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Camera Trapping for Wildlife[1]

B. W. McDonald, B. M. Mason, C. T. Callaghan, M. A. Lashley, and C. Baruzzi[2]

This publication is intended for landowners, land managers, educators, and researchers who are interested in observing vertebrate wildlife species.

Introduction

Many wildlife species use areas that overlap human activity, but these animals may be seen only rarely, perhaps because they are small or well-camouflaged, or because they are only active at night. In many cases, animals may also actively avoid people, making them difficult to observe. To effectively monitor the behavior and population dynamics of species of interest, researchers and land managers often rely on visual observations. Hunters also often rely on visual observations of wildlife to know the locations and environments used by game species, or how many individuals of those species are present on their property. Additionally, photographers, educators, and nature lovers often seek out wildlife to enjoy the beauty of animals in an area and to learn more about them. Camera traps (also known as remote cameras, trail cameras, or game cameras) offer an increasingly popular method of viewing wildlife that would otherwise go undetected.

Motion-triggered cameras have been used to capture images of wildlife for more than 100 years, though early set-ups relied on film, and were complex and unwieldy. The advent of digital cameras addressed many of the issues present in earlier attempts. In fact, there are now many commercially available remote-camera traps appropriate for everything from public use to research. Modern camera traps trigger through a combination of motion and heat sensors to take photos or videos whenever something moves in front of the sensor and has a temperature different from that of the surrounding environment (Figure 1). They can have a bright flash or take pictures in infrared, using light outside the visible spectrum to capture black and white images and allowing for even elusive nocturnal species to be captured in photographs. Most camera traps can store thousands of images on SD cards and often last several weeks or more on a single set of batteries!

What can be learned from camera traps?

Running a camera trap for a few weeks can give an idea of what species are present in an area and how common they are (Figure 2). Most camera traps also record the time each picture is taken, which gives information about when different species are most active. Additionally, the location of the camera trap and which species it observes provide information on the local distribution of different species (i.e., the spots throughout the area where they are most likely to appear).

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2. B. W. McDonald, biological scientist, UF/IFAS North Florida Research and Education Center, Quincy; B. M. Mason, data management analyst, UF/IFAS Fort Lauderdale Research and Education Center, Davie; C. T. Callaghan, assistant professor, global ecology, UF/IFAS Fort Lauderdale Research and Education Center, Davie; M. A. Lashley, associate professor; and C. Baruzzi, assistant professor, UF/IFAS North Florida Research and Education Center, Quincy; Department of Wildlife Ecology and Conservation, UF/IFAS Extension, Gainesville, Florida 32611.

Figure 1. Typical appearance of a modern camera trap.
Credits: Wildlife Ecology and Land Management Lab, UF/IFAS North Florida Research and Education Center

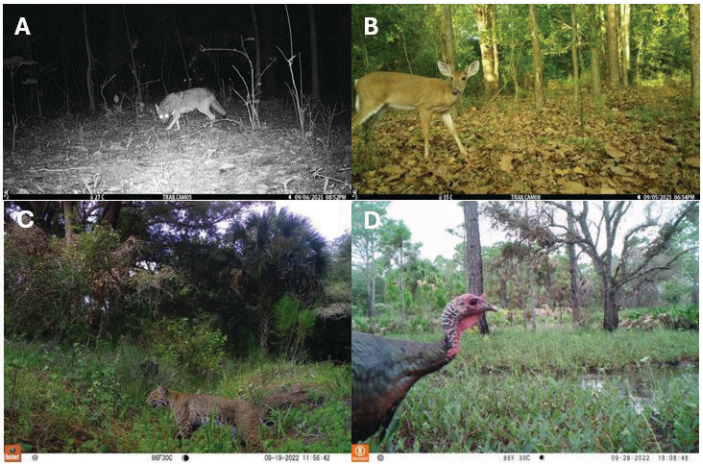

Figure 2. A variety of wildlife images including: A) a coyote, B) a female white-tailed deer, C) a bobcat, and D) a male wild turkey. All were taken on camera traps deployed using standard setup: knee height and facing parallel to the ground on a tree or post.
Credits: Wildlife Ecology and Land Management Lab, UF/IFAS North Florida Research and Education Center

Sometimes, camera traps can also capture images of animals performing specific behaviors, such as feeding or grooming, and interactions between multiple individuals or species, such as mating or predation. These images can be especially exciting to witness and can combine with other information collected by the camera to help paint a complete picture of how the species present interact with their environment.

