A Guide to Using Wildlife Cameras for Ecological Monitoring in a Community-based Context

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For more information on the WISE Lab and current research, visit www.wiselab.ca

For an example of how wildlife cameras can be used for monitoring, check out this video outlining Claire & Kathryn's camera project in partnership with Magnetawan First Nation: youtube.com/watch?v=UyMRMXlX5_w

To explore other case studies the WISE lab is involved in that aim to weaving Indigenous and Western knowledges, visit weavingknowledges.ca

Executive Summary

Environmental monitoring is an important part of understanding and caring for the land and water. Wildlife cameras can be an extremely useful tool for monitoring, providing insight about different animals by capturing photos of them over time. In a community-based monitoring context, there is great potential to use wildlife cameras for monitoring in a way that prioritizes Indigenous knowledge and supports community values, as they allow for community leadership in the process, connecting people to the land, and providing opportunities for knowledge-sharing. The main objective of this report is to provide guidance to those wanting to start a community-based wildlife camera monitoring program. Information within this report comes from a broad collection of published research, as well as tips and tricks learned from personal experience, summarized to create an outline for developing a community-based monitoring program. This report takes the reader through different stages of the design and implementation process, including a section explaining what wildlife cameras are and how they can be used for wildlife monitoring, creating a basic design for a camera program, different things to think about before cameras go out on the land, and actually using the cameras. While not the main focus of this report, there is also some information about how to sort, store, and use the photos obtained from the cameras, as well as additional resources that may be helpful for these stages. Overall, this report aims to help the reader 1) decide if wildlife cameras are a good fit for their monitoring goals and needs, 2) understand the basics for creating a wildlife camera monitoring program in a community setting, 3) better understand how to use wildlife cameras to accomplish their specific goals, and 4) understand some different ways that photos and information from wildlife cameras can be used to answer various monitoring questions.

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Acknowledgements

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Finally, we would like to thank the land and animals that we work with every day. These have been the teachers of some of our biggest lessons, and we continue to be humbled by how much we still have to learn.

Statement of Purpose

This user-friendly guide aims to describe what wildlife cameras are, how they can be used to support community-led monitoring, determine if they are a good fit for different monitoring goals and resources, and ultimately to help the reader create a community monitoring program using wildlife cameras.

A few important notes:

Throughout this report, some terms that appear frequently will be bolded and defined in the context of this guide within each page and in the glossary.

Additionally, in thinking about the importance of community, we have added info bubbles throughout the report with ideas and suggestions for community engagement at different stages of the monitoring process.

All photos and graphics shared throughout this report belong to the authors and research partners (Magnetawan First Nation) and have been included with permission. Maps have been created as an example and do not reflect real data.

Background

What is Monitoring and Why is it Helpful?

When thinking about the land and how we take care of it, the idea of 'monitoring' can help better understand the current state of the environment and if needed, what can be done to help preserve it. **Environmental monitoring** is a process that helps understand patterns and changes in the land, water, and wildlife over time. Sometimes, monitoring can be focused on specific questions – we may want to know more about moose and where they are spending time, find out how different **species** are affected by **human development**, or look at seasonal changes and the effects on wildlife. Other times, we might want to approach monitoring in a more general way, gathering a baseline of knowledge that can help answer future questions. We often call the knowledge we get from monitoring '**data**', which can be in the form of numbers, photos, or words; together, these data can help tell the story of the land.

Thinking about different monitoring questions is a good opportunity to talk with community members and get their feedback. Hosting community events or forums can be a great opportunity to discuss concerns, observations, or changes over time which can help direct monitoring ideas

Possible Questions to Guide Wildlife Monitoring

Number	Location	Health
• How many animals are there? • How have moose numbers changed over time? • Do moose and wolf numbers change in the same way over time?	• Where are the animals? • Are there more bears in spruce forest than in open spaces? • Do moose spend more time in wetlands than dense forest? Does this change in winter and summer?	• Are the animals healthy? • Do moose have ticks? • Are bears fat? • Do most deer have young with them?

Diversity

- What different kinds of animals are around?
- How many different animal species are on our territory? Does this change seasonally?
- What types of animals are active here during the winter?
- What species are active near roads? Are the same species also active near the railway?

Environmental monitoring: A process that helps understand patterns, changes, and relationships within the land, water, and wildlife.

Species: A specific kind of animal.

Human development: Changes or alternations to the landscape and built environment by humans.

Data: Information, commonly facts or numbers, that are collected and can be examined and/or measured to help guide decision-making.

Connection to Community-based Monitoring and Indigenous Guardianship

Globally, Indigenous Guardianship Programs have emerged as a way to reconnect and reinvigorate Indigenous knowledge systems, focusing on fostering connection with the land (Popp et al., 2020). Similarly, community-based monitoring is a flexible approach to environmental monitoring that focuses on the specific priorities of individual communities (Berkes, Berkes, & Fast, 2007). Perhaps most importantly, this type of monitoring centers communities within the monitoring process – prioritizing the interests, needs, wellbeing, knowledge, and values of the community as a whole. Applying this kind of holistic monitoring program as a form of Indigenous Guardianship can help communities tell a more complete story about their lands and ecological history.

Although wildlife monitoring conducted by Crown governments often use equipment and methods that are not accessible within a community context, technological advances in recent years have created new opportunities for community-based monitoring. In particular, **wildlife cameras** have grown in popularity while becoming increasingly effective, easier to use, and more accessible – making them an excellent tool for wildlife monitoring (Wearn & Glover-Kapfer, 2019). When thinking about compatibility with Indigenous Guardianship Programs and a community-based approach, cameras offer widespread and long-term monitoring possibilities, community control over monitoring goals, sole ownership of information, and photographs that can be used for community outreach. Beyond monitoring, these cameras can provide a platform for sharing place-based and generational knowledge throughout the community, getting people out on the land together.

Wildlife camera: A specially designed piece of equipment used to photograph animals in their natural environment.

Wildlife Cameras as a Tool for Monitoring

Wildlife cameras are specially made to be put outside and collect photographs of wildlife. Using a built-in motion sensor, these cameras automatically take pictures of animals – meaning they can be set up and left for a long period of time. For this reason, they are built to last through rain, snow, and both hot and cold weather. These cameras can be a great tool for environmental monitoring, whether there is an interest in specific questions or animals, or a desire to learn more about the wildlife in an area more generally (Swann & Perkins, 2014). Other benefits of wildlife cameras include the education and outreach potential, the ability to collect data without constant human intervention, and the fact that they can be used in many different ways (Blount et al., 2021).

However, as useful as cameras can be for monitoring, it is important to understand their limitations. One of the biggest challenges with wildlife cameras is that there is no 'one single way' to do things. This means that over the years there have been a lot of differences in how cameras have been used, making it hard to compare data (Burton et al., 2015; Forrester et al., 2016; Meek et al., 2015; Rich et al., 2017) or even decide which way is the 'best'. Another challenge is that different cameras, and even different animals, will have different **detection rates** (Blount et al., 2021; Mann et al., 2015; Swann & Perkins, 2014). This means that some cameras will be better at finding animals than others, and some animals are more likely to be found by cameras than others – this can change depending on environmental factors, like vegetation, season, light levels, etc. However, as long as these limitations are considered and understood, wildlife cameras are still able to provide useful information about wildlife.

Detection rate: frequency of being able to detect, or sense something and how accurately a camera can sense or photograph an animal.

The graphic above shows camera placement on a tree and how detection rates can be influenced by vegetation growth and snow accumulation.

Goals of this Report

1) Provide an overview of how wildlife cameras can be used as a tool to monitor wildlife

2) Outline how to create a simple community-based wildlife monitoring program with cameras based on your goals

3) Share tips and tricks for monitoring based on personal experience using wildlife cameras in a community-based setting

4) Suggest opportunities for community engagement that can be woven into the monitoring process

Using this Guide

This report is structured based on the process of starting a monitoring program, going through all of the different steps to be considered when getting started.

First, you need to consider what questions you have and what you want to get out of monitoring.

Next, think about what kind of monitoring will work for you – in this case, decide if wildlife cameras will be a good fit.

