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Biodiversity and Conservation Study of the St. Norbert Abbey, De Pere, Wisconsin - 2017 Annual Report

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2017 Annual Report

Photo credit: Google Earth

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Project Summary

Long term biological studies are rare but incredibly valuable for examining natural phenomena. Data collected over many years or decades allows for analyses of trends that would never be apparent in a single season. The research presented here is for the completion of the first field season in a long term study analyzing biodiversity trends at the St. Norbert Abbey. Using visual searches, live trapping, and trail cameras, the biodiversity and abundance of species was examined. Special emphasis was placed on small mammals, though other species were observed and documented. The goals of this project were to (1) provide preliminary diversity and abundance measures to allow for examination of annual variation and long term trends in species diversity and abundance and (2) establish a partnership and research platform able to provide stakeholders with pertinent biological data to ensure sound conservation and management decisions.

Introduction

The St. Norbert Abbey in De Pere, Wisconsin maintains a natural area consisting of a pond and surrounding wetlands commonly referred to as the Abbey Pond. Originally this property was part of a brickyard owned by John Hockers that was sold in the 1930s and the clay pit filled with water in the 1950s to become the Abbey pond (Houston 2011; Lehrke *et al.*). Adjacent to the pond was the former site of the Dr. John R. Minahan Stadium, built in 1938 (St. Norbert College staff 2011) and demolished in 2010 (Figure 1). This land has since been repurposed for agriculture. The Abbey pond is recognized by the city of De Pere as the only named natural pond within city limits (Lamine *et al.* 2010).