Occasionally, the species observed in camera trap photos can be difficult to identify, particularly at night, when they are moving fast, or only partially visible in frame. The online citizen science platform iNaturalist (https://www.inaturalist.org/) hosts a global community of naturalists from a variety of backgrounds whom are often able to assist in species identification. Many people use iNaturalist to document observations, often by uploading photographs of living organisms or the traces they leave, though audio recordings, also very helpful for identification, can also be uploaded. Each contribution to iNaturalist includes information on when and where the organism was observed. Contributors benefit from assistance in identifying species, helping elevate their observations to research-grade status. Sharing the information obtained from camera traps via iNaturalist or otherwise can provide valuable information to managers and scientists for conservation. Pictures captured by camera traps also serve as an excellent bridge to connect the public with nature, drawing attention to natural areas and potentially acting as a tool to build support for local conservation and management efforts.

Use Methods

There are several different methods frequently used when setting up camera traps to take images of wildlife. Placement of a camera trap or set of camera traps is dependent on the ultimate goal of the individual or group using it. To observe the highest diversity of species, it may be prudent to use varying methods to target distinct species. Below are a few commonly used methods of placing camera traps, with some examples of how these methods might be used.

Standard Setup (on a Tree or a Stake near a Trail or a Field)

One common method for putting out camera traps involves attaching the camera to a vertical tree or post with the camera facing a trail or other relatively open area. It is generally good practice to have at least 4–5 feet of clear space in front of the camera trap to provide a clear view of animals as they pass and to prevent the camera's flash from reflecting off nearby objects at night.

Placement of camera traps can be very flexible, particularly if one opts to use posts or tripods that can be moved to ideal locations. A good rule of thumb for camera height to capture images of a diverse group of North American wildlife species is to place the camera approximately 20 inches (50 cm) off the ground. This height is often around knee height for most, and placing a camera at or slightly above the knee is a good substitute to avoid the need to

measure in the field (Figure 3). Cameras in this position should catch smaller animals at the bottom of the image while also limiting larger animals like deer or bears, from being cut off at the top of the frame. However, there is no such thing as perfect placement, and animals occasionally move too close to the camera to get a good image, regardless of the setup.

Figure 3. An example of a camera trap being set for the standard setup. Note that the camera is on a vertical tree and is set at approximately the height of the technician's knee.
Credits: Wildlife Ecology and Land Management Lab, UF/IFAS North Florida Research and Education Center

Target Setup (Facing a Specific Structure or in an Unusual Area to Capture Images of Certain Species)

While the standard setup is best for capturing a diverse group of species, it may miss species that use specialized habitats or require intentional camera placement to observe. For example, a camera set at knee height along a trail will likely capture fewer images of rodents than a camera set closer to the ground. For some species, it may be better to set a camera trap to view a specific area or structure, such as a burrow or nest (Figure 4).

Targeted placement at high-use locations for a species of interest can substantially increase the likelihood of capturing pictures of that species to understand their behavior. Additionally, targeted setups may capture species not observed using the standard setup, thereby increasing the number of species observed in a region. This can provide valuable information about species that may be underreported because they are small or because they use specialized habitats.

