Mammal Monitoring at Boone Cliffs Nature Preserve

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This semester, we worked with Boone County Conservation District, doing mammal monitoring at Boone Cliffs Nature Preserve. BCCD recently acquired jurisdiction of the preserve and wanted to gather data on animal biodiversity of the area. Knowing biodiversity is essential to understanding the dynamics of the ecosystem, and can indicate its health. After much discussion with BCCD, we chose to assess mammals, as they tend to be more active in the winter to early spring than other animals and are easier to monitor using camera traps. We had considered using live trapping but determined that we did not have the time available to properly use this method. We set up seven cameras in different areas of the preserve, including a few cliff and hill areas, two different creek locations, and several locations in an upland beech forest. We aimed to collect data on species diversity, which areas had the most traffic, and the time of day that animals were most active. We set up two cameras on February 13, 2019 as a trial. Three weeks later, on March 6, 2019, we set up six more cameras.

A Survey of Mammalian Diversity at Boone Cliffs State Nature Preserve in Burlington, KY

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Introduction

Over the last century, human development has increased rapidly. In fact, the population of Kentucky has increased by over 2.5 million people in the last one hundred years (U.S. Census Bureau QuickFacts). As population and development have increased, natural areas have become harder to find and maintain. For this reason, the state of Kentucky has developed the State Nature Preserve program, which protects over 19,000 acres of significant natural areas for education and science (Kentucky Energy and Environment Cabinet 2019), including land in Northern Kentucky at Boone Cliffs State Nature Preserve.

Boone Cliffs is a valuable and beautiful resource for the people of Northern Kentucky, particularly citizens of Boone County wherein the cliffs reside. Because of the scientific and educational value of this natural area, the Boone County Conservation District has taken an interest in maintaining and promoting the nature preserve. To further emphasize the value of Boone Cliffs, the Conservation District have commissioned several studies within the preserve to measure various parameters of the ecosystem's health, including the work presented in this report. The aim of this survey was to conduct an inventory of all the different mammal species that inhabit Boone Cliffs. By doing this, we will better understand the wildlife community and have baseline data from which to compare future studies. This approach allows us to monitor changes in the wildlife of Boone Cliffs over time and give the Boone County Conservation District more reliable information to help focus their conservation and education planning.

Methods

Boone Cliffs is named for the twenty-to-forty-foot composite material cliffs deposited there from glacial activity about 700,000 years ago (The Nature Conservancy). It is seventy-four acres of land situated along Middle Creek (The Nature Conservancy). Within Boone Cliffs, we

found several different habitat types in which to conduct our survey by placing eight trail cameras to photograph passing mammals. We chose to use cameras for two primary reasons. First, trail cameras greatly reduced the amount of time and labor needed to complete traditional trapping methods. Secondly, camera traps are less invasive for the wildlife being studied, and allow analysis of animals in their more natural state (Cloyed et al. 2018). We first placed two cameras within a streambed where we expected animals to congregate for water. We then placed two cameras near the namesake cliffs to monitor animal movement from the top to the bottom of the cliffside and vice-versa. Finally, we placed four cameras within an upland beech tree forest on a plateau above one of the cliffs. The four cameras in the beech forest comprised an upland habitat type, while the cameras near the cliffs and along the stream constituted the bottomland habitat.

All eight of the cameras were placed in strategic places where we found evidence of mammals including remnants of scat, tufts of fur, or partially eaten food. The cliff cameras were placed alongside the cliff in an area that had an obvious animal trail. The creek cameras were both placed facing upstream toward curves in the bend of the stream. This was done to collect photographs of mammals using this creek as their water source. The four cameras in the beech forest were placed in a small area in proximity to each other, but facing different directions. This was done to cover the largest space of the habitat without crossing the cameras' fields of view.

These trail cameras were used to capture still images of an organism passing in front of the camera. They were set up to be motion-triggered through the settings within the camera. Once motion triggered the camera, it took a burst of three pictures. We decided this was the best plan because out of three pictures at least one of them would be clear enough to identify the animal. Once the burst of three pictures was taken, we programmed the cameras to wait five

minutes before taking more photos to avoid getting pictures of the same animal moving back in front of the camera. Each camera also recorded the date, time and temperature of each photograph to aid in later analysis.

We began data collection with two trial cameras on February 13, 2019. We used these cameras to verify that our procedure was viable. After a three-week trial period, we placed the remaining six cameras on March 6th. After this, we went out to Boone Cliffs once every week or two to collect the photographs which had been locally saved onto the cameras' SD cards. We uploaded each photograph to a central database where we could then organize and analyze each individual picture. After nearly a month of data collection, we took down the cameras on March 29th, and began the process of identifying each mammal found in the photographs. *Mammals of Kentucky* by Roger Barbour and Wayne Davis, was instrumental in helping us to identify the animals present in the pictures (1974). After the species, camera name, date, time, and temperature were all entered, we used the program Microsoft® Excel to analyze the data.