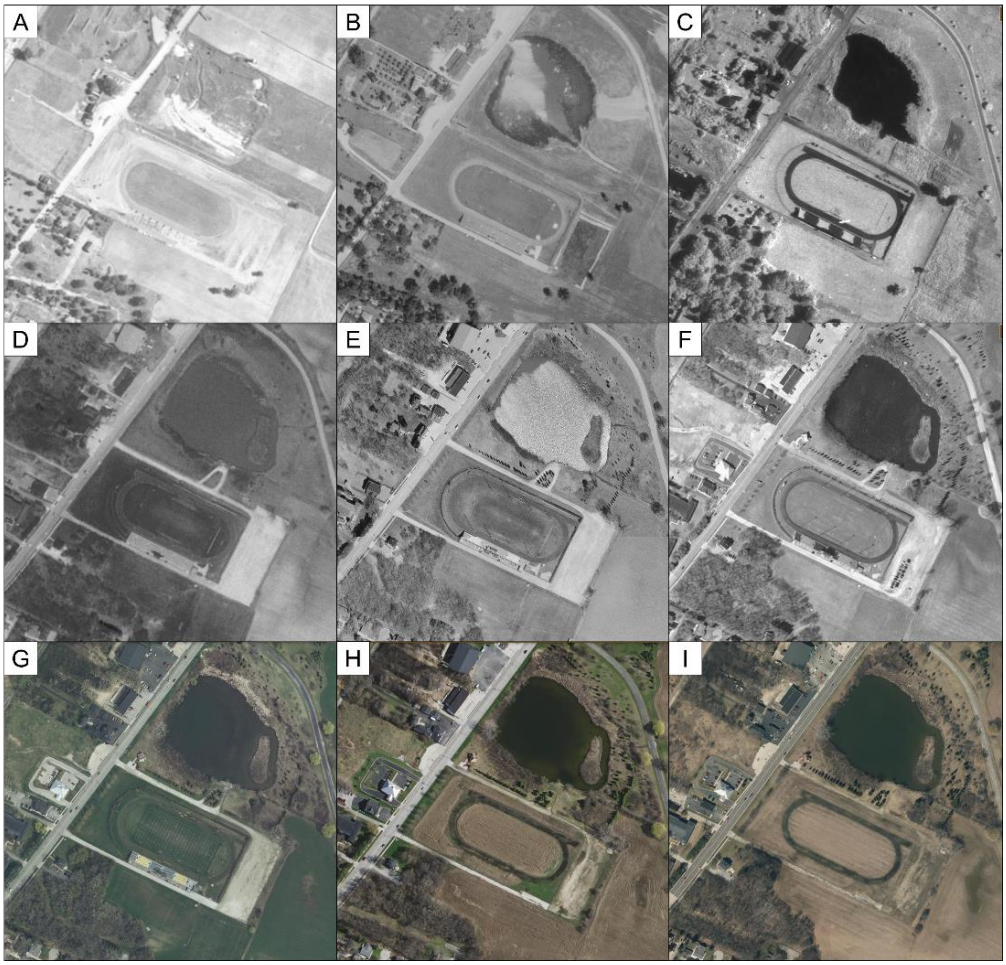

Figure 1. Arial photos of the Abbey pond and surrounding property A) Summer 1938, B) Summer 1960, C) Summer 1978, D) Spring 1992, E) April 2000, F) April 2005, G) April 2010, H) May 2014, and I) April 2017. Photos courtesy of the Brown County Government via BrownDog Online GIS Map (https://browncounty.maps.arcgis.com/home/index.html).

To date, no studies have been published that identify the species diversity or population demographics at the Abbey pond. Any documentation of wildlife occurrence have through the citizen science database "ebird" (Sullivan *et al.* 2009) or anecdotal accounts in media (e.g. (Green Bay Press Gazette 1973; Meinert 2006)). The property has been managed primarily for recreation by the Norbertines and the Brown County Chapter of the Izaak Walton League. The Abby pond provides a patch of habitat in an otherwise suburban environment. There is high potential for occupation by migrating or transient animals in addition to those utilizing this area as part of their range. Barriers to movement would depend on the individual's ability to cross moderately trafficked roads. Populations and species occurrence are therefore presumed to fluctuate by typical processes (i.e. births

and deaths) as well as from immigration and emigration. Here we detail the first of what is anticipated to be an annual biological survey of the Abbey pond with special emphasis on mammalian species.

Methods

Small Mammal Mark-Recapture

Small mammal capture was carried out with all necessary permissions and permits (IACUC 041702, WI Department of Natural Resources SCP-SOD-011-2017). Animals were captured using Sherman style box traps (aluminum live trap, 7.62x7.62x25.4 cm or 5.08x6.35x16.51 cm, Figure 2A) and baited with black oil sunflower seeds. Cotton balls were placed in the trap to provide bedding for the animal until it could be released. The door is triggered to close via a spring-plate mechanism opposite the opening. The animal's weight pushes the plate down allowing the door to close, injury is unlikely even if limbs or the tail is caught. Sherman style box traps are the industry standard for safe and humane live trapping of small mammals. Thirty two traps were placed along transects in the study area near natural cover and undisturbed areas (Figure 3, Appendix Table S1). Trap placement attempted minimize exposure to extreme temperatures or predators. The study period lasted 7 days (6 nights) from August 27- September 2, 2017 (calendar days 239-245), during which the traps were monitored twice daily (approximately 6am and 6pm each day), to limit the time captive to no more than 12 hours. Animal handlers wore leather gloves to prevent bite injury. Upon removal from the trap, data was collected from each animal (sex, body length, tail length, limb length… etc.). The ear was cleaned with isopropyl alcohol and a metal ear tag (2.36 mm wide, ~0.25g, Figure 2D) affixed to the inner lower 1/3 of the pinnae by puncture and crimped closed. A crimping tool was used that secures the tag without applying pressure to the ear. The animal's weight was measured using a hanging scale and cloth bag. Any animals with notable characteristics, such as sexual status, the presence of parasites, or physical abnormalities were noted. Following all handling and measurements, the animals with a good disposition were immediately released otherwise were left in the cloth bag for ~5 minutes to rest before being released back into the wild near the point of capture.