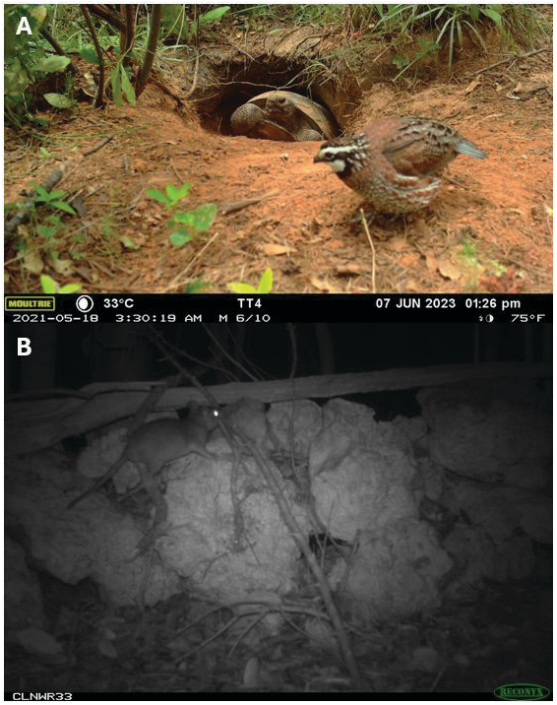

Figure 4. Camera traps targeted at specific resources or objects can help observe a particular species or behaviors. A) A camera targeting a gopher tortoise burrow has captured an image of the gopher tortoise emerging just as a bobwhite quail passes by. B) A camera targeting supplemental nest structure captures a Key Largo woodrat engaging in stick-stacking behavior.
Credit: Wildlife Ecology and Land Management Lab, UF/IFAS North Florida Research and Education Center (A); and U.S. Fish and Wildlife Service (B)

Alternatively, camera traps can be set to view specific areas of interest with no target species in mind. Different environmental features, whether natural or built by humans, are likely to receive different amounts of use and may attract a variety of species. Targeting specific areas, such as trails, wildlife road crossings such as tunnels or overpasses, or bodies of water, can also help answer questions about how wildlife use different resources. Another example could be using camera traps to pest removal efforts. Land managers can use images of nuisance animals to fine tune the placement of traps or bait in order to adjust their setup to better respond to the animals they are targeting.

Checking Camera Trap Photos

To view the pictures taken by the camera trap, turn off the camera and remove the SD card. Use a computer to read the SD card either using an SD card reader slot or an external SD card reader, which are readily available online. Ideally, most camera trap photos will contain animals, but it is common for plants to trigger the camera trap when the sun or wind hits them just right. We recommend viewing

all photos and saving those with animals of interest in a separate folder on your computer. Look carefully at each photo, as there may be tiny animals, such as butterflies, small lizards, or small songbirds, or well-camouflaged animals in the frame.

Camera Trap Set-Up

Modern camera traps have quite a few settings that can affect both the quantity and quality of the images they capture. Below are some general recommendations for settings given a standard deployment. Keep in mind that different camera brands and models may have different labels for these settings, so be sure to check user manuals when using a camera for the first time. Test the settings on a new camera trap before deploying it, as differences in hardware and software can influence the functionality of these settings across different models and brands.

Images per Trigger: When the motion sensor on a camera trap is triggered, most cameras can take either a single image or a series of subsequent images (typically ranging between 2–10 images). Capturing more images gives a better chance of identifying quickly moving animals and/or distant animals. It also allows more time to examine animal behavior and to observe multiple individuals in a group. The downside of this setting is that with more images SD card memory will fill up more quickly, and batteries will drain more rapidly.

Image Quality: Camera traps, particularly newer models, often have several settings for image and video quality. These may be listed in the form of text (for example: "Low," "Moderate," or "High") or as the number of megapixels (MP) the camera lens uses to process the image. Lower-quality photos take up less storage space but can sometimes be grainy, particularly at night. Higher-quality photos can be quite impressive on modern camera traps, but they may be more prone to motion blur, and they take up much more storage space. A moderate setting (often between 8–16 MP) is frequently adequate for solid picture quality without exhausting storage space too quickly.

