce the risk of theft, consider placing the traps in the most remote areas, hidden from people, and inform trusted locals about the purpose of this work.

Prepare for deployment

Set the correct date and time. Label the trap with a camera code and site code. Each SD card should have a unique ID number. Record the camera trap number and the SD card number used.

NOTE: Before deployment in the field, record all the necessary specifications of each camera trap being used, including the type of trap, type of batteries, size of SD card slot, and any technical issues or malfunctions. We recommend completing the ***Camera Trap Checklist*** *before going into the field (available in Appendix I).*

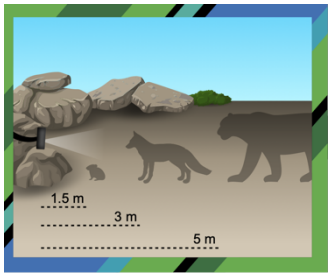


4 FIELD SETUP

1. Navigate your GPS to the selected point.

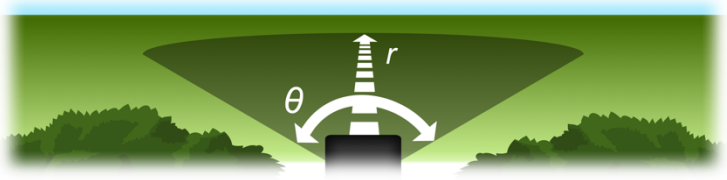
2. Search for evidence of targeted wildlife in the area (e.g., tracks, dung, pug marks, etc.).

3. Avoid locations where direct sunlight might face the camera lens. If no natural shade is present, create artificial shade using rocks, leaves, or branches.



4. The chosen location for installation should be 5 m (for large mammals, e.g. ungulates, snow leopard), 3 m (for medium-sized mammals, e.g. fox, lynx), or 1.5 m (for small mammals, e.g. pika, marmot) from the spot where the target species is expected to pass.

NOTE: Camera traps have a notional detection zone, defined by the radius, r, and angle, θ. Camera traps effectively monitor the surface temperature of the scene inside the detection zone. Choose an appropriate location for the detection zone on your camera trap.



5. Before you begin, record the basic survey information in the datasheet:

- Date
- Site name and description
- Elevation
- Camera trap number
- SD card number

