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Biodiversity and Conservation Study of the St. Norbert Abbey, De Pere, Wisconsin - 2018 Annual Report

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2018 Annual Report

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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 the completion of the second annual field season of a long term study to analyze biodiversity trends at the St. Norbert Abbey. Using visual searches, live trapping, and trail cameras, the biodiversity and abundance of species were examined. Special emphasis was placed on small mammals, though other groups were observed and documented. The goals of this project are to (1) collect data annually on diversity and abundance measures to allow for examination of variation and long term trends; and (2) further a research partnership and platform capable of providing 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 (Figure 1). 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. 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 photo of the Abbey pond and surrounding property ca.2018 courtesy of GoogleEarth.

To date, this ongoing study is the only publicly available data that specifically examines species diversity or population demographics at the Abbey pond. Any documentation of wildlife occurrence has been sporadic through the citizen science database "ebird" (Sullivan *et al.* 2009) or in anecdotal accounts in media (e.g. (Green Bay Press Gazette 1973; Meinert 2006). The property has been managed primarily for recreation by the Norbertines at the St. Norbert Abbey and the Brown County Chapter of the Izaak Walton League. The Abbey 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 urban adapted animals utilizing this area as part of their range. Barriers to movement would largely depend on the individual's ability to cross moderately trafficked roads, agricultural fields, or suburban development. Populations and species occurrence are therefore presumed to fluctuate by typical processes such as births and deaths or immigration and emigration. Hunting or other population augmentation methods would not be applicable. Here we detail the second annual 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 051801, WI Department of Natural Resources SCPSRLN-18-023). 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 to minimize exposure to extreme temperatures or predators. The study period lasted 5 days (4 nights) from August 20- August 24, 2018 (calendar days 232-236), during which the traps were monitored twice daily (approximately 6:00 and 18:00 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 2B) 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.

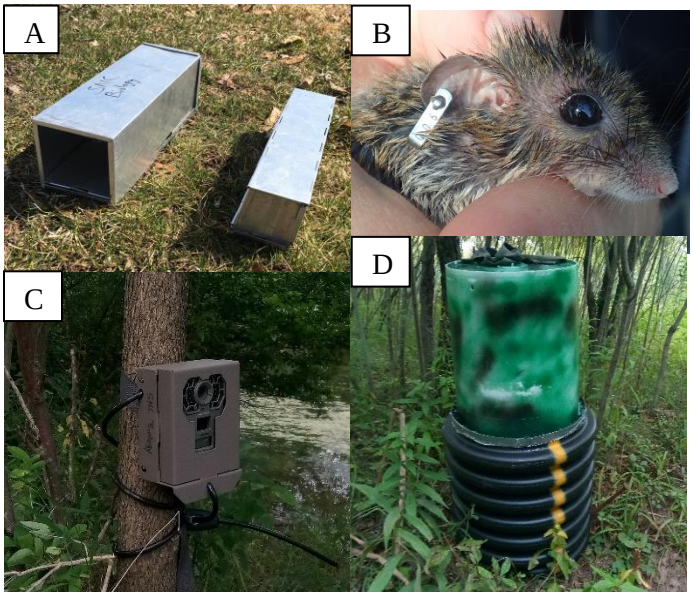

Figure 2. Mark-recapture and visual search materials. A) Large (7.62x7.62x25.4 cm) and small (5.08x6.35x16.51 cm) Sherman live traps. B) Peromyscus sp. fitted with ear tag. C) Stealth Cam Trail Camera. D) Plastic 5-gallon bucket trap with camera attached to top inside and aimed at the ground.