Information on Pictures: Most camera traps allow the photographer to toggle a band of information on or off at the bottom and/or top of the image. At a minimum, this typically contains the time and date the image was taken, but depending on the camera trap model, it may also include your chosen name for the camera trap (helpful for keeping track of your images if you have several camera traps deployed in different places), the phase of the moon, the temperature, or the image number. This information can be helpful to view at a glance and is usually left on for research uses; however, in some cases, it can be visually distracting and may reduce the appeal of images. The bands can be cropped out of the final image or negated by adjusting camera trap settings. Remember that if you are planning to post an image to any public platform, any sensitive information contained in the band information (i.e., specific coordinates, addresses, names, etc.) will be visible on the platform and, therefore, must be removed before you upload images.

Recovery Speed: Recovery speed is the speed at which the camera trap recovers from the act of taking an image (or series of images) before it can take another photograph. This is a hardware setting, and usually cannot be adjusted. It is analogous to the shutter and mirror flipping up and down in traditional cameras. It allows the sensor in the camera trap to readjust for changes in the scene. A faster recovery speed is generally considered to be better.

Trigger Speed: Trigger speed can be defined as the time between the motion sensor detecting motion and the camera trap taking a photo. Like recovery speed, it is also built into the hardware of the camera. A faster trigger speed is generally better, as it ensures a minimal delay in photos being captured as wildlife passes by. Cameras with good trigger speeds often get better pictures and make species identification easier. In most cases, it is recommended to have a camera with a minimum trigger speed of one second or less. Unlike recovery speed, however, many cameras have a setting that allows the user to adjust the timing between subsequent triggers in a camera for different circumstances. In areas with particularly high wildlife visitation, such as around a food resource, it may not always be desirable to capture as many images of an individual or group of animals as technically possible. Many camera traps have an option labeled "Delay" or "Trigger Speed" in the camera settings. This option allows the user to set the amount of time between one trigger of the camera and the next to several different lengths. For instance, you could opt to have the camera take a second picture only after five minutes have passed since the initial trigger. This option can help reduce the number of images you will have to review while still allowing you to obtain a representative sample of species using a given area.

Sensitivity: The motion sensors on camera traps typically have a few pre-determined levels of sensitivity that affect how likely they are to trigger. These often are listed as "Low" to "High." In general, higher sensitivity settings are recommended to avoid missing wildlife. However, setting the sensitivity very high can result in large numbers of

photos of vegetation swaying in the wind, particularly in environments with tall grass or other similar plants that are easily moved by wind. Lowering the sensitivity can reduce unwanted photos of swaying plants without much of a loss in the ability of the camera trap to detect and photograph medium and large wildlife species. You can verify that the camera is sufficiently sensitive by walking in front of it and ensuring that it takes a picture.

Flash: Camera traps can have a white flash or an infrared flash. The white flash has the advantage of producing colored nighttime photos, but the sudden bright light is very noticeable and may startle passing wildlife or people. Infrared flashes are recommended to avoid altering animal behavior as much as possible. Older infrared flashes still tend to give off some visible light, though some cameras are now marketed as having "no-glow" or "low-glow" flashes that further minimize the chance of disturbance. In the settings, there are sometimes options to manipulate how long the flash lasts, which can be useful for addressing glare (faster flash) or illuminating dark spots (longer flash) in nighttime images.

Time Lapse: In some instances, it may be advantageous to have the camera trap take pictures at set intervals instead of when something triggers the motion sensor. Most camera traps available have a time-lapse feature (sometimes called "field scan") that allows you to set a time, such as once an hour, to take an image or series of images. This can reduce the number of images received in places with high activity and give a representation of what one might find at a given location randomly. In most cases, the time-lapse and motion-trigger modes are separate, though on some models both can be enabled simultaneously.

Additional Considerations

When making use of camera traps, there are several things to keep in mind. First and foremost, it is important to keep the view of the camera parallel to the ground as much as possible to get the best results. Sometimes, it can be difficult to find a tree trunk or other environmental structure at the right angle in an area where a camera is desired. There are several ways to work around this problem. One option is to use a tree growing at an angle, not straight up and down, and "shim" the camera by wedging a stick between it and the tree trunk so that the camera itself is at the right angle, even if the tree is not (Figure 5). Another strategy is to use a stake or other item placed manually at the site to ensure a reliable mount for the camera. Stakes and tripods are frequently useful, and they are often outright necessary when placing cameras in more open areas with no trees.