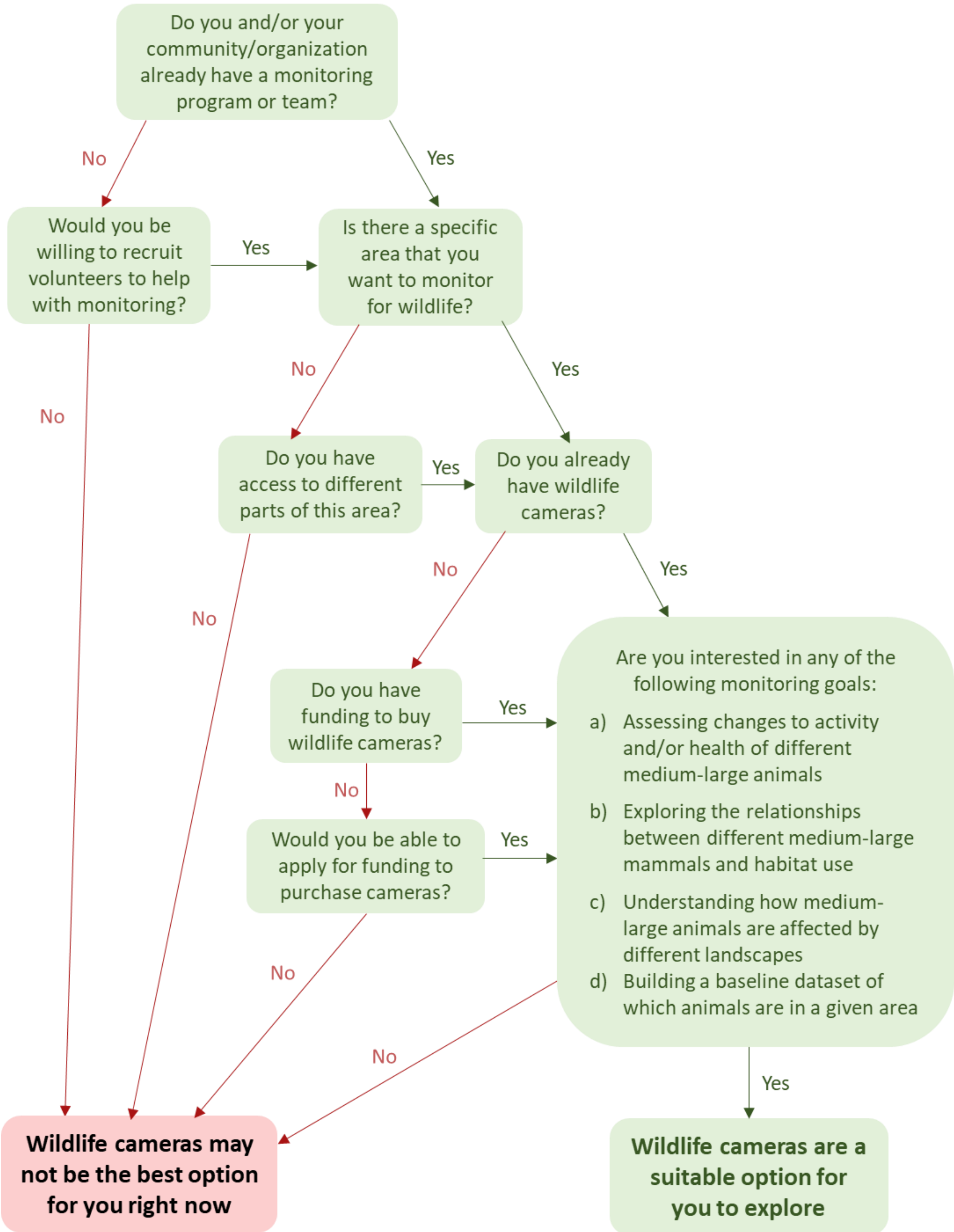
Then, you want to think about how you might set up your design – thinking about the area you want to monitor and where you might want your cameras. This may change over time and will be affected by what you want to monitor – a single species or multiple species.

Once you have an idea of the design, you can start thinking about what materials you need, how they work, and what you need to get ready before the cameras can start recording.

Finally, after your cameras are ready and you start monitoring, you can start thinking about what you can do with your photos and other camera information.

Getting Started

Before continuing through this guide, here are some questions to help determine if wildlife cameras are a good option for monitoring based on the current goals and capacity of your community or organization.



Working with community volunteers, land guardians, youth, and hunters may be a good way to increase the capacity of monitoring programs. Consider how outreach activities can help engage with people – photos from wildlife cameras are a really fun way to share information about monitoring!

Creating Your Monitoring Program

Design

There are many design options for deploying wildlife cameras which can make it difficult to determine the best approach. Reflecting on monitoring questions, consider how **environmental variables** change over space and time, and how either space or time must be held constant to see the effects of the other. For example, to explore changes in wildlife over time, it is important to assess the same locations. To explore changes across different locations, it is important to assess them at the same time. Because of this relationship, it is recommended to begin a monitoring program using a standard grid design which will also provide flexibility for future monitoring.

Grid designs can be used to explore the number of animals around (**abundance** and **density** - Burgar et al 2018; Palmer et al 2018; Sollmann et al 2013), different kinds of animals around (**biodiversity** - Colyn et al 2018; Rovero et al 2014; Stewart et al 2019; Swanson et al 2015; Tobler et al 2008), where animals are spending time (**occupancy** - Rovero et al 2014), and more. Once the grid has been placed over the geographical area of interest, the center of each grid cell can be used as a random – but uniform – place to deploy cameras, giving a good starting point for robust data. It is important to remember, too, that even places where cameras do not pick up a lot of animal activity still tell us a lot – finding no animals in a place is still data!

To make it easier, the process of making a grid design can be broken down into 3 main steps: 1) find and outline the area you want to monitor on a map, 2) place a grid with square shaped cells over top of the map, and 3) find the center of each cell within the grid.

Talking to land-users and hunters is a great way to find out which areas are accessible and plan routes to get to each site. These conversations may even help identify areas to focus on or get interested volunteers to help out.

Environmental variable: A specific feature, condition, or element that may change. Examples include vegetation growth, habitat, and season.

For help navigating computer mapping software, try exploring:

https://support.esri.com/en/technical-article/000022784

Abundance: The number of individuals within a species in a defined area. When you count the number of individuals within a set area, it is reported as just a number (ex. there are 10 bears in this territory).

Density: The number of individuals within a species relative to a unit of area. This is reported as a rate, or function, of the area you observed (ex. there is 1 bear per km^2). Density differs from abundance in that the number of individual animals will change with area (ex. 1 bear/km^2 compared to 10 bears/10km^2), while abundance is always defined for a set area (ex. 10 bears in this territory)

Biodiversity: The variation of life in the natural world, such as different wildlife and plants.

Occupancy: A measure of where different species are spending their time. This is sometimes presented as "presence or absence data", which indicates if a particular species is present in a particular area or not.

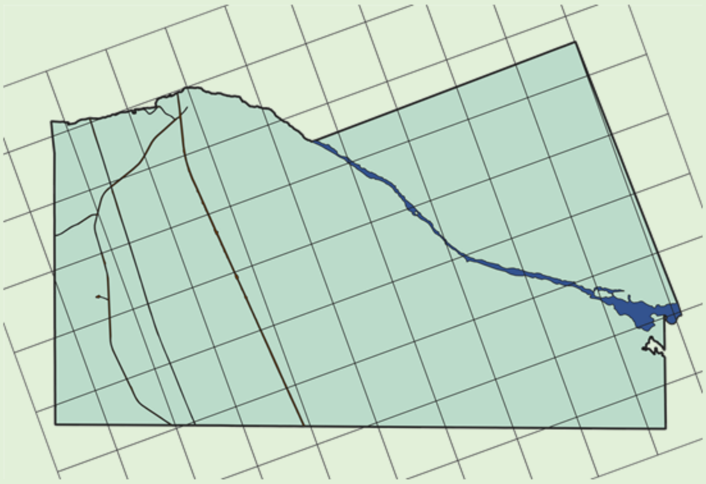
Designing a Wildlife Camera Grid

1) Define the area

- Think about the area you want to monitor
- Examples include traditional territory, reserve lands, or any significant area
- Once you pick this area, find it on a map (you may need to define boundaries)

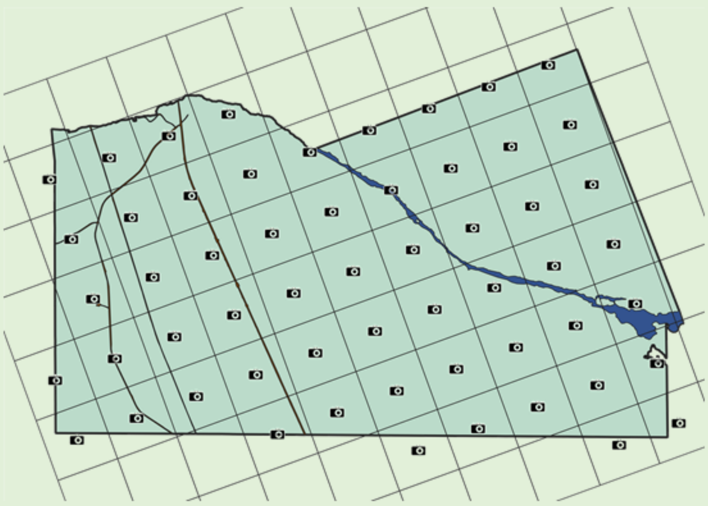
2) Make and place a grid

- Place a grid over your map, creating equally sized cells
- The size of cells will depend on your monitoring goals (see section below), but 1km by 1km is a good starting point
- You can place the grid at random, or align it with map features, as done here