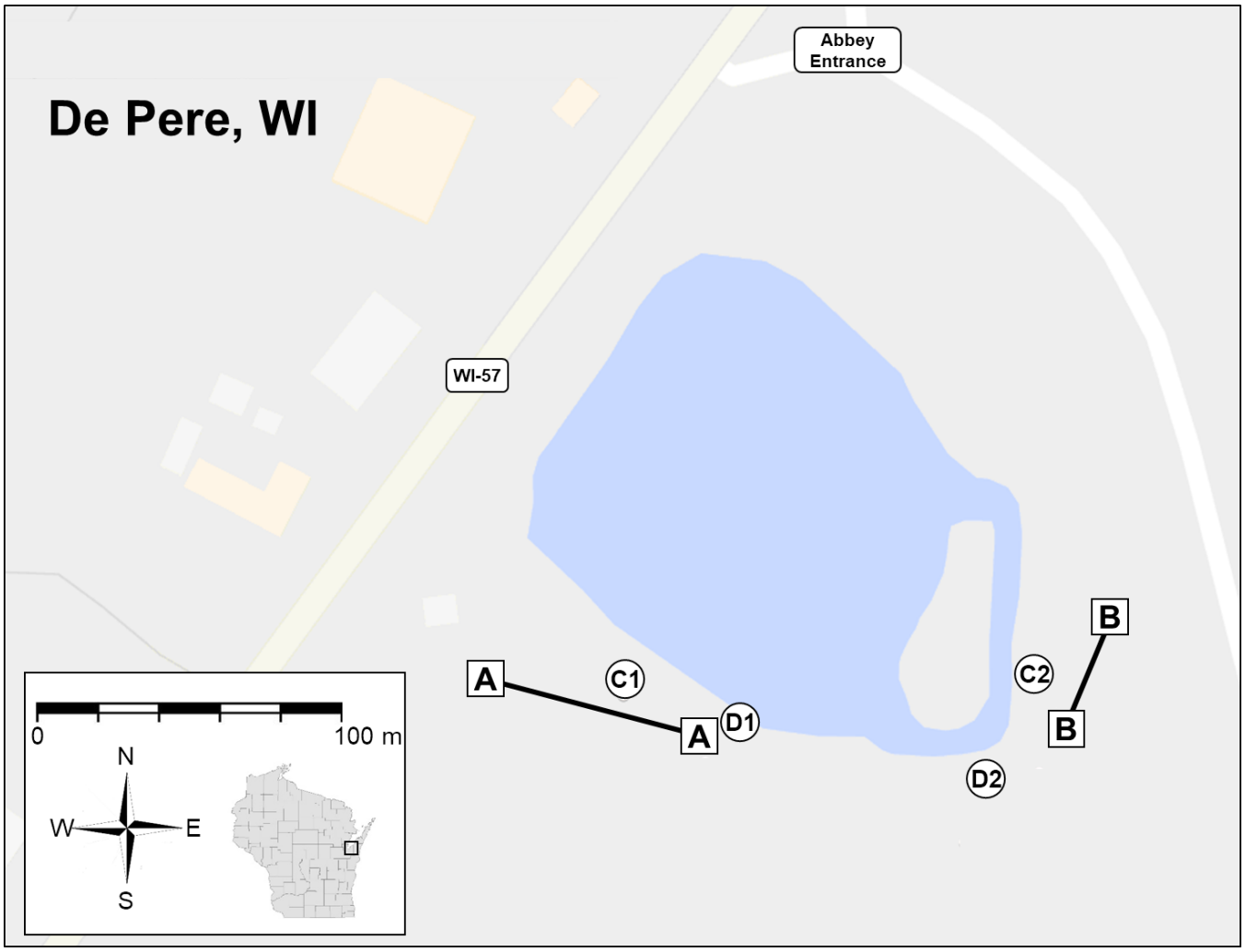

Figure 3. Trapping transect and camera locations. A) Transect of traps 1 - 16, B) Transect of traps 17 - 32. C) Cameras 1 and 2 on trees. D) Cameras 1 and 2 with bucket modifications

Camera trapping

Two trail cameras with passive infrared motion triggers and infrared illumination (Stealth Cam, Grand Prairie, TX, Figure 2C and figure 4) were placed, one at each transect (Figure 3, Appendix Table S2). At two locations one camera was placed ~1 meter above the ground on a tree in areas were animals were likely to traverse. Cameras were deployed for 23 days between August 20 and September 11. Two cameras were mounted inside an inverted bucket with modifications for close focus and baited with cat food, bacon, and dried insects (Figure 2D). 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 (5 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.

