Selfies with Citizens: Remote Cameras at Tettegouche State Park

Ryan Pennesi
Miami University of Ohio
Global Field Program
Finland, MN

Issues in Biodiversity:
Bio 633 F
March, 2020

Abstract:

Motion triggered cameras are a popular method of surveying biodiversity, which is especially relevant in an age where global biodiversity is in decline due to a variety of factors (climate change, habitat destruction, over-harvesting, poaching, etc). The State of Minnesota faces its own ongoing issues in biodiversity and there are many research and monitoring efforts underway to facilitate species conservation. Implementation of environmental education curriculum has a strong power to connect people to the natural world and foster an appreciation for nature. Minnesota State Parks in the northeast region of the state draws in hundreds of thousands of visitors annually and have an incredible ability to reach the public through interpretive programs. The following lesson plan is intended for Tettegouche State Park and Wildlife Managers/Researchers to use with the general public. The curriculum described in this project will use camera traps as a tool to raise awareness for conservation and wildlife monitoring efforts in the state. The lesson will give participants hands-on experience and a working knowledge of this technology. There is potential for the implementation of this curricula to deepen the public's understanding of the State's natural resource management practices. Successful implementation of the lesson may serve as a starting point for future development of a citizen science volunteer effort using trail cameras on public and private lands of Minnesota. The general public is a largely untapped resource when it comes to wildlife monitoring in Minnesota.

Instructional Context:

This lesson plan is intended for use by Tettegouche State Park in northeastern Minnesota (See Figure 1) and state wildlife managers/researchers. Students reached by this lesson plan are targeted as adults, although people of all ages and experience levels can participate. The goal of this lesson is to connect the public to Minnesota's wildlife and biodiversity through hands-on learning. The curriculum described will use camera traps as a tool to establish a baseline knowledge of conservation/wildlife monitoring efforts in the state of Minnesota. Another goal is to deepen the public's understanding of the State's natural resource management plans and practices. Knowledge gained will be of current research methodologies, monitoring, and conservation efforts in Minnesota that use remote cameras as a key tool for science and conservation. The content will connect with the students by providing context that wildlife is all around us. Participants will discover that trail camera technology can be intuitive and that everyone has the ability to learn the skills necessary to collect scientific data. Students will gain experience tracking wildlife and obtain hands-on experience with setting and checking camera traps in the field.

The demographic of visitors to Minnesota State Parks are wide-reaching. Minnesota State Parks have an incredible draw in the amount of visitors that they entertain annually--on average there are 9,700,000 each year (MNDNR, 2020). Three of the five most visited State Parks in the state are in northeast Minnesota along the State's "North Shore" of Lake Superior. In 2019, Gooseberry Falls State Park received 756,704 visitors, Tettegouche State Park received 478,146 visitors, and Split Rock Lighthouse State Park received 394,972 visitors (MNDNR, 2020). Each State Park has its own management plan, but all have similar goals surrounding naturalist interpretation and environmental education. In the Tettegouche State Park management plan, a main goal of programming is to provide "first-hand, resource-based interpretation for all state park clientele in order to help establish a sense of stewardship for the state's natural and cultural resources" (MNDNR, 1997). The goals of the Park's management plan align well with the goals of this lesson.

Instructional Input:

In the state of Minnesota there are over 2,000 native wildlife species and an estimated 16 percent of those have been categorized as Species in Greatest Conservation Need (SGCN) (MNDNR, 2016). The criteria to be considered a SGCN is that the species is rare, populations are on the decline, or face serious threats that forecast probable decline (MNDNR, 2016). Data derived from wildlife surveys in Minnesota is important to biologists and policymakers facing ongoing controversies such as wolf management and the declines of fisher and marten populations in the past decade (Abraham, 2018). Scientists and natural resource professionals are tracking these species on a state-wide level. Studies using camera traps in research methodologies have been utilized for large-scale, long term monitoring of terrestrial wildlife (Steenweg et al., 2016). Motion-triggered cameras have also proven to be an effective survey technique because they can be used to estimate distribution, behavior, corridor use, and population size, among other metrics of wildlife population dynamics (Moruzzi et al., 2002). Additionally, remotely triggered cameras are preferred to detect species like forest carnivores that are nocturnal, have secretive habits, may be difficult to physically trap/handle, or that occur at low densities (Iannarilli et al., 2018).