3) Find and mark centroids

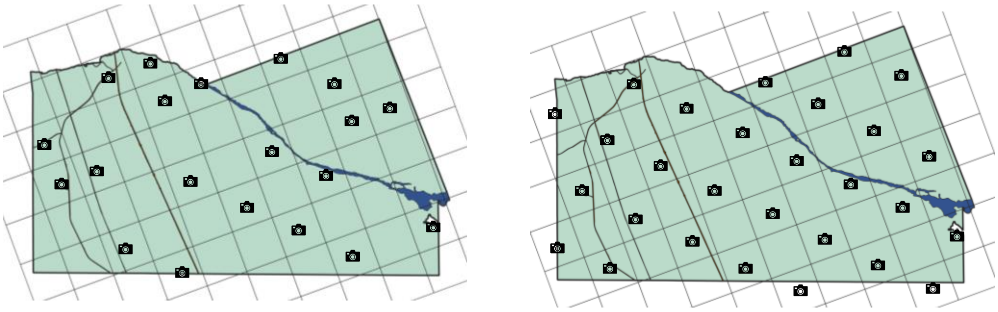
- Find and mark the centre of each cell (called the centroid)
- Each centroid gives you a unique, random, and evenly spaced point to place a camera
- Note that some points may need to be adjusted (in water body, not accessible, etc), but this gives you a starting point



Modifying Grid Design

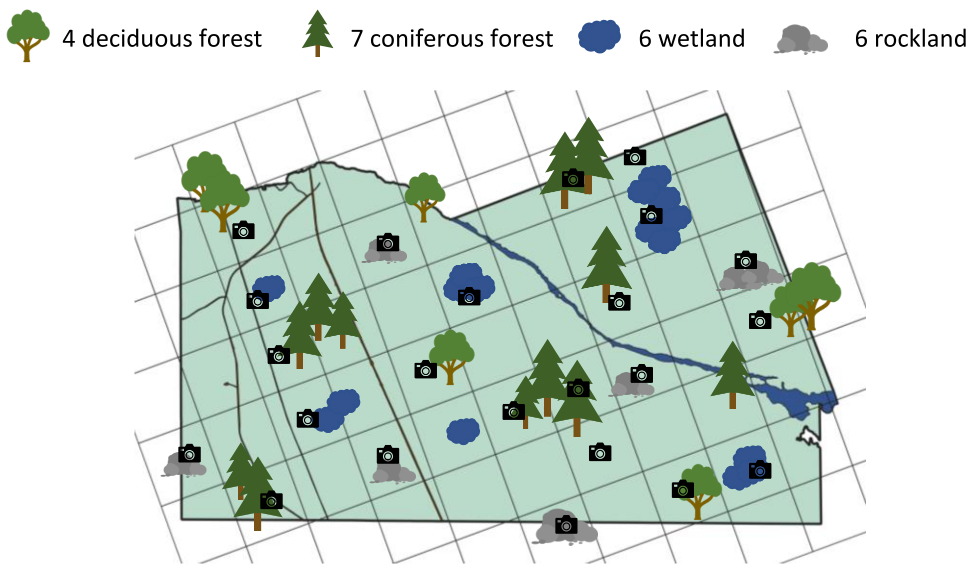
Once created, a camera grid design can provide a good baseline to work from and as the monitoring program develops over time it can be used as a building block. Not only does the grid allow data to answer different questions all at once, but it can easily be modified to suit changing needs, interests, and levels of capacity.

If covering an especially large area, or if you don't have the number of cameras required to cover your entire grid, you can choose to only place cameras in some of the cells (selecting at random or based on specific criteria) (Parsons et al., 2018). This may be called a **partial coverage design**. These select sites can stay consistent over your monitoring period, or you can rotate them over time to get a larger area of coverage.



The above maps show examples of partial coverage using random and uniform approaches.

If you are interested in investigating **land-based features** (ex. habitat types), and how they may influence animals, you can use a **stratified design**. In this case, you would determine the number of cameras that will be deployed for each feature and then randomly distribute cameras where that feature occurs. If possible, it is favourable to have a similar number of cameras for each feature so they can be evenly compared. This design can provide robust data when a species is expected to occur more or less frequently near one feature compared to another. It is important to know that feature-based placement is often tailored to a specific species or group and can be helpful for answering specific questions; however, it is not as useful for general, multi-species monitoring as it can add **bias** to camera placement.



The above map shows an example of stratified design based on land-based features.

Note: If you have specific monitoring questions and are interested in using a more complex design, we recommend engaging with experts for guidance if that expertise is not held within the community. This will help ensure your approach will best suit your specific goals.

Partial coverage design: A type of monitoring design that only partially covers the study area.

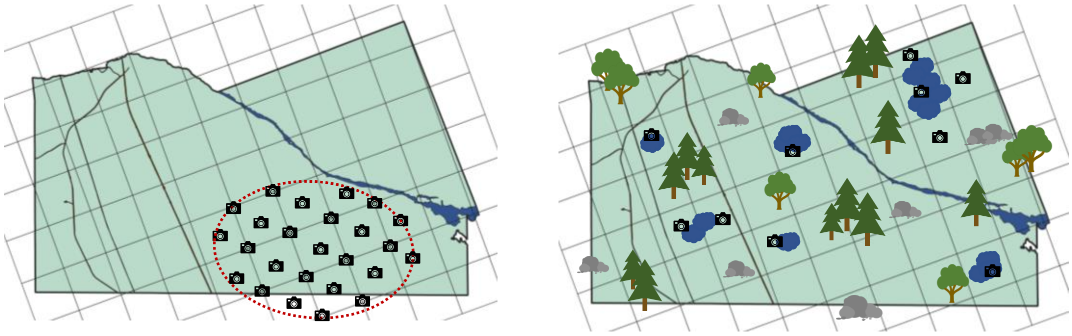
Land-based features: Specific characteristics of the environment that can be isolated or mapped. Land-based features can include entire habitat types (for example, forests), water features (for example, rivers), human-made infrastructure (for example, roads), and more.

Stratified design: A type of monitoring design in which sampled units are classified or organized categorically. These sampling units may be selected randomly or targeted, so long as all units are then grouped by commonalities for further analysis.

Bias: A skewed or altered perspective. Biased data refers to data that may be inaccurate or unevenly portrayed (usually in favour of specific variables) and is therefore not as robust.

If you are interested in specific places within your monitoring area, you may want to focus camera effort there to create a **clustered design**. This may be to highlight or focus on specific land-based features (ex. river or road), areas of greater animal activity, specific habitats, or for land-use planning. Once these areas of interest are identified, a more concentrated block of cameras can be placed using either the centroid locations or the grid as a guide for different spacing.

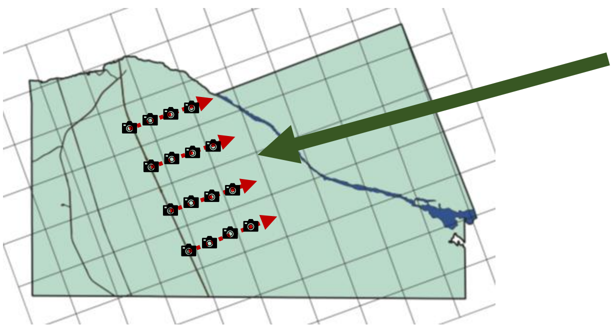
Clustered design: A type of study design that focuses camera effort on specific places within the monitoring area using concentrated blocks of cameras.

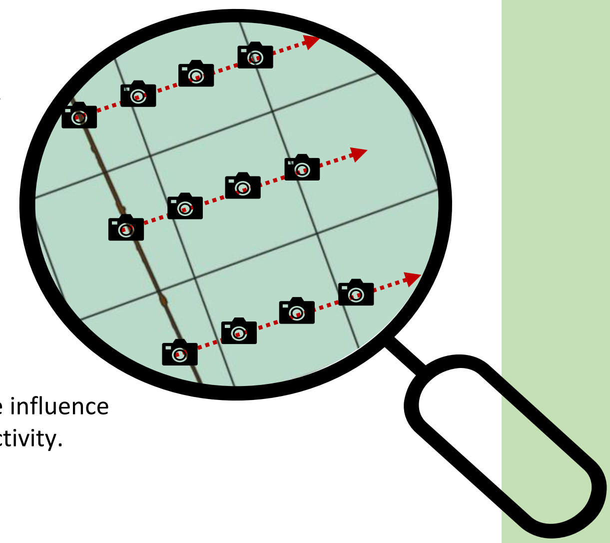


The above maps show examples of clustered design based on a specific area or land-based feature (ex. wetland habitats) of interest.

If you are interested in covering the distance between different points, you may want to use what is called a **transect design** (Wait et al., 2018; Mann et al., 2015). This could be a way to look at the influence of different land-based (ex. river) or human features (ex. road) on animal activity, having a camera placed at the initial feature with additional cameras placed at different spacings from this starting point. It should be noted that depending on the size of your grid, you may be able to align your grid to certain larger features creating a transect effect.

Transect design: A type of design in which sites or sampling follow a set pathway or line.





The above map shows a transect design to assess the influence of a specific feature, in this case a road, on wildlife activity.