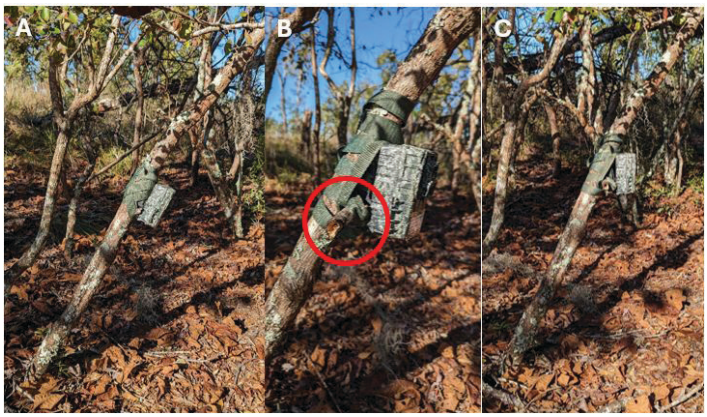

Figure 5. A camera trap with a stick being used as "shim" to ensure the angle is correct. A) shows the camera deployed on a slanted tree facing towards the ground. B) shows a zoomed-in view of the stick being placed behind the camera to adjust the angle. C) shows the same camera after the stick is in place, now with the correct angle. Credits: Wildlife Ecology and Land Management Lab, UF/IFAS North Florida Research and Education Center

Additional security measures may be necessary to prevent camera theft or damage from either people or wildlife. Many cameras have holes built into their frames to secure cable locks for theft prevention, and some manufacturers build rigid metal boxes to encase cameras to protect them from physical damage.

Camera traps can fail during a deployment, often when they run out of SD card memory or battery power, or when there is a malfunction in the camera itself. Using the right batteries and SD cards can help minimize this risk. Lithium batteries offer the best overall lifespan but are difficult to dispose of, whereas alkaline batteries tend to function relative to their price—higher-end batteries usually perform better and can be stored longer. Some camera manufacturers also include additional power features, such as solar panels or support plug-ins to alternative power sources for a longer battery life. SD card performance and longevity will vary by class and brand, but size is the most critical aspect. Many cameras list a maximum SD card size with which they are compatible. A larger card size means you won't need to change out the card in a deployed camera trap as frequently. If only recent pictures are of importance, some camera traps allow you to select a setting that automatically clears the oldest pictures as new pictures are taken.

As camera traps have become more widely used, a number of advancements to the technology have been made, such as the implementation of wireless connectivity, either short-range using Wi-Fi or Bluetooth or long-range using cellular data networks. Using antennae, cellular-network-enabled camera traps can send the images they take directly to a database, or even a phone or email inbox, sometimes in almost real time! Before purchasing one of these cameras,

be aware that they typically require a subscription-based plan, and make sure to verify that the network used by the camera has adequate service in the area where you plan to use the camera.

It is good practice to wave a hand or walk in front of the camera trap to ensure it is responding to motion and triggering as expected, both when deploying the camera and when retrieving it. Finally, when a camera trap is set up and ready to take pictures, always double-check that it is switched on before you leave!

Conclusion

Camera traps offer a means of viewing many kinds of wildlife in a minimally invasive way compared to many other methods. They can be deployed using different methods to help answer a variety of questions, including what species are present in an area, when these species are active, where they can be found, and even how they respond to changes in their environment. A wide variety of camera traps at various price points are available commercially now, allowing you to find an appropriate camera to suit the specific needs of all your wildlife observation projects.

Additional Resources

Valdez, R. 2018. "The Art and Science of Camera Trapping. National Parks Conservation Association." Available at https://www.npca.org/resources/3236-the-art-and-science-of-camera-trapping

iNaturalist. 2023. "Getting Started." Available at https://help.inaturalist.org/en/support/solutions/folders/151000552105

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