In order for conservation efforts to be long-lasting and effective, there needs to be human community support surrounding the goals of those projects (Kareiva, 2012). Researchers have demonstrated the power of using remotely triggered cameras with citizen science volunteers. The data that volunteers help to collect can be used to answer applied management questions as well as connect those people to wildlife (Parsons et al., 2018). Furthermore, a study by Schuttler, et al. (2019) suggests that citizen scientists, including young students, can contribute to real-world research, verified by professionals. The study also boasted of community-wide impacts as a result of the community involvement in wildlife monitoring in diverse locations around the world (Schuttler, et al., 2019). Camera trap technology is increasingly accessible and affordable, with people of many different backgrounds able to experiment with its use (Brown & Gehrt, 2009). MNDNR research biologist, John Erb, suggests that remote cameras offer easy and

reliable species identification and are increasingly popular among outdoor enthusiasts (Abraham, 2018). A recent Minnesota Conservation Volunteer (MCV) article, entitled, “Counting on Cameras" covered the future of remote camera surveys in the state. The article suggests that researchers are considering the coordination and training of citizen volunteers to help with wildlife monitoring efforts (Abraham, 2018).

Lesson Plan:

Student Objectives are to understand how remote cameras inform land managers and scientists in implementing natural resource management plans. Students will learn how to set up and check a remotely triggered camera in the field (See Figure 2) and practice skills such as wildlife tracking and interpreting animal signs. Additionally, students will gain experience setting trail cameras in the field and presenting their setups to their peers. The students will have the opportunity to bring their peers to their camera and will demonstrate how they chose the location and what animals they suspect the camera may detect if left in the field. Active experimentation (AE) such as this is a critical piece of the experiential learning cycle in which knowledge is created for the student (Kolb & Kolb, 2009).

Table 1. Lesson Plan Outline (3 hours total)

Lesson Part	Description	Time
Pre-Lesson Preparation	Set a trail camera nearby 2-4 weeks prior to lesson date	N/A
A) Presentation: Remote Cameras and Conservation in Minnesota	PowerPoint Presentation demonstrating monitoring, research and conservation using trail cameras	45 minutes
B) Pre-Trip Checklist	Go over equipment to take into the field	15 minutes
C) Animal Signs Hike	Learn and practice basic wildlife tracking skills	30 minutes

D) Field Check Trail Camera	Visit a trail camera setup in the field and identify species	15 minutes
E) Practice Camera Placement	In small groups, participants practice deploying cameras on their own and receive feedback from instructor	30 minutes
F) Student Survey	Participants provide feedback on the course and willingness to participate in future projects	15 minutes

Pre-Lesson Preparation: 2-4 weeks prior to the date of the lesson, a trail camera will have been set by the instructor in a predetermined location. When placing the camera the instructor should think about talking points for when the students field check the camera. The camera should be set in an area with habitat features and likely detectable wildlife species in mind.

Part A) PowerPoint Presentation: The first part of the lesson plan is a slideshow presentation demonstrating the power of trail cameras as a conservation science and resource management tool. The slideshow will be broken down into sections. ***Section 1) Remote Cameras: A History***. This section will explain the technology as well as show how it has evolved over time, starting in the late 1800's to modern day. ***Section 2) Wildlife Tracking and Interpreting Sign***. This section will explain the basics of tracking wild animals and cover a few examples of what to look for when interpreting animal signs. ***Section 3) Trail Camera Placement***. This section will explain the fundamentals of setting up a camera in the field in regards to factors such as: location, fastening the camera, positioning, direction to face, field of detection, etc. ***Section 4) Remote cameras and Conservation in Minnesota***. Two conservation/research projects taking place in Minnesota will be briefly explored. In each of these three case studies, remote cameras have played an integral role in the research. *Case 1* is the use of trail cameras to monitor declining fisher (Martes pennanti) populations in Minnesota. According to a recent article in the Minnesota Conservation Volunteer magazine, the species population has decreased by roughly half since 2002 (Spring, 2019 & Joyce, 2019). According to furbearer research scientist John Erb (with the