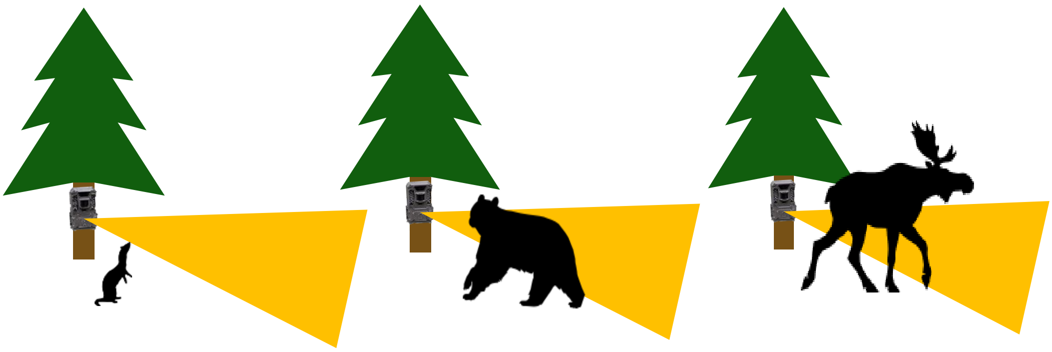
The number of people helping with monitoring is something that should be considered when deciding if you need modifications. Working with community volunteers may help cover more ground, especially if there are some areas that are well-travelled by community members.

Animal Groups

In many ways, the animals you are interested in monitoring will influence how to set up your cameras. Larger animals often travel larger distances, meaning that cameras can be placed further apart from one another. This is in comparison to smaller animals which don't travel as far, meaning that cameras should be placed closer together. In addition, the height that a camera is placed on a tree should reflect the general size of the target animal in order to increase the chance of **detection** and successful photos (Palencia et al., 2021). In order to 'detect' an animal, the animal must enter and move within the camera's **field of view**.

Detection: A camera's ability to sense or photograph an animal.

Field of view: The actual area (in front and to the sides) in which a camera is able to detect movement.



The graphic above shows how the height of the camera should reflect the size of the target animal to increase the chance of detection. In this case, the yellow area shows the field of view.

If there is a particular animal you are interested in monitoring, it is recommended to create your program with that animal in mind to increase the likelihood of detection. Alternatively, if you are interested in monitoring as many different animals as possible, you may want to build your design around medium animals because this is generally the size class for which cameras are designed and should provide suitable results. Regardless of if you are monitoring one particular animal or wildlife in general, the likelihood of detection will vary among all animals, but remember that finding no (or very few) animals in an area is still data! With all of this in mind, organizing wildlife based on their size can make it easier to determine how to set up your camera grid.

What Do You Want to Monitor?

Small animals (ex. mink)	Medium animals (ex. black bear)	Large animals (ex. moose)	Variety of animals
*Cell size: $500m^2$ Approx. camera height: 60cm Considerations: Since they are small and move quickly, small animals can be difficult to detect with wildlife cameras, however for some species using bait may help (see page 23). Having cameras placed lower will also increase the chance of vegetation growth or snow accumulation blocking the camera.	*Cell size: $1km^2$ Approx. camera height: 75cm Considerations: Medium and large mammals are most easily detected by cameras due to their size. Therefore, the specific position of cameras isn't as important, as long as it is consistent.	*Cell size: $5km^2$ Approx. camera height: 90cm Considerations: Medium and large mammals are most easily detected by cameras due to their size. Therefore, the specific position of cameras isn't as important.	*Cell size: $1km^2$ Approx. camera height: 75cm Considerations: Be sure to deploy cameras at a variety of habitat types within your grid as the amount of time spent in each habitat will differ among animals. Note that this approach will provide insight to many animals but won't be as accurate as targetting a specific animal.

***Note that these are generalized suggestions. Assessing the home range size of the animal(s) you are interested in monitoring will ultimately help you pick the most appropriate cell size. Some small animals have larger home ranges, and some large animals have smaller home ranges, so if you are interested in a specific species you may need to adjust accordingly. Our recommended cell sizes are generated based on research designs published within academic literature, in combination with our personal experience.** For examples and further reading, see: Coyln et al., 2018; Kays et al., 2020 (review article for wildlife camera study designs); Palmer et al., 2018; Sollman et al., 2013.

Using Wildlife Cameras

There are many considerations that can be made when starting up a wildlife camera monitoring program. This section will outline the most important considerations and provide recommendations to help ensure that your program is successful. These recommendations should be considered in the context of your monitoring objectives and goals, program capacity, and the land that is being monitored. Above all else, it is most important to ensure consistency among wildlife cameras when it comes to brand, settings, and **deployment**.

Deployment: The act of setting up and activating a wildlife camera for monitoring.

Equipment and Supplies Needed

Wildlife cameras

With constant advances in technology, there are many brands and models of cameras that have slightly different features (see table on page 19) making it difficult to know exactly which cameras are best. If different camera brands, or even models, are used within a monitoring program it can be difficult to compare the photos that they collect because of these differences. For this reason, one of the most important things to consider when selecting what cameras to use is to make them all the same if possible. Having cameras that are consistent across all sites will ensure that your data can be compared more easily. However, if you have different types of cameras, it is still possible to overcome these differences – you just may need to use more specialized statistics, so reaching out to an expert may be helpful.

Newer camera models will often have improved photo or video quality and a greater number of settings that can be adjusted. If these models are affordable within your program budget that is great; however, remember that you do not need the newest or fanciest camera model to have a successful program!

When purchasing a camera, note that they are sometimes available either on their own or as a bundle that comes with batteries and an SD card (more details about batteries and SD cards can be found below). If you are just starting out, purchasing the bundle could be a great way to save on costs. There may also be an option to bulk order cameras for a lower cost directly from the brand if you are buying many at once.

The number of cameras you will need depends on the size of your monitoring grid and how close cameras are being placed together. If you are using a basic grid design, you can figure out the approximate number of cameras needed by considering the total area you are monitoring and divide that by the size of each cell (this is outlined in the "What Do You Want to Monitor" visual above).

$$\frac{\text{Total area to monitor (km}^2\text{)}}{\text{Size of each grid cell (km}^2\text{)}} = \text{Number of cameras}$$

If your sampling area is $50km^2$ and you want to monitor small animals, the equation would be:

$$\frac{50km^2}{0.5km^2} = 100 \text{ cameras}$$

If you would like to monitor medium animals, the equation would be:

$$\frac{50km^2}{1km^2} = 50 \text{ cameras}$$

Note: See Appendix I for an estimated budget to get your wildlife camera program started.

Tip: We recommend that you also purchase extra cameras in preparation for lost or damaged cameras – tips on minimizing the chance of damage can be found below.

Batteries

Most cameras will require six AA batteries and will come equipped with one set of alkaline batteries to get you started. Alkaline batteries are sufficient to begin with; however, lithium batteries are known to last longer, especially during periods of cold temperatures (such as winter months). For both alkaline and lithium, battery life will vary across seasons due to changes in temperature and therefore, cameras should be checked more frequently during periods of cold temperatures (winter months). If possible, it is recommended to use lithium batteries for all cameras and during all times of year. There may be some cameras that have alternate forms of power (ex. internal rechargeable battery), or that use different sizes and amounts of batteries, so make sure you know what your cameras need specifically.

When selecting battery type and SD card size, consider the capacity of your community/organization and how frequently people are able to perform maintenance checks on cameras.

SD cards

Some cameras will come with an SD card, but this should be confirmed with the specific camera model when it is purchased. It is recommended to have at least two SD cards for each camera, as this will make maintenance checks and data collection as simple as possible - simply swap the new SD card for the old, rather than waiting to download photos in the field. When purchasing additional SD cards, note that some cameras may require a specific type of SD card. For example, some will use a microSD card that gets put into an adapter. All cameras will clearly outline any specific requirements so be sure to check before purchasing additional cards.

SD cards come in a wide range of storage size including 16GB, 32GB, 64GB, and 128GB; the amount of storage you need will depend on whether photos, videos, or both are being collected. As a baseline, at least 16GB should be used, but it is recommended to use 32GB or more if possible; at this storage level data should try to be downloaded off the cards every 3-4 months. Data should be collected more frequently if there is concern of **false triggers** taking up storage space, such as in areas with a lot of plant growth.

Setting up cameras for a trial run in a backyard or forest nearby and walking in front is a great way to become more familiar with the sensitivity of the camera trigger and how this can be adjusted. More details about adjusting these settings can be found below.

False trigger: Any time that a camera takes a photo of a non-target event or species. For example, if there is tall grass or trees in the camera frame, movement from wind may cause the camera to capture photos even when there is no animal present.

Photos tend to be the best option for monitoring as they provide insight into what animals were present at the camera without using up a lot of storage space on the card. However, video footage can be helpful if there is interest in assessing animal behaviour or other specific monitoring questions – note that video will use more storage space and battery power. For this reason, if videos are being recorded it is recommended to use an SD card that is 64GB or larger and to visit the camera at least every three to four months.

When transferring data from wildlife cameras to computers, some computers will have an SD card port that the card can go right into. However, some computers (especially Mac laptops) will require an adaptor to connect the SD card to your computer, and this can be purchased from electronic stores or online.