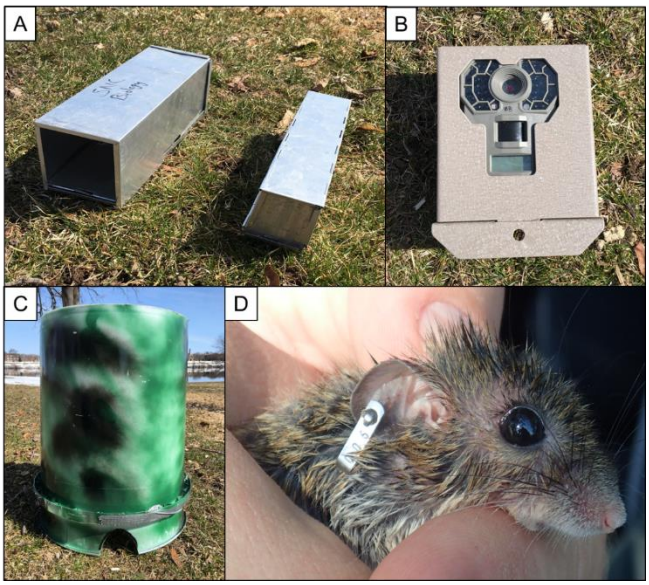

Figure 2. Mark-recapture and visual search materials. A) Large (7.62x7.62x25.4 cm) and small (5.08x6.35x16.51 cm) Sherman live traps. B) Stealth Cam Trail Camera C) Plastic 5-gallon bucket trap with camera attached to top inside and aimed at the ground. D) Peromyscus sp. fitted with fingerling ear tag.

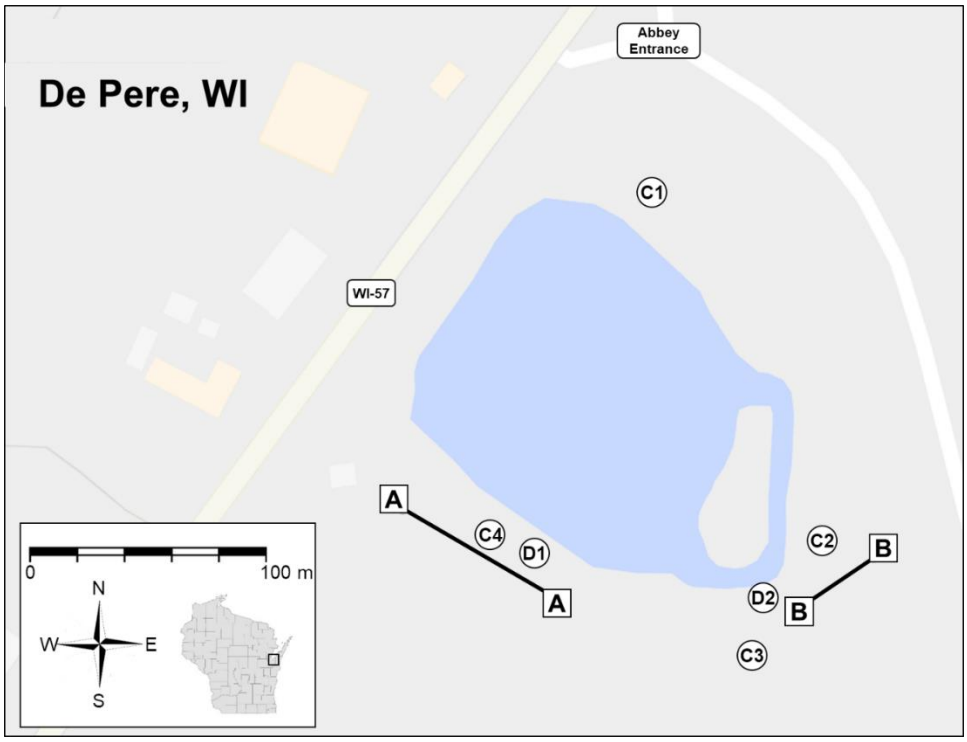

Figure 3. Trapping transect and camera locations. A) Transect of traps 1 - 16, B) Transect of traps 17 - 32. C) Cameras 1 – 4 baited with scent lures. D) Cameras 1 and 2 with bucket modifications

Camera trapping

Six trail cameras with passive infrared motion triggers and infrared illumination (Stealth Cam, Grand Prairie, TX, Figure 2B) were placed at each transect (Figure 3, Appendix Table S2). At each of four locations one camera was placed ~1 meter above the ground on a tree with a scent bait (rabbit urine, commercial predator attractant, peanut butter / vanilla extract, or commercial sweet bait) in areas were animals were likely to traverse. Cameras were deployed for 58 days between August 27 and October 23. Two cameras were mounted inside an inverted bucket with modifications for close focus and baited with black-oil sunflower seeds or other sweet baits (Figure 2C). This modification is used to detect additional small mammals that may not enter the live traps. Cameras with modifications were deployed for the same duration as the live traps (7 days). Camera settings were chosen to maximize battery life while collecting photo or video when triggered. Upon retrieval, files were analyzed to determine species diversity and if possible identify unique individuals for measures of abundance and behaviors.