Minnesota Department of Natural Resources), the decline of fishers can be attributed to habitat loss and change. It has been hypothesized that a general lack of large diameter trees in the northeast Minnesota forested landscape may be threatening long-term fisher population survival (Spring, 2019). Artificial den boxes are being monitored to determine whether their installation could help supplement a lack of larger diameter cavity-potential trees on the local landscape. Fishers have been captured on camera in Tettegouche State Park. *Case 2* is the use of trail cameras by the Voyageur National Park. The Voyageurs Wolf Project is a collaboration between the University of Minnesota and Voyageurs National Park. The team is investigating wolf ecology and trying to fill in the gaps in the scientific literature (Voyageurs Wolf Project, 2019). Wolves have a controversial history in Minnesota: at one time they were nearly extirpated (a low of around 400 animals) and have been federally listed, delisted and relisted several times in recent management history. Gray wolves in Minnesota are currently being considered for removal from the List of Endangered and Threatened Wildlife under the Endangered Species Act (Anderson, 2020). Trail cameras are one of the main monitoring tools used by the Voyageur Wolf Project, which have led to some remarkable insights. One such observation through remotely triggered camera footage suggests that wolves may hunt fish in the spring as a supplemental food source (Gable et al., 2018). Wolves and Fishers are both regular visitors to Tettegouche State Park, their tracks and sign can be found year round within the park boundaries.

Part B) Pre-Trip Checklist: This portion of the lesson will take place outside in close proximity to the buildings/facilities. The instructor will demonstrate the appropriate gear to bring whenever scouting for camera placement or when retrieving a camera (See Pre-Trip Checklist in the Appendix). Materials reviewed will be essential equipment including but not limited to: batteries, memory cards, straps, folding saw, lens wipes, cover scent, etc.

Part C) Animal Signs Hike: The instructor will lead a 30 minute hike with the goal of ending at the camera staged in the field 2-4 weeks prior to the lesson. Students will be encouraged to interpret any animal sign they find and to consider how a trail camera could be used to gather

information about the maker of the sign. The instructor may point out things they notice along the way and provide resources such as a tracks & sign I.D book.

Part D) Field Check Trail Camera: At the camera, the instructor will coach a student volunteer through opening the camera, turning it off and removing the memory card. The instructor will insert the memory card into a digital camera or other portable device for viewing images such as an ipad. A discussion with partners prior to revealing the images is a helpful exercise to have the students generate a hypothesis about what could have been detected. As the group reviews the images, they are encouraged to participate in data recording using the Camera Trap Data sheet (see Appendix). The instructor will go through the images with the group and ask thoughtful questions to the group (examples below).

- Why did we detect this animal in this location?
- What can the time/date stamp tell us about this animal's behavior?
- How do different species use this location differently?
- What was intentional about this trail camera setup?

Part E) Practice Camera Placement: Students will use the skills they have been practicing to explore the immediate area (instructor's discretion on rules for exploring the park). Participants can work alone or in small groups to find a potential trail camera setup location. If the instructor has extra trail cameras, each individual or group will practice setting up a camera and experimenting with its settings. If the instructor does not have extra trail cameras, the participants will choose a location and imagine where they would place a camera (the instructor could pass out card-board cutouts representing a trail camera if desired). Once each individual/group has had time to set a camera, the whole group will visit each setup. Each individual/group will present their setup to the whole group, explaining *why* and *how* they chose their spot. The instructor may offer feedback or pointers at this time.

Part F) Student Survey: Students will be offered a voluntary survey as a learning assessment and to provide feedback for future development of the lesson (see Post Lesson Participant Survey in Appendix).

Reflection:

I anticipate the active experimentation phase (practicing the setup of remote cameras during the lesson) of the lesson to drive home for students that they have the ability to learn how to use this technology on their own. I have done similar programs and it seems that the field check of the camera is the portion of the lesson that grabs participants' attention. According to a recent article by the Minnesota Conservation Volunteer Magazine, Minnesotans have a tendency to watch nature closely and get excited about remote, automated, motion-triggered cameras; a common reaction to trail camera images is "surprise and enlightenment: look what is living among us" (Goetzman, 2018). The next step will be implementing the lesson at Tettegouche State Park. After successful delivery there, the next phase will be recruiting other collaborators and host facilities to deliver the lesson. Given the opportunity, this lesson would be adapted for other audiences and settings, such as school children, private landowners, hunters, and visitors to nature centers, city parks, and other state parks.