Figure 4. Photo of a male white-tailed deer (Odocoileus virginianus) visiting the pond edge at night. Photo captured using infrared illumination, which produces no visible light.

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.

Vegetation Surveys

A vegetation survey was performed to provide a habitat description for each transect. A center point was identified in the transect, from there 25 meters were measured out in the four cardinal directions and a 50 m x 50 m square was marked off. Trees within this square with a diameter at breast height (DBH) that was greater than 5 cm were measured and recorded. If the DBH was less than 5 cm then it was only counted, the diameter was not recorded. Canopy and ground cover were also estimated, this was done by picking 20 random spots in the square and using a tube with crosshairs pointing straight up and down. If the crosshairs were on anything green it was recorded as a positive result, this was done twice at each spot – once for the canopy and again for the ground cover. Finally, the canopy height was calculated. This was done by choosing one of the taller trees, measuring a distance from it, then using a protractor to determine the angle to see the top of the tree.

Analyses

For each year basic diversity indices, averages of morphological measurements, and population demographics were calculated. 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. A t-test was used to determine significance, all statistical analyses were conducted in R (R Core Team 2019) using R studio (RStudio Inc. 2018).

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
Two mammal species were captured by live trapping; 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).

Population demographics were available 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, as 92.3% were male (Table 2) with an estimated population of 18 mice across both transects (Table 3). For eastern chipmunk, 100% of those caught were male – with a population size around 3 (Table 2). For either species, no individuals were captured in traps of the opposing transect. Overall species richness was 2 with mouse and chipmunk found in both transects (Table 3). The mouse and chipmunk population estimates are half of what they were in 2017 (Table 4).

Vegetation Survey
The surveys show the dominant tree and shrub types in each transect. In transect A, Hawthorn and Willow are dominant (Table 5). In transect B, Buckthorn and Red Cedar are dominant (Table 6). Also, transect B had more canopy cover than transect A (Table 7).

Table 1. Observed animal species.

Common Name	Scientific Name	Method	Notes
Mammals			
White-tailed Deer	*Odocoileus virginianus*	Camera	Appendix Figure S1C
White-footed mouse	*Peromyscus leucopus*	Live trap / camera	Appendix Figure S1A
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 S1B
Red fox	*Vulpes vulpes*	Camera	
Marsupials			
Virginia Opossum	*Didelphis virginiana*	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	Appendix Figure S1E
Black-crowned Night Heron	*Nycticorax nycticorax*	Camera /visual	Appendix Figure S1D
House Sparrow	*Passer domesticus*	Visual	
Common Grackle	*Quiscalus quiscula*	Visual	
Amphibians			
American toad	*Anaxyrus americanus*	Visual	Appendix Figure S1F

Table 2. Population demographics for white-footed mouse (*Peromyscus leucopus) and Eastern chipmunk (Tamias striatus) during 2018.*

	Peromyscus leucopus			***Tamias striatus***		
Transect	**A**	**B**	**All**	**A**	**B**	**All**
Avg. Weight (g)	21.7	18	21.5	106.4	67.5	93.4
Avg. Ear Length (mm)	13.5	15	14.0	15.5	16	15.7
Avg. Hind Foot (mm)	19.6	16	19.4	36	37	36.3
Avg. Body Length (mm)	78.4	80	78.3	145	136	142
Avg. Tail Length (mm)	75.9	66	75.4	112	102	108.7
Avg. Total Length (mm)	154.3	146	153.7	257	238	250.7
No. Male	11 (91.7%)	1 (100%)	12 (92.3%)	2 (100%)	1 (100%)	3 (100%)
No. Female	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
No. Unknown Sex	1 (8.3%)	0 (0%)	1 (7.7%)	0	0	0
Total Unique Captures	12	1	13	2	1	3
Total Recaptured	9	1	10	4	1	5
Total Captures	21	2	23	6	2	8
Avg. Times Recaptured	1.75	2	1.67	3	2	2.7
Est. Population Size	17.3	3.8	18	3.2	1	2.8

Table 3. Trapping summary.