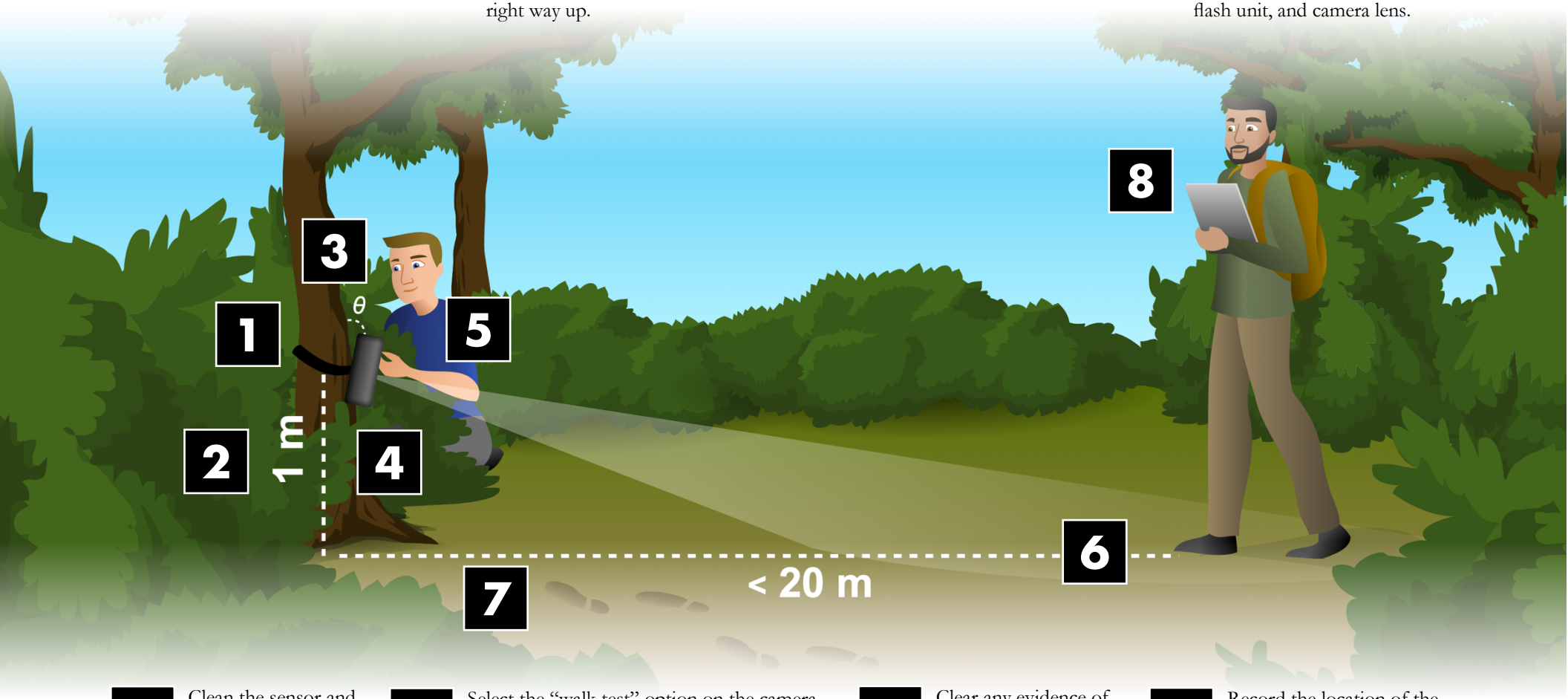
5 FIELD METHODOLOGY

1 Attach the camera trap to a secure support, like a rock or tree trunk at least 20 cm in diameter.

2 Securely fasten the camera 1 m above ground for large mammals, 0.5 m for medium-sized mammals, or 0.2 m for small mammals. Ensure the trap is the right way up.

3 Angle the camera slightly downward to capture the base of the target area.

4 Ensure the camera trap is not easily visible to the naked eye, while keeping vegetation and other obstacles from blocking the sensor, flash unit, and camera lens.



5 Clean the sensor and camera lens, then turn on the camera.

6 Select the "walk test" option on the camera and walk within 20 m of the camera lens to test if the camera is positioned correctly. A red light signals movement is detected.

7 Clear any evidence of human presence from the trapping station before leaving the site.

8 Record the location of the camera (site name, GPS coordinates) and the time the camera is set.

When ready to retrieve the camera trap or SD card...

9 Walk in front of the camera lens and trigger the motion sensor. A red light signals movement is detected.

10 Open the camera trap, press the "OK" button twice, and wait a minute or two.

11 Turn off the camera trap and collect either the camera or the SD card.

12 Record the date and time of camera or SD card retrieval and new SD card number (if applicable).

13 If continuing the survey, immediately insert a new SD card and replace the camera batteries before repeating **steps 5–8**.

6 RESOURCES

Adapt Afghanistan: An online repository of over 1,000 spatial data layers related to climate change vulnerability and resilience covering climate, natural hazards, ecosystems, biodiversity, hydrology, and local community sectors. https://adaptafghanistan.com

Create Random Points: A tool for creating random points in ArcGIS Pro. https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/create-random-points.htm

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APPENDIX I: CAMERA TRAP CHECKLIST

The following page is a sample checklist surveyors can use to record the necessary specifications of each camera trap. We recommend surveyors complete the checklist before going into the field to ensure that any issues or malfunctions are known beforehand. Surveyors should print as many copies of the checklist as they might need to use based on the number of camera traps that will be deployed.

CAMERA TRAP CHECKLIST

No.	*Camera Type*		*Sealant Check*		*Card Slot*			*Battery*						*GPS Location*		Date & Time	Person Responsible
	Make	Model	No issues	Issues	Size	Working	Not working	Alkaline			Lithium			Lat.	Long.		
								AA	*C*	*D*	*AA*	*C*	*D*				
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8 APPENDIX II: SAMPLE DATASHEET

The following page is a sample datasheet surveyors can use to record the necessary data in the field. We recommend surveyors review the structure and content of the datasheet before going into the field. Surveyors should print as many copies of the datasheet as they might need to use based on the number of survey sites selected.

Project name: _____

Site		*Equipment*		*GPS*			*Installation*		*Retrieval*				Comments
Site name	**Site description**	**Camera no.**	**SD card no.**	**Lat.**	**Long.**	**Elevation** (in meters)	**Date & time**	**Team names**	**Round**	**Date & time**	**New SD card no.**	**Team names**	