Getting Cameras Set Up

Camera settings

Depending on your specific wildlife cameras, the adjustable setting options may differ slightly. Common settings include **sensitivity**, **trigger speed**, number of photos taken per trigger, **delay period** between triggers, and photo quality. In addition, the field of view (see page 15) will vary across camera brands and models, and cannot be adjusted. Above all else, the most important thing is to be consistent with your settings across all of your cameras so that sites can be compared. A starting point for general monitoring of medium-large animals would include the following settings:

Sensitivity: moderate

Trigger speed: as fast as possible

Number of photos taken or photo series: five

Delay period between triggers: five minutes

Photo quality: high (note that higher quality will use more storage space on SD cards but will yield more identifiable photos that can also be used for outreach)

Date & time: be sure to correct this to be accurate for each camera

Sensitivity: How much movement detected by the camera's sensor will trigger a photo to be taken. High sensitivity is more likely to pick up small movements by trees in the wind or long grass, resulting in more false triggers, while low sensitive might miss small animals or those that are further away.

Trigger speed: The amount of time between when the camera's sensor detects movement and a photo is actually taken. This lag time can vary quite a bit across different brands and models of cameras, making consistency important.

Delay period: Following a photo series being taken, how long the camera will be inactive before it can be triggered again. This feature prevents many photos being taken of the same individual(s), filling up space on SD cards.

If you are trying to detect small or elusive animals, these settings can be adjusted to increase the sensitivity and number of photos taken per trigger, but it is important to note this will result in far more photos, using more SD card storage and taking a longer time to review data.

Within the settings there will often be an option to name the camera. It is encouraged to provide a unique name for each of your cameras to keep track of which camera was at each site.

Some cameras will have a “time lapse” feature that sets the camera to take one series of photos at a set time each day. Activating this feature is highly encouraged if possible because it can be used to confirm if cameras were in working condition each day.

As a final reminder, adjust the settings as they best suit your desired monitoring goals and be sure to keep all cameras consistent.

Labelling cameras and SD cards

To organize all your field gear and keep track of which sites cameras and SD cards are collecting data at, it is recommended to label them with a unique identifier. This will be particularly helpful when collecting SD cards and transferring photos to a computer. Using a sticker or other weatherproof material is best for labelling cameras, while a permanent marker can be used for SD cards. Options for a unique identifier may look like an acronym for your community/organization followed by 001,002, 003... and so on.

Considerations to Help with Deployment

Camera placement

Setting up cameras will take a little bit of practice and the best way to learn is to check back on cameras and the photos they collect to see what challenges may arise. To help minimize the challenges encountered, here are some recommendations to consider:

- As a general rule, cameras should be placed at approximately shoulder height of your target animal and angled straight (Palencia et al., 2021).

- Depending on the geographic location, reducing possible glare from sunlight may be a consideration. During winter months the sun remains lower in the southern part of the sky. Placing all camera facing north can help minimize how this affects your photos.

- Consider the terrain in front of the camera. If the ground dips or rises, consider adjusting the height of the camera to reflect where the animals will be.

- Each tree is unique, and many will not be straight up and down. Placing a stick between the camera and tree can help adjust the angle of the camera.

- Bring a small saw to remove vegetation that could cause false triggers. When placing each camera, consider how vegetation will grow over the coming months and/or if snow will pile up.

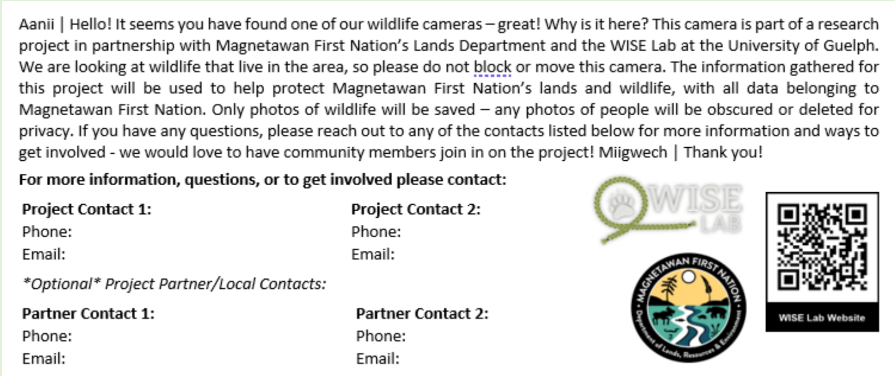
This photo shows an example of where a stick was used to regulate the angle of the camera when deployed. This is an easy way to adjust camera position on trees that are not straight and flat.

Securing Cameras

To ensure that cameras stay in their deployment location and in a working state for as long as possible, a few considerations can be made to avoid the loss or damage of cameras by people, wildlife, and weather.

A. Information Cards

Having information cards or stickers attached to cameras will tell anyone who comes across your cameras who they belong to and what they are for. Be sure that cards or stickers are weather-resistant (laminating paper or simply putting them in a Ziploc bag can be an inexpensive solution) and are out of view of the camera lens. Zip ties can be a good way to secure these to the camera. When securing information cards, make sure they won't set off the camera during windy days.



Aanii | Hello! It seems you have found one of our wildlife cameras – great! Why is it here? This camera is part of a research project in partnership with Magnetawan First Nation's Lands Department and the WISE Lab at the University of Guelph. We are looking at wildlife that live in the area, so please do not block or move this camera. The information gathered for this project will be used to help protect Magnetawan First Nation's lands and wildlife, with all data belonging to Magnetawan First Nation. Only photos of wildlife will be saved – any photos of people will be obscured or deleted for privacy. If you have any questions, please reach out to any of the contacts listed below for more information and ways to get involved - we would love to have community members join in on the project! Miigwech | Thank you!

For more information, questions, or to get involved please contact:

Project Contact 1:
Phone:
Email:

Project Contact 2:
Phone:
Email:

**Optional* Project Partner/Local Contacts:*

Partner Contact 1:
Phone:
Email:

Partner Contact 2:
Phone:
Email:

This is an example of an information tag used to provide details about cameras. Include why the camera is there, what it is for, who is involved, and contact information.

> This is a great way to let people know about the monitoring work being done within the community, and maybe even get some interested volunteers. It is helpful to include contact information so people can get in touch to learn more or get involved. Especially if wildlife photos will be shared!

B. Camera Locks

Equipping cameras with a cable and lock is common when cameras are placed in a public location or if there are concerns about people removing or altering cameras. Cord and lock combos are available for purchase, although they can be costly. Galvanized wire and aluminum sleeves are a cost-effective alternative.

C. Bear Boxes

If it is expected that cameras may be damaged by either animals or people, there are different options to consider for protecting cameras to keep them in working order. Especially if there are bears – who are often responsible for camera damage – in the area, it may be worthwhile to invest in bear boxes to minimize damage. To avoid additional animal interference, ensure that camera straps are pulled tight and tucked in. This will reduce the chance of animals pulling on straps, as well as their ability to move the camera from its original position.

Even with thorough planning, it is expected that some cameras may become damaged over time. Performing maintenance checks on cameras regularly (every few months) and budgeting for replacement cameras is recommended.

Baiting camera sites

Depending on specific monitoring goals, some additional steps can be taken to increase the likelihood of detecting a specific species. For carnivores such as wolves, bobcats, or fisher, bating sites may be considered to increase detection. However, using bait requires further consideration, precaution, and involvement. Note that only a small amount of bait, or a scent lure, should be used, as you do not want to habituate animals to the place or bring them in from far away, but rather attract animals that are already nearby. The use of bait tends to be most helpful if you are interested in monitoring more elusive carnivores only, because the bait will change the natural movement of animals on the land (Heim et al., 2019; Wait et al., 2018) and may affect the ability to accurately detect other species. Additionally, if only some sites are baited, it can be challenging to compare results across the whole monitoring area. For this reason, if there is interest in monitoring a species that can be difficult to detect (such as those noted above) it is encouraged that you use a species-specific approach.

Information to Record During Deployment & Maintenance Checks

Once your cameras are ready to be deployed throughout your monitoring area, here are some considerations for collecting notes during both deployment and maintenance checks. Having these notes can keep track of when cameras were last visited, which set of photos were taken at each site, and help interpret the data that has been collected by your cameras. Notes can be recorded simply on a paper data sheet (such as the ones in Appendix II and III) and later input into a computer program (ex. Microsoft Excel) for storage. Alternatively, if your community or organization uses the ArcGIS program, the Survery123 platform may be a suitable option for data collection. Survey123 allows you to use mobile devices in place of paper data sheets and will automatically store your notes electronically.

The table below outlines important information to record at each site during deployment and maintenance checks, in addition to more specific notes that may be helpful depending on your monitoring goals.

For more information on the Survey123 platform, see this video:

https://www.youtube.com/watch?v=mxwF0k39fG0

Deployment Data	Maintenance Check Data
General Notes - Essential	**General Notes - Essential**
• Names of people who deployed cameras • Date & time • Site name • Location (GPS coordinates if possible) • Wildlife camera ID • SD card ID • Habitat notes (ex. Forest, rocky, wetland) • Accessibility notes (don't rely only on GPS to find sites!)	• Names of people checking cameras • Date & time • Site name • New SD card ID (if changing) • Note if batteries were changed • Note any damage or alterations made to camera • Note if the time and date are still correct
Specific Notes - Recommended	**Specific Notes - Recommended**
• What camera was deployed on • Direction camera is facing • Height of camera • Specific habitat notes (may be related to monitoring goals) • Photos of the site/camera for reference	• Vegetation growth around camera • Type of batteries used • Signs of wildlife presence nearby (ex. Scat, tracks, browse) • Changes to habitat • Photos of any changes to site for reference

Deployment Tips

During deployment and maintenance checks, we recommend a few often overlooked pieces of gear to help things go smoothly.