Transect	A	B
Species Richness	2	2
Trap Nights	4	4
Effort (Traps * Nights)	68	68

Table 4. Small mammal population estimates by year.

Species	2017	2018
Peromyscus leucopus	42.7	18.0
Tamias striatus	6.9	2.8

Table 5. Vegetation survey at transect A.

Tree	Total Number	Average Diameter
Red Cedar	38	19.3 cm
Hawthorn	7	10.5 cm
Willow	1	9 cm
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Willow	255	< 5cm
Hawthorn	209	< 5cm

Table 6. Vegetation survey at transect B.

Tree	Number of Trees	Average Diameter
Red Cedar	42	18.7 cm
Black Ash	12	12.6 cm
Quaking Aspen	8	13.5 cm
Buckthorn	6	6.8 cm
Hickory	5	13 cm
Butternut	4	23.1 cm
Maple	1	6.4 cm
Willow	1	114.6 cm
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Buckthorn	223	< 5cm
Red Cedar	102	< 5cm
Autumn Olive	14	< 5cm
European Spindle Tree	10	< 5cm
Pignut	6	< 5cm
Quaking Aspen	2	< 5cm
Butternut	1	< 5cm
Bebb's Willow	1	< 5cm

Table 7. Ground and Canopy Cover per transect.

Transect	Ground Cover	Canopy Cover	Canopy Height
A	60%	20%	4.7 m
B	60%	40%	10.5 m

Discussion

This study is important for continuing long term biological monitoring of species at the Abbey pond. Small mammal trapping was the major focus of this work and two species were captured – this is an indicator that other species may inhabit this area or may be attracted to this area with some habitat improvements. Comparing the mouse and chipmunk populations from this year to last year shows a decrease in population sizes. This decrease is especially present in transect B, which might be due to a reduction in ground cover from tree pruning. Additionally a snowstorm in late April 2018 might also have had an effect on the population sizes through reduction in food availability at a time when winter energy reserves have already been depleted. Continued study in needed to determine how significant these events were or if the population size decrease is

consistent with long-term trends. The vegetation surveys establish a habitat description for each transect that can be used to compare studies in future years. Although the major tree types in each transect are not likely to change much from year to year, the canopy and ground cover might fluctuate at shorter intervals with direct effects on rodent populations.

Future Directions

The primary objective will be to repeat this mark-recapture survey to estimate changes in population size. Vegetation surveys will also be repeated to track any changes in the plant communities. Visual searches will be increased and specific classes of animals will be targeted for more thorough documentation of occurrence, the bird populations will be targeted in particular.