Visual searches

To augment live and camera trapping efforts, surveys for other species were conducted. At each site visual searches were conducted to identify plant, amphibian, reptile, bird, and arthropod diversity. Feces and tracks were identified as indicators of an animal's presence (e.g. feces from a raccoon, Figure 4).

Figure 4. Raccoon feces.

Analyses

The collected data was compiled into Microsoft Excel, where then various calculations were performed to determine averages for morphological measurements, recapture rates, male-female population composition, and other such statistics. The Schnabel method (Schnabel 1938) was utilized to estimate population size from mark and recapture rates. This method involves mammal capture, an examination for previous marking, then marking (if applicable) prior to release over the course of multiple sampling events. It operates under the assumptions that the population is constant, random sampling occurs, and that each individual is equally likely to be captured in a given sampling.

Results

Study Locations

Visual searches, live trapping, and trail cameras were deployed in the natural area surrounding the Abbey pond. The pond itself is roughly 4.5 acres in size on approximately 13.5 acres of land surrounded on all sides by gravel or paved roads. The Fox River is ~ 250m to the north and west with a developed commercial and residential district in between. To the south and east are small agricultural fields (300 to 900m) with the St. Norbert Abbey and residential neighborhoods beyond. Vegetation is early successional and has been subject to substantial browsing form an abundant deer population. This site is open to the public and has near daily visitors.

Biodiversity

Four mammal species were captured by live trapping; northern short-tailed shrew (*Blarina brevicauda*), meadow vole (*Microtus pennsylvanicus*), white-footed mouse (*Peromyscus leucopus*), and eastern chipmunk (*Tamias striatus*). A number of other species were identified through visual sightings, trail cameras, or observation of scat and sign (Table 1).

Table 1. Observed animal species.

Common Name	Scientific Name	Method	Notes
Mammals			
Northern short-tailed shrew	*Blarina brevicauda*	Live trap	Appendix Figure S1A
Virginia Opossum	*Didelphis virginiana*	Visual	
Striped skunk	*Mephitis mephitis*	Scat	
Meadow vole	*Microtus pennsylvanicus*	Live trap	Appendix Figure S1B
White-tailed Deer	*Odocoileus virginianus*	Camera	Appendix Figure S1C
White-footed mouse	*Peromyscus leucopus*	Live trap / camera	Appendix Figure S1D
Raccoon	*Procyon lotor*	Scat / camera	
Grey Squirrel	*Sciurus carolinensis*	Visual / camera	
Eastern Cottontail	*Sylvilagus floridanus*	Visual	
Eastern Chipmunk	*Tamias striatus*	Live trap / camera	Appendix Figure S1E
Red fox	*Vulpes vulpes*	Camera	
Birds			
Red-winged Black Bird	*Agelaius phoeniceus*	Visual	
Sandhill crane	*Antigone canadensis*	Camera /visual	
Canada Goose	*Branta canadensis*	Visual	
Great Horned Owl	*Bubo virginianus*	Call	
Eastern wild turkey	*Meleagris gallopavo*	Camera / visual	
Black-crowned Night Heron	*Nycticorax nycticorax*	Camera /visual	
House Sparrow	*Passer domesticus*	Visual	
Common Grackle	*Quiscalus quiscula*	Visual	
Amphibians			
American toad	*Anaxyrus americanus*	Visual	Appendix Figure S1F

Population demographics were restricted to live trapped animals with more than one individual represented. A single northern short-tailed shrew and single meadow vole were captured; therefore, demographics are only summarized for white-footed mouse and eastern chipmunk. We should note that the ranges of white-footed mouse (*P. leucopus*) and deer mouse (*P. maniculatus*) largely overlap and differentiation between the two species can be a challenge. Base on morphological measurements (Table 2) the mice capture in this study align with those characteristic of *P. leucopus* (Stromberg 1979). For white-footed mice, males were dominant among all individuals captured, 56.4% being males and 33.3% females (Table 2) with an estimated population of 65 mice across both transects (Table 3). For eastern chipmunk, females were dominant (57.1%) whereas males were fewer (42.9%) with a total estimated population size of 10 chipmunks (Table 2). For either species, no individuals were captured in traps of the opposing transect. Overall species richness was 4 with mouse and chipmunk found in both transects (Table 3). Northern short-tailed shrew was only found in transect A and meadow vole only found in transect B.