Having a small case/box to carry SD cards in while out in the field can protect them from weather conditions and keep them organized and safe between sites. Ziploc bags can be helpful for this as well!

Using a saw or hatchet can help eliminate vegetation at the site of deployment, reducing false triggers. A compass (or compass app on a smart phone) will ensure your cameras are all facing in the same direction.

Always have extra batteries!

If you will be checking cameras during the winter months, consider bringing a lighter or heat source in case the locks freeze or have ice buildup.

When in doubt, write it down! It is easy to say you will remember something, but much harder to actually remember – especially after a long day in the field. If there is something noteworthy or important to record, write it down right away. You will thank yourself later!

When thinking about visiting camera sites initial deployment or maintenance checks, time of year can make a big difference on accessibility and ease of travel between sites. For example, spring and fall months will have the least understory vegetation making it easier to navigate through dense forests, while also avoiding peak summer heat and black fly season. Snow may also be an important consideration for winter months. Community members and land users know the land best, and so this is a great opportunity to work with the community to plan site visits and access.

What's Next?

Storing Photos

Once you begin collecting photos from your cameras, you will quickly realize how much space these photos can take up on your computer. Having an external hard drive to store photos on can save room on your computer and help to keep the photos safe in the event of a computer crash. There are also options for storing photos online using 'clouds' like OneDrive and Google Photos but note that photos will often exceed the storage provided with free accounts. Using an external hard drive to sort photos by each site is often the easiest for managing all wildlife camera data.

Although there is a cost associated with buying extra storage (whether through the cloud or an external hard drive), the cost is very small compared to the time and effort needed to get the data in the first place! You are better off having extra copies of everything rather than not enough. Also keep in mind that if you have multiple hard drives, they should be stored in different places – having multiple back ups isn't helpful if they are both lost!

Sorting Photos

Methods for sorting photos will not be discussed thoroughly in this guide, but a brief overview of some general options will be provided. One option is to sort photos manually, filtering out false triggers and noting which species have been photographed throughout the sampling time. This approach is straightforward, but it can be very time-consuming depending on how many cameras you have. Alternatively, some online programs are now able to automatically sort photos using special computer software. These programs are quite new and often cost money, but they can save a lot of time. There are also some free, open-source options, but they often require data to be shared publicly – which is a major consideration for community data privacy. There are benefits and drawbacks to both manual and automatic options for photo sorting and analysis, so these should be explored further when considering the capacity of your monitoring program.

A program called *Timelapse* can serve as a middle ground option. This program makes it easier to manually organize photos by allowing the customization of templates specific to monitoring goals which can be used to pull out useful information from each photo. Timelapse is available for PC computers and is favourable as it is free, relatively user-friendly, and can be easily customized to different monitoring programs.

Sorting photos can be really time consuming but can be a very fun way to engage with community members – especially youth! It's always exciting to reveal what the cameras caught and makes for great outreach material. Also, be sure to share good photos on social media if you have it!

Find more information about the Timelapse program here:

http://saul.cpsc.ucalgary.ca/timelapse/

Using Wildlife Camera Photos

Once SD cards have been collected from cameras and photos have been transferred onto a computer, you can look at this data in a few different ways. Thinking back to some potential monitoring questions, you may be interested in what species are around, how many species are around, and where they are within your monitoring grid. Using the detection rate of species at each camera is a simple way to gain insight into some of these questions. To get your detection rates, you need to count how many times a certain species appears in front of each camera over a set period of time. This can then be interpreted to explore different questions about abundance and species richness, as explained in greater detail in the following sections (Pineda-Cendales et al., 2020).

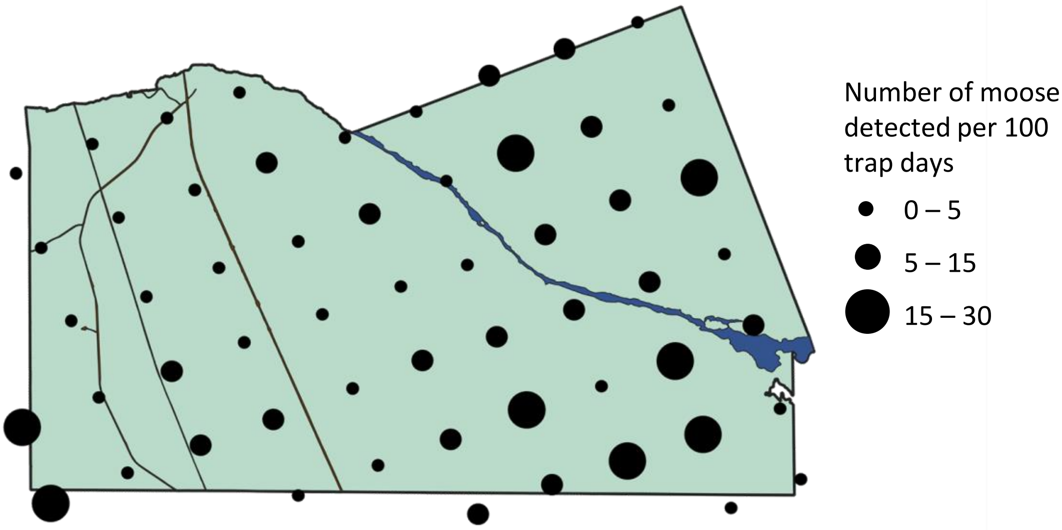
Using wildlife cameras to explore species occurrence

The most basic thing you can do with wildlife camera photos is determine if an animal is photographed at a specific location or not. This is often called **species occurrence** and can be found by simply reviewing the photos from a given camera. If an animal is caught on camera, you can confirm it occurs in that particular location. However, a lack of detection does not confirm that the species does not occur in that location, but rather that it did not come into the camera's field of view. Factors such as detection rate, camera angle, camera settings, and general bias may all contribute to an animal not being caught on camera, even if it is in the area. In other words, the animal may be present but not have been photographed. As this does not require any fancy calculations or analysis, monitoring for species occurrence can be a great way to get started and can be particularly helpful if you are interested in observing species that may be rare, nocturnal, or elusive, creating a species inventory, or mapping out where animals are.

Species occurrence: The presence or absence of a species at a given location.

Exploring abundance using detection rates

If your monitoring focuses on a particular species, such as moose, the detection rate can be used as a way of exploring relative **abundance** (sometimes called a **Relative Abundance Index** or **RAI**). This involves counting how many times a moose appeared in front of the camera over a certain amount of time (Pineda-Cendales et al., 2020). For example, the number of times a moose was photographed over 100 consecutive days. Although this does not specifically answer how many individuals are in your sampling area (often referred to as **density**), this can help answer many potential monitoring questions related to abundance. When using this approach, it is important to note that this specifically tells you how often that species was at your camera site – it does not tell you how many unique individuals were found or provide definite numbers for the entire grid cell. It explores the abundance of a species at each site compared to other sites within the grid (Gilbert et al., 2020), and therefore can provide useful information about animal activity and patterns. Note that cameras are often set to take numerous photos when triggered (known as a photo series), so it may be easier to consider how many times the camera was triggered by that species. After calculating the detection rate for each site, applying this to your map can provide you with an effective visual to better understand that animal's activity across the land.



*Please note, this figure is for example only and does not reflect real data.

This data is particularly helpful in determining a baseline of where wildlife are spending time on the land and how this changes yearly (Townsend et al., 2014). Further, the activity of animals across your grid may change within the year – such as between summer and winter – and show interesting seasonal patterns. In this case, it may be helpful to divide yearly data by picking a set number of days in the summer and winter to compare detection rates (Liu et al., 2013).

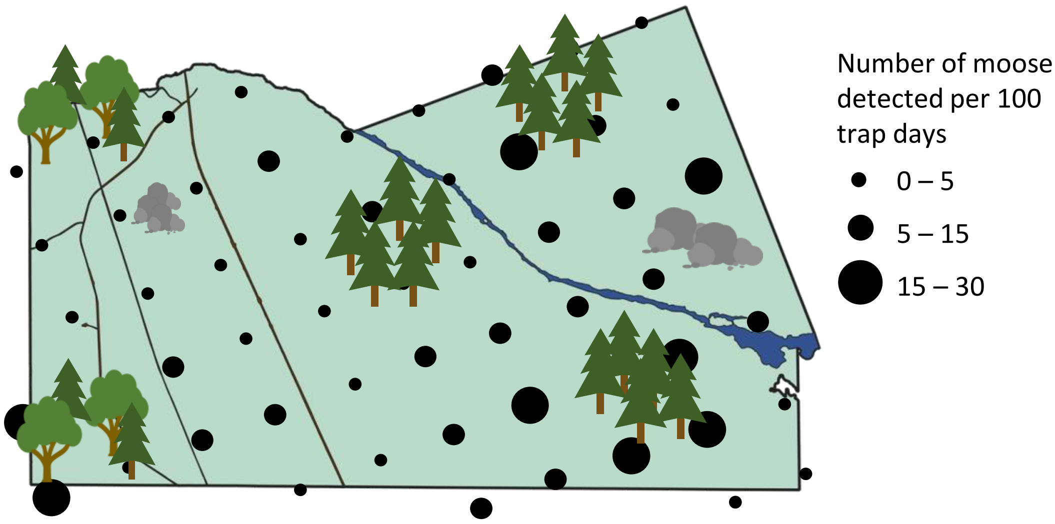
Abundance: The number of individuals within a species in a defined area. When you count the number of individuals within a set area, it is reported as just a number (ex. there are 10 bears in this territory).

