Using motion-detection cameras in a college ecology course

Abraham J. Bernal; James T. Bowes; Carrie M. Getson; Michelle C. Hilton; Erin M. Jaskiewicz; Derek E. Kapp; Daniel S. Kermick; Katie L. Maley; Mary N. Mulcahy, Emily S. Porter; Jennifer Reitz; Laura Schneeberger; Harry E. Stobart, III

Contact: Mary Mulcahy
Division of Biological and Life Sciences
University of Pittsburgh at Bradford
Bradford, PA 16701

mnp1@exchange.upb.pitt.edu

Abstract: Wildlife experiences are rare in college biology programs due to the lack of facilities for housing animals, concerns about rabies and other animal-borne diseases, and animal welfare issues. For several years, students at the University of Pittsburgh at Bradford have been introduced to wildlife ecology using artificial nest experiments that investigate this question: Does nest predation differ on forest edges compared to forest interiors? These experiments provide hands-on data collection on local mammals but avoid any direct contact between humans and the animals. This spring, the artificial nest experiment was revised to include motion detection cameras next to the nests to allow identification of predators. These infrared cameras (also called "stealth cameras" or "scouting cameras") are used by hunters to identify areas where wild game animals are active. Four of the cheapest digital stealth cameras available (about $70 a piece) were purchased, and mounted on trees in pairs; one immediately adjacent to a forest edge and one placed more interior to the forest edge. Animals were baited to the cameras by nests (plastic bowls) and artificial "eggs" containing a flour and lard mixture. Nests were set out in February in weather varying from snowy to sunny and 15°F to 50°F. The cameras captured pictures of blue jays, squirrels, raccoons and deer visiting the nests, and students graphed the presence of animals at edge versus "interior" nests. The cameras generated much excitement among the students, and forced them into the scientific literature on nest predation, edge effects, and artificial nest experiments.

Introduction

Forests are rapidly being replaced with roads, houses, and farms. In addition to the loss of forest habitat, this development also results in forest fragmentation and a greater amount of edge habitat. Edges are the parts of forests that are connected to the roads, farms, and fields. Edges can have negative effects on species that use interior habitats. For example, migratory songbirds that normally thrive on the interior of the forests are now being threatened by predators because they are being forced to live on the edges of the forest. Predation can lower the reproductive success of interior species and threaten some species with extinction.

Wildlife experiences are rare in college biology programs due to the lack of facilities for housing animals, concerns about rabies and other animal-borne diseases, and animal welfare issues. For several years, students at the University of Pittsburgh at Bradford have been introduced to wildlife ecology using artificial nest experiments that investigate this question: Does nest predation differ on forest edges compared to forest interiors? These experiments provide hands-on data collection on local mammals but avoid any direct contact between humans and the animals. This spring, the artificial nest experiment was revised to include motion detection cameras next to the nests to allow identification of predators.

Procedure

Choose a location with an edge. Please note that you can design this experiment to test many other things than just the effects of a forest edge so if you don't have a local forest edge, think about other hypotheses that you could test!

My students and I have constructed artificial nests with the clear wide-mouthed plastic punch cups that you can buy at a grocery or discount store. Then, near the top of the cups, we punched a few holes with a hole puncher. You can then put pipe cleaners through these holes and hang the cups from trees. You can also set the cups on the ground. The eggs are made by mixing flour and lard in a 1.6 to 1 part ratio as suggested in a different baiting experiment by Williams (1993). The lard will become warm with students' hands and the flour/lard mixture may need to go into the refrigerator if it gets too sticky despite addition of more flour.

We used the tape measure to set three nests (field, edge, and interior) along a transect that ran from a field at the edge of a forest to 20 m into the forest. Without question, a better experimental design should put the interior eggs at least 50 m into a forest. In our case, we repeated this for three transects, and we also put nests right at the boundary between the field and forest. For the location inside the forest and right at the edge, we put two nests, one on the ground and one hung from the tree. We used brightly colored flagging to keep track of where our nests were (Yes, the flagging itself may affect the visibility of the nests to predators, but if you can't find the nests later on - the project is doomed!). We placed a motion-detecting digital weatherproof camera near the nests to record what kinds of predators visited our nests.

Materials and Equipment

- Infrared triggered cameras: See table 1 to review the details of the cameras we used.
- Locks and Cables – To secure the cameras from disturbance or theft. Hardware stores sell all the pieces to make loops on your own cables of desired length. Ideally get several locks that all use the same key.
- Bowls or cups –to act as nests and hold the eggs.
- Flour & Lard – Used to create artificial eggs (a 1.6 part flour: 1 part lard by weight, mix until dough-like and not too sticky; place in refrigerator or freezer to harden.)
- Flags – Used to mark sites where bowls and cameras were placed
- Other types of bait – bird seed, rodent food, etc. could all be used as bait.
- Nickel-metal halide rechargeable batteries and a recharger (we use rechargeable C batteries; hints to keep your batteries long-lasting: buy a recharger that turns itself off; recharge groups of batteries that you will use together in the same device; & do not let the batteries overheat while charging them. Charge in the refrigerator?)

Table 1. Details of the cameras used in this study; this is not an endorsement of either of these brands or models.

Feature	**Wildview ® Camera Model STC-TGL1**	**All About Game ® Model AAGH850**
Exact Cost & Purchase Site	Ebay – TNM Sales 3 cameras/$220+15ship = $78.33/camera $10 manufacturer's rebate on each camera Final cost: $68.33/camera	Ebay – Bargain Outfitters 1 camera /$59.97+10 shipping Final Cost: $69.97/camera
Picture Resolution	0.3 megapixel	0.3 megapixel (640 x 480 pixel)
Camera chassis	Weather resistant plastic housing	Weather resistant plastic housing
Motion Detection	Passive Infra-Red (PIR) up to 30-feet	Passive Infra-Red (PIR) up to 15-feet
Picture Storage	8MB built in SDRAM for 200 low quality or 70 high quality pictures	Internal volatile memory for 108 low quality or 54 high quality pictures. "Actual number of pictures may vary depending on picture complexity"
External Storage Expansion	SD Memory Card Slot. Expandable to 512mb. (Card sold separately)	SD Memory Card Slot. Expandable to 512mb. (Card sold separately)
PC connection	Plug and play USB storage device	USB 1.1 as removable drive interface with standard Windows XP/2000
Focal Length	? Assume Fixed	Fixed
Daytime Reaction Time	?	3 to 3.5 seconds "The digital camera needs a few seconds to wake up from the stand-by mode"
Photo Flash	Up to 15 feet	Up to 16 feet
Power Supply	4 C batteries	9 AA batteries for 8-14 days of operation depending on conditions and quality of batteries. "Do not use rechargeable batteries"
Mounting Kit	Nylon strap with buckle	Nylon strap with buckle
Other Features/Lack of features	No way to turn off flash No date stamp	Flash can be disabled No date stamp

Conclusion

Our sample sizes and the depth of our "interior" nests were insufficient to document edge effects if they existed. Nonetheless, students enjoyed the field work and loved the surprise of downloading the pictures. We documented predation by squirrels, deer, raccoons, and blue jays. The exercise was very successful at providing an avenue for discussion of experimental design, habitat fragmentation, edge effects, and realism of artificial nest experiments. This exercise is excellent for introducing students to peer-reviewed scientific literature since many studies have been published on these topics.

Suggested Reading

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