Results

In total, we captured photographs of 132 separate individuals from nine distinct species and six distinct families of mammals during our survey (Table 1). Of these species, white-tailed

Table 1. The nine mammal species that were present at Boone Cliffs State Nature Preserve, their familial relationships, their behavioral characteristics, and the number of each seen in the survey.

Common Name	Species	Family	Behavior	Number Captured
Eastern Chipmunk	*Tamias striatus*	Sciuridae	Diurnal	17
Fox Squirrel	*Sciurus niger*	Sciuridae	Diurnal, Crepuscular	4
Grey Squirrel	*Sciurus carolinensis*	Sciuridae	Diurnal, Crepuscular	10
Groundhog	*Marmota monax*	Sciuridae	Diurnal	3
Raccoon	*Procyon lotor*	Procyonidae	Nocturnal	23
Virginia Opossum	*Didelphis virginiana*	Didelphidae	Nocturnal	3
Red Fox	*Vulpes vulpes*	Canidae	Nocturnal	34
American Mink	*Neovison vison*	Mustelidae	Nocturnal, Crepuscular	1
White-tailed Deer	*Odocoileus virginianus*	Cervidae	Nocturnal, Crepuscular	37

deer (37 individuals) and red fox (34 individuals) made up over 50% of the individuals we observed while the American mink and Virginia opossum were the most uncommon species at only 3% of the individuals captured (Figure 1).

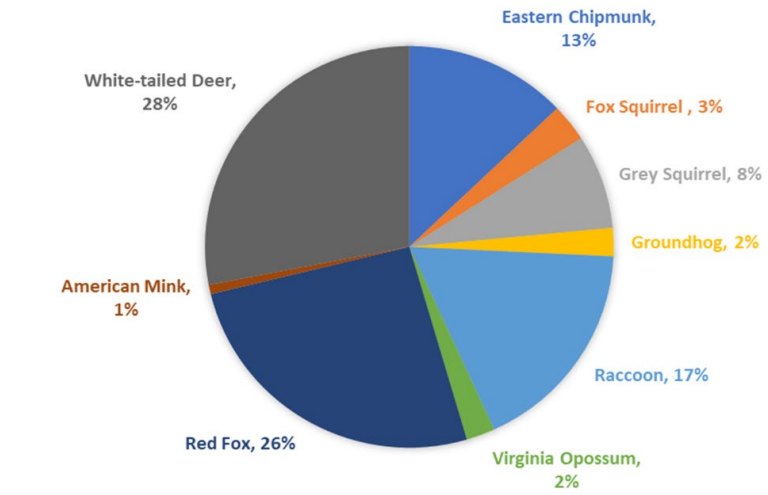

Figure 1. The number of each mammal species expressed as the percentage of the total mammalian community of 132 individuals.

The distribution of individuals was spread throughout Boone Cliffs both temporally and spatially. In total, 44% of the pictures were recorded during the daylight hours of 6:00am - 6:00pm, with the remaining 56% of the mammals captured at night (Figure 2). We also recorded at least one mammal species in seven of the eight camera locations, with one of the cameras in the upland beech forest not capturing any mammal species during the course of this study (Figure 3). This showed that mammal populations could be found throughout the study area. However, we found the maximum

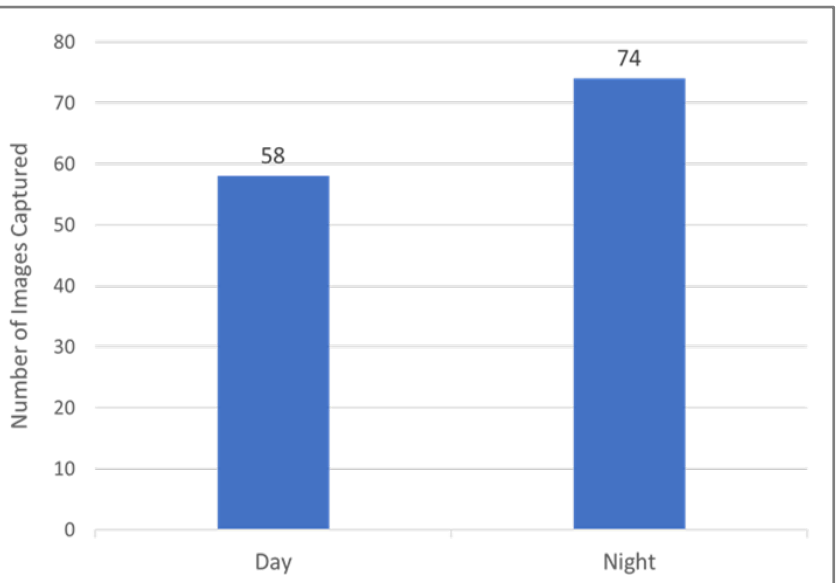

Figure 2. The number of images captured by the 8 trail cameras during the day (6:00am EST – 6:00pm EST) and night (6:00pm EST – 6:00am EST).

diversity at the Cliffs camera, where we spotted at least one individual from seven of the nine total species found in the survey (Figure 3).