The Minnesota Department of Natural Resources (MNDNR) is currently investigating the feasibility of switching their main state-wide carnivore population survey method from tracking surveys (recording animal tracks on shoulders of dirt roads twice annually) to using remotely triggered cameras (Abraham, 2019). Some of the biggest obstacles the state will face is the up-front cost of purchasing enough cameras for these surveys, the overwhelming amount of images to analyze, and distributing equipment across the State (Abraham, 2019). What if citizen scientists could be trained to deploy their own camera traps and collect wildlife population data--even help to process their own images? This could eliminate prohibitive costs and aid with the time investment of processing a large influx of images. Ellen Candler is a researcher with the University of Minnesota that is currently studying the efficacy of using deer hunters as voluntary

citizen scientists to collect data on carnivore assemblages visiting their "offal piles" across the state. The hunters use their own cameras and upload the images to a shared location. With the right training program and set of rigorous research protocols, I am confident that the Minnesota public could be an enthusiastic and invaluable tool for conservation science.

Literature Cited:

Abraham, J. (2018). Counting on Cameras. Could Cameras replace tracking surveys for monitoring carnivores? Minnesota Conservation Volunteer Magazine. January-February 2018. Retrieved from: https://www.dnr.state.mn.us/mcvmagazine/issues/2018/jan-feb/game-cameras.html

Anderson, D. (2020). Minnesota's path isn't so clear after wolves become delisted. Retrieved from: https://www.startribune.com/anderson-minnesota-s-path-isn-t-so-clear-when-wolves-are-delisted/568529752/

Brown, J., & Gehrt, S. D. (2009). The basics of using remote cameras to monitor wildlife. Ohio State University Extension Agriculture and Natural Resources Fact Sheet W-21-09 Ohio Sate University, Columbus, OH.

Gable, T. D., S. K. Windels, and A. T. Homkes. (2018). Do wolves hunt fish in spring as a food source? Mammalian Biology 91:30-33 [PDF]

Goetzman, K. (2018). Trail Cams, Transmitters, and Other Wild Tech. Minnesota Conservation Volunteer Magazine. January-February 2018. Retrieved from: https://www.dnr.state.mn.us/mcvmagazine/issues/2018/jan-feb/from-the-editor.html

Joyce, Michael. (2019). Environment and Natural Resources Trust Fund (ENRTF) M.L. 2019 ENRTF Work Plan (Main Document). Subd. 03i

Kareiva, P., & Marvier, M. (2012). What is conservation science? BioScience, 62(11), 962-969.

Kolb, A., & Kolb, D. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. S. Armstrong & C. Fukami (Eds.). The SAGE handbook of management learning, education and development (pp. 42–68). Los Angeles: SAGE.

Minnesota Department of Natural Resources (MNDNR). (2020). Minnesota Facts & Figures. Retrieved from: https://www.dnr.state.mn.us/faq/mnfacts/state_parks.html

Minnesota Department of Natural Resources. (2016). Minnesota's Wildlife Action Plan 2015-2025. Division of Ecological and Water Resources, Minnesota Department of Natural Resources.

Minnesota Department of Natural Resources (MNDNR). Division of Parks & Recreation. (1997). Tettegouche State Park Management Plan. Office of the Commissioner. Retrieved from: https://files.dnr.state.mn.us/parks_trails/mgmtplans/tettegouche_plan.pdf

Moruzzi, T.L., T.K. Fuller, R.M. Degraaf, R.T. Brooks, and W. Li. 2002. Assessing remotely triggered cameras for surveying carnivore distribution. Wildlife Society Bulletin 30:380–386.

Iannarilli, F., Erb, J., Arnold, T., Fieberg, J. 2018. Evaluation of design and analysis of a camera-based multi-species occupancy survey of carnivores in Minnesota

Parsons, A. W., Goforth, C., Costello, R., & Kays, R. (2018). The value of citizen science for ecological monitoring of mammals. PeerJ, 6, e4536. https://doi.org/10.7717/peerj.4536

Rovero F, Zimmerman F, Berzi D, Meek PD. (2013). Which camera trap type and how many do I need? A review of camera features and study designs for a range of wildlife research applications Hystrix. Ital J Mammal 24:9–17

Schuttler SG, Sears RS, Orendain I, Khot R, Rubenstein D, Rubenstein N et al. (2019). Citizen science in schools: students collect valuable mammal data for science, conservation, and community engagement. Bioscience 69(1): 69–79

Spring, Joe. (2019). Field Notes: New dens for fishers. Minnesota Conservation Volunteer Magazine (MCV)

Steenweg R, Whittington J, Hebblewhite M, Forshner A, Johnston B, Petersen D, et al. (2016). Camera-based occupancy monitoring at large scales: Power to detect trends in grizzly bears across the Canadian Rockies. Biol Conserv. 201: 192–200.