Acknowledgements

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Appendix

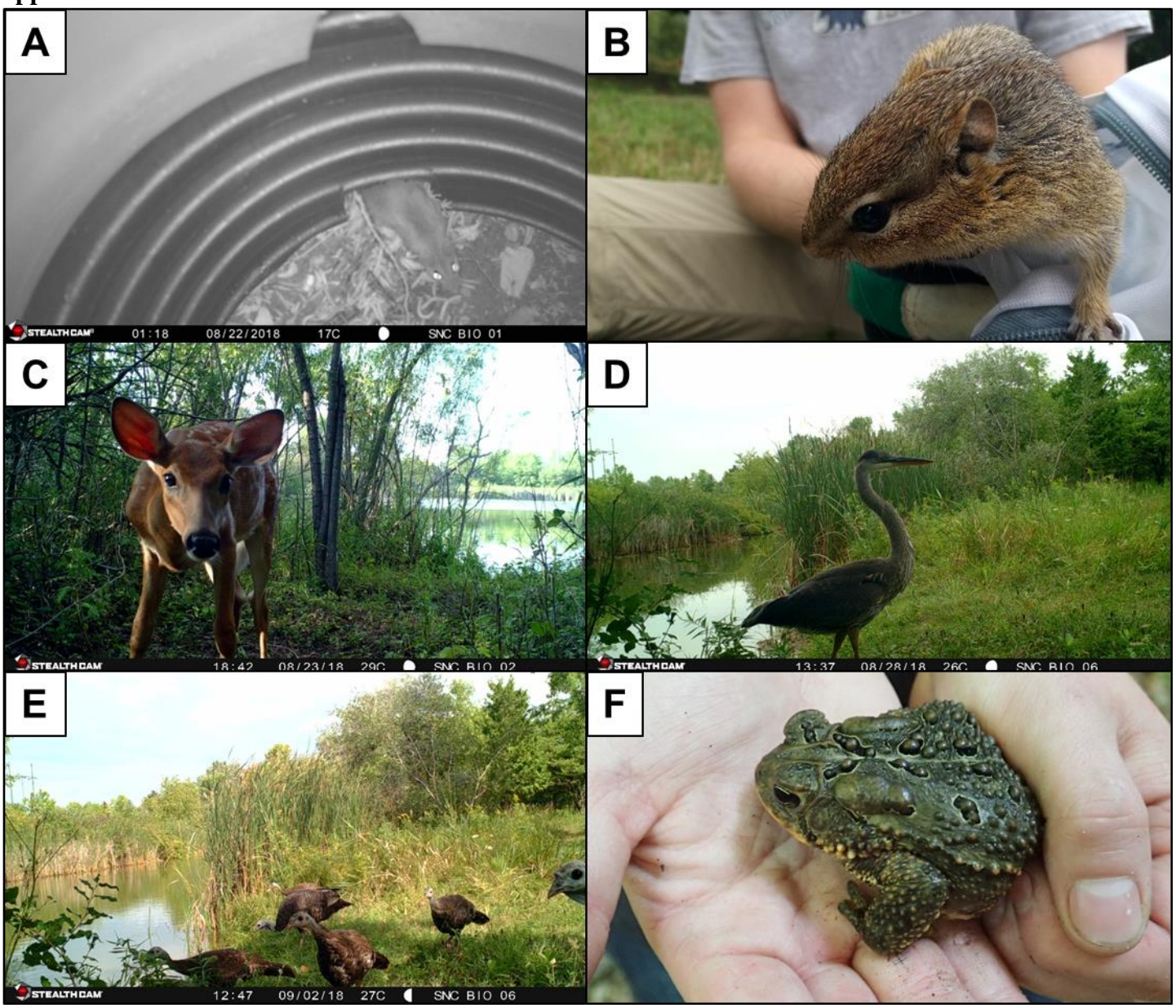

Figure S1. Photographic documentation of animal species. A) White-footed mouse (Peromyscus leucopus), B) Eastern chipmunk (Tamias striatus), C) White-tailed deer (Odocoileus virginianus), D) Black-crowned night heron (Nycticorax nycticorax), E) Eastern wild turkey (Meleagris gallopavo), F) American toad (Anaxyrus americanus).

Table S1. Trapping transect summary.

Transect	Trap #		Coordinates		Traps		Start		End		Total
	Start	End	Start	End	# Large	# Small	Date	Time	Date	Time	Trap Nights
A	1	16	N 44.46032 W 88.05260	N 44.46032 W 88.05178	8	8	20-Aug-18	16:00	24-Aug-18	6:00	4
B	17	32	N 44.46035 W 88.05031	N 44.46066 W 88.05014	8	8	20-Aug-18	16:00	24-Aug-18	6:00	4

Table S2. Camera trap summary.

Camera	Coordinates	Start Date	Start Time	End Date	End Time	Bait / Lure / Scent	Settings	Notes
C1	N 44.46047 W 88.05206	20-Aug-18	15:30	11-Sep-18	14:00	None	Photo	
C2	N 44.46049 W 88.05043	20-Aug-18	15:30	11-Sep-18	14:00	None	Photo	
D1	N 44.46035 W 88.05165	20-Aug-18	15:00	24-Aug-18	18:30	Cat food, bacon, freeze-dried insects	Video	Bucket modification
D2	N 44.46019 W 88.05058	20-Aug-18	15:00	24-Aug-18	18:30	Cat food, bacon, freeze-dried insects	Video	Bucket modification