Table 2. Population demographics for white-footed mouse (*Peromyscus leucopus) and Eastern chipmunk (Tamias striatus).*

	Peromyscus leucopus			***Tamias striatus***		
Transect	**A**	**B**	**All**	**A**	**B**	**All**
Avg. Weight (g)	22.0	21.2	21.6	101.0	101.6	101.4
Avg. Ear Length (mm)	15.6	13.7	15.0	16.3	15.5	15.9
Avg. Hind Foot (mm)	19.6	20.2	19.8	33.3	32.9	33.1
Avg. Body Length (mm)	78.6	86.2	80.4	164.7	146.1	155.4
Avg. Tail Length (mm)	74.1	75.0	74.3	111.0	104.9	107.5
Avg. Total Length (mm)	119.9	48.9	87.1	275.7	214.5	240.7
No. Male	13 (61.9%)	9 (50%)	22 (56.4%)	1 (33.3%)	2 (50%)	3 (42.9%)
No. Female	7 (33.3%)	6 (33.3%)	13 (33.3%)	2 (66.7%)	2 (50%)	4 (57.1%)
No. Unknown Sex	1 (4.8%)	3 (16.7%)	4 (10.3%)	0	0	0
Total Unique Captures	21	18	39	3	4	7
Total Recaptured	37	21	58	8	11	19
Total Captures	58	39	97	11	15	26
Avg. Times Recaptured	2.67	2.00	2.36	3.33	3.75	3.57
Est. Population Size	33	33	65	4	6	10

Table 2. Trapping summary.

Transect	**A**	**B**	**All**
Species Richness	3	3	4
Trap Nights	6	6	6
Effort (Traps * Nights)	96	96	192

Discussion

This study is a crucial step for long term biological monitoring of species at the Abbey pond. Small mammal trapping was the major focus of this work and four species were captured – this is a strong indicator that other species may inhabit this are or may be attracted to this area with some habitat improvements. Through mark-recapture sampling, we now have an estimated population size that can be annually monitored for quantifiable changes as a proxy for biological events. These events could be changes in predator species populations, habitat alteration, introduction of a new competitor species, or changes in food availability (e.g. oak mast year). An additional 16 species were documented through camera trapping or visual sightings. It is important to note that

these species were documented opportunistically and targeted surveys were not conducted. This is an indication that there is substantial diversity at the Abbey pond that has yet to be explored.

Future Directions

With this work, we have established transects that will be monitored annually. The primary objective will be to repeat this mark-recapture survey to estimate changes in population size. In future iterations, a more in depth habitat analysis will be conducted to establish long term changes to vegetation structure and diversity. Visual searches will be increased and specific classes of animals will be targeted for more thorough documentation of occurrence.