Voyageurs Wolf Project. (2019). About the Project. Retrieved from: https://www.voyageurswolfproject.org/about-the-project

Wisconsin Department of Natural Resources. (2019). Snapshot Wisconsin: A volunteer-based project for wildlife monitoring. https://dnr.wi.gov/topic/research/projects/snapshot/

Appendix:

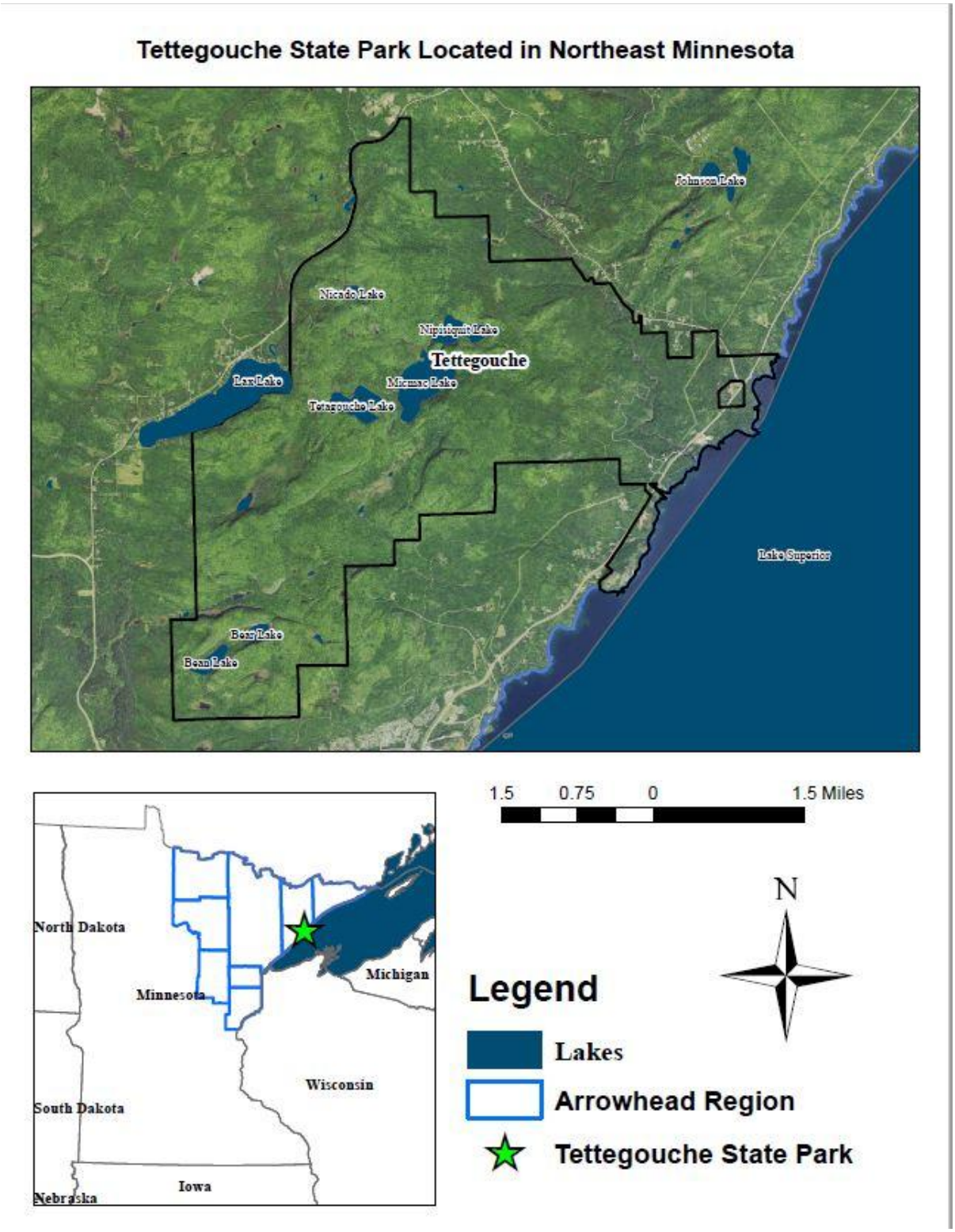

Figure 1: A map of northeast Minnesota showing the location of Tettegouche State Park. Prepared using ArcMap 10.5.