Relative abundance index (RAI): Uses detection rate as a measure of abundance by counting the number of times a specific species is captured on camera over a set period of time.

Density: The number of individuals within a species relative to a unit of area. This is reported as a rate, or function, of the area you observed (ex. there is 1 bear per km^2).

The map to the left shows how photographs from wildlife cameras can be used to show where moose are spending time within a monitoring area. Each circle represents a wildlife camera site, with the size of the circle showing how frequently a moose appeared on the camera over 100 consecutive trap days. Generally, the larger the circle the more time moose spend in the area.

Depending on your monitoring goals and the deployment data you have collected, you can also explore abundance data in various contexts, such as different habitat types. This is a good reminder to make sure the data you collect fits your specific questions – be sure to check your data sheets with that in mind. If you are interested in reading more about using detection rates for abundance data, you can look up “relative abundance index using wildlife cameras” for more specific details (see Liu et al., 2013).



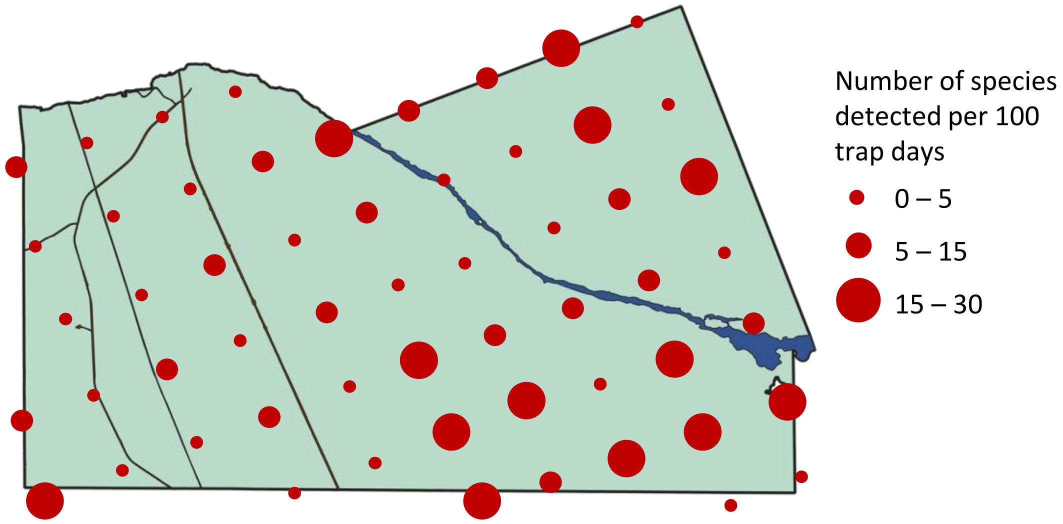
*Please note, this figure is for example only and does not reflect real data.

Exploring species richness & diversity

If you are interested in looking at how many different species – sometimes called **species richness** – are photographed at each of your camera sites, you can use a similar approach to what we used for looking at abundance. Similar to detection rate, this involves counting how many different species are caught on camera over a certain amount of time (Pineda-Cendales et al., 2020). For example, you may want to look at how many different species were photographed over 100 consecutive days. When taking this approach, we recommend focusing on a grouping of similar animals (ex. based on size) because they will have a similar detection rate based on how the camera is placed (Simpson et al., 2020). Wildlife cameras tend to best capture photographs of medium to large animals, so this is often a good grouping to use.

Species richness: The number of species found in a specific place.

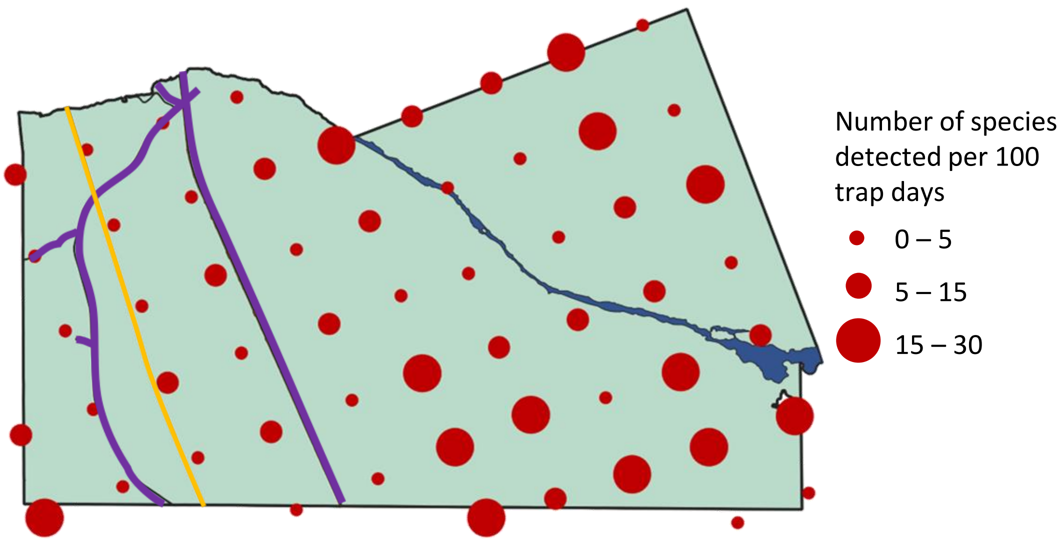
Calculating the number of species found at each site in your monitoring area can help you understand how species interact with each other and how they are being impacted by changes on the land. This can also help you see which areas have a lot of different species activity – sometimes called ‘biodiversity hotspots’ - which may be a good starting place for future, more intensive monitoring or protection efforts. To read more about this approach, you can look up terms like “species richness from wildlife cameras” for more specific details.



*Please note, this figure is for example only and does not reflect real data.

The map to the left shows how photographs from wildlife cameras can be used to find species richness. Each circle represents a wildlife camera site, with the size of the circle showing the number of species photographed over 100 consecutive trap days. Generally, the larger the circle the more species have been photographed.

Similar to relative abundance, species richness can also be interpreted in many contexts depending on your monitoring questions. One example of this is looking at the influence of different features on the land such as roads, railways, and rivers. This can be understood by considering the distance of each site to the feature of interest.



*Please note, this figure is for example only and does not reflect real data.

Investigating wildlife health

Aside from detection rates, wildlife cameras can provide a glimpse into the health of both individual animals and animal **populations** on the land. As cameras photos provide a close-up visual of individual animals, indicators of health such as body condition, presence of parasites, hair loss, and wounds can be noted.

Population: A set and distinct group of individuals of a particular species. For example, a population of moose refers to all moose within a specific geographic area.

A side profile photo of a bear can provide insight on the health and reproduction ability of an animal based on body composition.

Moose are highly susceptible to winter tick. The presence of this parasite can be noted by examining moose photos for signs of hair loss. Spring is often the best time of year to assess photos for ticks.

This moose does not seem to have been noticeably affected by winter tick.

Hair loss and body composition can also be used to note signs of mange in canid species.

Photos of offspring can be helpful to note breeding populations. The presence of twins or triplets can also provide insight to the health of adults in species such as moose and bears.

For species that you can visually tell apart male and female individuals, wildlife cameras can also provide insight to population health by noting the ratio of males to females that are photographed. The ratio of males to females can help understand the breeding ability of the population and predict whether the population is expected to increase or decrease. If relevant, considerations should be made for the time of year that photographs are analyzed as the ability to distinguish between sexes can become more difficult at certain times of year for some animals (ex. White-tailed deer shed antlers in the winter season, making males and females appear similar in photographs).

Final Remarks

Overall, there are numerous ways to use wildlife cameras to better understand the activity, diversity, and health of wildlife on the land. You are not limited to the suggestions discussed regarding habitat type or land-based features when using detection rates, and health can be explored as a side component of your monitoring program. We hope that these examples will provide inspiration, guidance, and tools for you to equip your monitoring program to best address your concerns.

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Glossary

Abundance: The number of individuals within a species in a defined area. When you count the number of individuals within a set area, it is reported as just a number (ex. there are 10 bears in this territory). Abundance data can be challenging to obtain with camera data alone, but see Relative Abundance Index (RAI) for a suitable alternative.

Biodiversity: The variation of life in the natural world. In the context of this guide, biodiversity refers to the variety of different wildlife species found in an area.