Acknowledgements

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Appendix

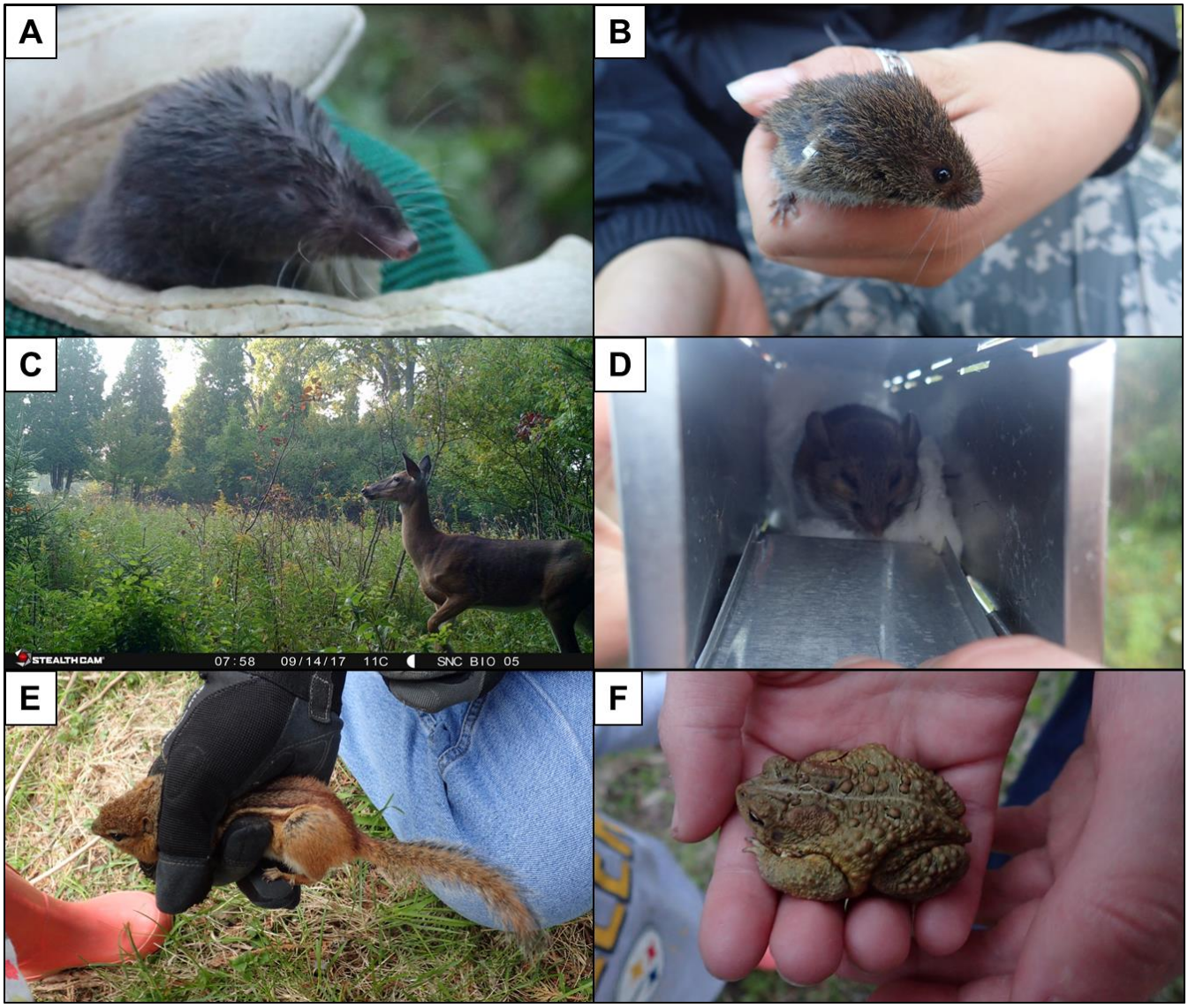

Figure S1. Photographic documentation of animal species. A) Northern short-tailed shrew (Blarina brevicauda), B) Meadow vole (Microtus pennsylvanicus), C) White-tailed deer (Odocoileus virginianus), D) White-footed mouse (Peromyscus leucopus), E) Eastern chipmunk (Tamias striatus), F) American toad (Anaxyrus americanus).

Table S1. Trapping transect summary.

Site	Trap #		Coordinates		Traps		Start		End		Total
	Start	End	Start	End	# Large	# Small	Date	Time	Date	Time	Trap Nights
A	1	16	N 44.46027 W 88.05178	N 44.46059 W 88.05250	8	8	27-Aug-17	14:00	23-Jul-17	6:00	6
B	17	32	N 44.46024 W 88.05042	N 44.46041 W 88.05007	8	8	27-Aug-17	14:00	23-Jul-17	6:00	6

Table S2. Camera trap summary.

Site	Coordinates	Start Date	Start Time	End Date	End Time	Bait	Settings	Notes
C1	N 44.46178 W 88.05124	27-Aug-17	19:00	23-Oct-17	13:30	Peanut butter, vanilla, oats	Photo	
C2	N 44.46046 W0 88.05035	27-Aug-17	21:00	23-Oct-17	13:30	Commercial sweet (berry)	Photo	
C3	N 44.46004 W 88.05072	27-Aug-17	15:30	23-Oct-17	13:30	Rabbit urine	Photo	
C4	N 44.46047 W 88.05211°	27-Aug-17	15:40	23-Oct-17	13:30	Commercial predator scent	Photo	
D1	N 44.460301 W 88.051772	27-Aug-17	16:20	23-Jul-17	6:00	Black oil sunflower seeds	Video	Bucket modification
D2	N 44.460287 W 88.050575	27-Aug-17	16:35	23-Jul-17	6:00	Black oil sunflower seeds	Video	Bucket modification