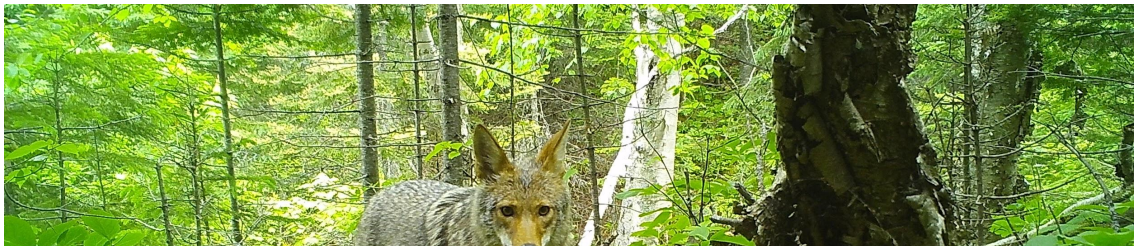

Figure 2: A coyote in Tettegouche State Park using a game trail. This camera was checked with a group of visitors to the park during an interpretive program about trail cameras and wildlife tracking.

Slide 1: Title Slide of the PowerPoint presentation portion of the lesson. View or download the full presentation HERE

Remote Camera Info Sheet

PRE-Trip Checklist

1. Trail Camera Manuals Especially good to have with you when first getting to know how to program functions on your camera

2. Extra Batteries It is a good idea to buy a voltage tester and check replacement batteries before you bring them into the field

3. Extra Memory Cards Erase and format your cards at home (certain file formats from one trail cam might not be compatible with another). The standard that I use is 8GB—but many take up to 32GB

4. Extra Straps Tie-down straps like the ones used for fastening a canoe work great (I use 6' straps)

5. Something to view pictures in the field Whether it's a laptop, digital camera, or SD card viewer, bring something to check the functionality of your scouting cameras

6. Folding Saw/Pruner It is imperative to remove vegetation that is directly in front of the sensor and it may help for a cleaner image of your subject

7. Cover Scent Some camera-trappers go the extra mile. Masking scent can help minimize the impact of checking your cameras (too much human scent can deter animals from visiting)

8. Keys for camera locks Getting to a camera deep in the wilderness, just to realize you can't retrieve it is the worst!

9. Lens Wipes Something to clean off your lens if it has been out for a while. (your sleeve works too)

10. Zorb-it packs Changes in humidity can result in condensation building up on the inside of the lens cover. Condensation can produce blurred images. Moisture absorbing packs help to combat this phenomenon.

Camera Trap Data Sheet

Site Name: Tettegouche State Park **Date Installed: _____ Date Checked: _____**

Trapping Effort (total days operational in field): _____

Upon approaching the camera, open it up and turn off the power source. Eject the SD memory card and insert into a card reader device (ipad, digital camera, laptop, etc). Go through the images as a group and keep track of each mammal or bird detected. Record the time of detection by referencing the time stamp on the images.

Common Name	Scientific Name	Time Stamp	# Of Unique Detection Events

Observations/Notes:

Post Lesson Participant Survey

Instructions: Please circle the answers that best describe you.

1. How likely are you to continue camera trapping on your own?

Unlikely Somewhat Unlikely Not Sure Somewhat Likely Very Likely

2. How confident do you feel about setting up a trail camera on your own?

Not Confident Somewhat not confident Not Sure Somewhat Confident Very Confident

3. How well do you understand the role of camera traps in wildlife conservation efforts in MN after this lesson?

No better Slightly Confused Not Sure Somewhat More Much Better

4. How likely would you be to become a citizen scientist camera trap volunteer for the MNDNR?

Very Unlikely Somewhat unlikely Not sure Somewhat Likely Very Likely