Bias: A skewed or altered perspective. Biased data refers to data that may be inaccurate or unevenly portrayed (usually in favour of specific variables) and is therefore not as robust.

Clustered design: A type of study design that focuses camera effort on specific places within the monitoring area using concentrated blocks of cameras. This approach can be used to highlight land-based features (for example roads), specific habitats (for example wetlands), areas with specific animal activity, or even as an application for land-use planning. See figure on page 14 for visual.

Data: Information, commonly facts or numbers, that are collected and can be examined and/or measured to help guide decision-making.

Delay period: Following a photo series being taken, how long the camera will be inactive before it can be triggered again. This feature prevents many photos being taken of the same individual(s), filling up space on SD cards.

Density: The number of individuals within a species relative to a unit of area. This is reported as a rate, or function, of the area you observed (ex. there is 1 bear per km^2). Density differs from abundance in that the number of individual animals will change with area (ex. 1 bear/km^2 compared to 10 bears/10km^2), while abundance is always defined for a set area (ex. 10 bears in this territory)

Deployment: In the context of this guide, deployment refers to the act of setting up and activating a wildlife camera for monitoring.

Detection: The ability to sense or pick up on something. In this guide, detection refers to a camera's ability to sense or photograph an animal.

Detection rate: The frequency of being able to detect, or sense something. In this guide, detection rate refers to how accurately a camera is able to sense or photograph an animal. This is affected by many different variables, such as the size, speed, and behaviours of an animal, the lighting, vegetation growth, and season.

Environmental monitoring: A process that helps understand patterns, changes, and relationships within the land, water, and wildlife. It may be focused on better understanding the current state of the environment, investigating changes over time, or finding ways that humans can help protect and support the natural world.

Environmental variable: A specific feature, condition, or element that may change. Examples include vegetation growth, habitat, and season.

False trigger: In the context of this guide, a false trigger refers to any time that a camera takes a photo of a non-target event or species. For example, if there is tall grass or trees in the camera frame, movement from wind may cause the camera to capture photos even when there is no animal present. Plants are one of the primary causes of false triggers, which is why it is important to consider what seasons cameras will be out for, and how much vegetation growth is expected.

Field of view: The actual area (in front and to the sides) in which a camera is able to detect movement.

Habitat: A place within the environment where a specific species finds their needs being met, allowing them to survive and reproduce. This will vary between different species, as a suitable habitat will need to have conditions that fulfil species-specific biological needs. However, some species may have multiple different habitats – and may use different habitats for different purposes. For example, moose can be found in both forests and wetlands. Habitats may be classified broadly (for example, wetland) or more specifically (for example, Spruce Bog).

Human development: In the context of this guide, human development refers to any changes or alterations to the landscape and built environment by humans. Often refers to infrastructure or human activities that have a notable impact on natural systems.

Land-based features: Specific characteristics of the environment that can be isolated or mapped. Land-based features can include entire habitat types (for example, forests), water features (for example, rivers), human-made infrastructure (for example, roads), and more.

Feature-based design: In the context of this guide, a feature-based design refers to a monitoring design (such as a camera grid) that is guided by specific land-based features (for example, roads or railways). This type of design is best suited for answering specific questions related to the features being highlighted. See figure on page 13 for a visual.

Occupancy: A measure of where different species are spending their time. This is sometimes presented as "presence or absence data", which indicates if a particular species is present in a particular area or not. Note that in the context of wildlife cameras, data can confirm the presence of a species but not the absence, and it is important to consider how this is affected by detection rates.

Partial coverage design: A type of monitoring design that only partially covers the study area. This approach can be used in either a random or targeted way, depending on monitoring goals. A partial coverage design may be applied over time on a rotating basis to cover a larger area or stay focused on the same area. This design may be a good option when resources or capacity are limited. See figure on page 13 for a visual.

Population: A set and distinct group of individuals. In the context of this guide, a population refers to a unique grouping of individuals of a particular species. For example, a population of moose refers to all moose within a specific geographic area.

Relative abundance index (RAI): Uses detection rate as a measure of abundance by counting the number of times a specific species is captured on camera over a set period of time. For example, how many times a moose was photographed over 100 camera days.

Sensitivity: How much movement detected by the camera's sensor will trigger a photo to be taken. High sensitivity is more likely to pick up small movements by trees in the wind or long grass, resulting in more false triggers, while low sensitive might miss small animals or those that are further away.

Species: A specific kind of animal. For example, moose, white-tailed deer, and black bear are each a different species.

Species occurrence: The presence or absence of a species at a given location.

Species richness: The number of species found in a specific place.

Species-specific: Relating to one specific species. For example, focusing specifically on moose.

Stratified design: In the context of this guide, a stratified design is a type of monitoring design in which sampled units are classified or organized categorically. These sampling units may be selected randomly or targeted, so long as all units are then grouped by commonalities for further analysis. For example, when thinking about a camera grid design, a stratified approach may categorize camera sites based on habitat to compare data from wetlands, forests, and rock outcrops. See page 13 for a visual.

Transect design: A type of design in which sites or sampling follow a set pathway or line. Points may be selected randomly or uniformly along the transect (path). For example, if monitoring animal activity relative to hiking trails it may be beneficial to use a transect design, allowing cameras to be placed at various distances from the trail for comparison. See page 14 for a visual.

Trigger speed: The amount of time between when the camera's sensor detects movement and a photo is actually taken. This lag time can vary quite a bit across different brands and models of cameras, making consistency important.

Wildlife camera: A specially designed piece of equipment used to photograph different animals in their natural environments. Most wildlife cameras are made with medium-large mammals in mind, therefore these tend to be the best species to target when being used for monitoring purposes.

Budget Information

Knowing a rough estimation of your expenses will be very helpful in setting up a wildlife camera program. Though costs may vary over time and by location, here is an example of estimated costs to help guide you based on purchases made in 2020-2021 in Southern Ontario, Canada. Note that some retailers may offer a discount for bulk orders, which may be helpful for lowering costs for materials like trail cameras (ex. direct from the brand) and batteries (ex. ULINE).

Wildlife Cameras: *Costs depend a lot on brand and model, you may find options ranging anywhere from $70-$600, so be aware of what you are buying.*

Bushnell Prime Low Glow Trail Camera: $120 per camera*

Batteries: *Different camera models may use different types and amounts of batteries, so make sure you know what you need before you buy.*

Lithium AA Batteries: $76 for 24 pack ($3.17 each), 6 per camera (varies by camera)

or Alkaline AA Batteries: $23 for 24 pack ($0.96 each), 6 per camera (varies by camera)

SD Cards: *Cost tends to go up as size of SD card increases.*

32 GB Card: $18 for 2 pack ($9 each), 2 per camera (to rotate)

Locking System:

Basic Key Locks: $13 each, 1 per camera
Cable: $0.30 per foot, 3.5 feet per camera is recommended (length needed varies by tree size)
Aluminum Sleeves: $0.22 each, 2 per camera

Material	Cost per Unit	# Needed	Total Cost
Bushnell Prime Low Glow Trail Camera	$120/each	50 (45 plus 5 extras)	$6000
Lithium AA Batteries	$76/24	13 packs of 24	$988
32 GB SD Card	$18/2	50 packs of 2	$900
Basic Key Locks	$13/each	50	$650
Cable	$0.30/foot	175 feet	$53
Aluminum Sleeves	$0.22/each	100	$22
			$8613

Additional Costs & Considerations

In addition to the base equipment listed above, there will be additional costs related to getting cameras out on the land – fuel, vehicle/UTV/boat upkeep, and wages/honoraria are essential considerations. Depending on terrain and access it may take 2-6 weeks to get to 50 cameras, in addition to time spent preparing them, additional site visits, and eventually sorting through photos. Some other useful items to include in your budget if you don't already have them: GPS units, tablet(s) and case(s), computer(s), external hard drive(s), printer, laminator, zip-ties, first-aid supplies, Ziploc bags, and general camping equipment. That said, with ~$9000 in start-up materials, the overall budget for getting a wildlife camera project started (based on 50 cameras) will be approximately $15 000 overall.

Wildlife Camera Deployment Notes

Surveyors: ____

Date: ______________________________ Time: ____________________________

Site ID: _______________ GPS Coordinates: _______________ ______________

Camera ID: _________________________ SD Card ID: _______________________

Direction of Camera: ______________ Height of Camera: __________________

Habitat Notes (expected vegetation growth, nearby signs of wildlife, etc):

____

____

____

____

Accessibility of site & access notes: ____________________________________

____

____

____

Confirmed camera turned on (check box): ☐ Y

General Notes: ____

____

____

____

Wildlife Camera Maintenance Check Notes

Surveyors: ____

Date: _____________________________ Time: ____________________________

Site ID: ____________________________

Signs of Wildlife Presence: ____

Vegetation Growth: ____

Changes in Habitat: ____
____
____

Damage or Alternation to Camera: ____
____

SD Card Replaced (check box): ☐Y ☐N If yes, new SD card ID: _____________

Batteries Replaced (check box): ☐Y ☐N If yes, Battery Type: _______________

General Notes: ____
____
____
____