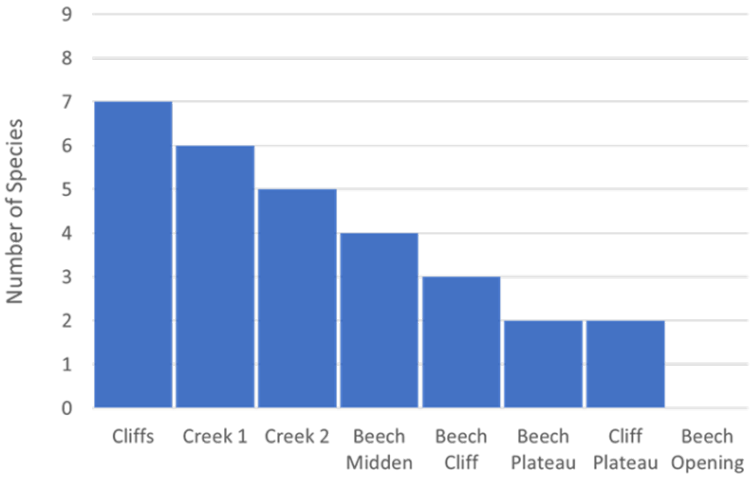

Figure 3. The number of mammalian species caught by each camera trap, from greatest to least. One of the 8 trail cameras did not record any photographs.

Discussion

Our findings suggest that Boone Cliffs contains a healthy diversity of mammalian wildlife. We observed many of the common forest mammals that one would expect to see, but we also captured more uncommon species such as the red fox and the American mink. White-tailed deer and red fox made up nearly 50% of the total individuals that we observed, but our images indicated that we likely captured the same individuals on multiple occasions. Our diversity becomes much more even when accounting for these same individuals being observed multiple times.

To look at the total health of the mammal population, we not only looked at which mammals were present in Boone Cliffs, but also how they behaved. We found that the mammals in Boone Cliffs were not limited to a single location or time of day. When we compared the time of day of each image, we found that 28% more mammals were captured at night than during the day. This makes sense, as several of the species -- including the red fox and Virginia opossum -- are known to be nocturnal (Table 1). We also found that the mammals were spread throughout different locations in Boone Cliffs. Of our eight cameras, we recorded at least two mammal

species in six of them. This means that there is either a large population of these mammals in the nature preserve, or they are easily moving through it.

While we were able to successfully capture images of many medium or large-sized mammal species, we did not find any evidence of smaller mammals such as mice, shrews, and voles. Because we observed a high proportion of red fox activity, and these small mammals are a known prey source for red foxes (South Carolina Department of Natural Resources 2015), we believe that these smaller species were likely present at Boone Cliffs. It is most likely that our cameras were not sensitive enough to capture the movements of the small mammals as they crossed a camera's field of view. To collect population data on these small mammals going forward, we recommend utilizing more sensitive trail cameras specialized for small animals or implementing alternative methods such as traditional live-trapping to supplement the camera photography.

Conclusion

This survey allowed us to establish a baseline for future research and monitoring at Boone Cliffs Nature Preserve. Overall, we found that the mammalian community at Boone Cliffs is diverse and healthy, with a good mix of consumers, scavengers, and even predators. However, it is unlikely that the scope of this survey was large enough to successfully capture every mammal species within Boone Cliffs. Future surveys should attempt to collect images from more areas within the preserve, focusing on the areas immediately above or below the cliff faces or near streams due to the high likelihood of capturing a variety of mammals.

When starting this survey, we were unsure whether using cameras would be sufficient to analyze the complete mammalian community. While we surely did not find every mammal

within Boone Cliffs, we feel that using trail cameras was the most effective method. Traditional trapping would have likely led to the loss of some captured individuals, especially in the colder winter months. For this reason, we believe that cameras were a useful strategy and recommend that future surveys consider their use in addition to or as an alternative for traditional trapping.

References

Barbour RW, Davis WH. 1974. Mammals of Kentucky. Lexington: University Press of Kentucky, Kentucky Nature Studies: 5.

Cloyed CS, Cappelli LR, Tilson DA, Crawford JA, Dell AI. 2018. Using Camera Traps to Assess Mammal and Bird Assemblages in a Midwestern Forest. J Fish Wildl Manag. 9(2):496–506. doi:10.3996/122017-JFWM-103.

Kentucky Energy and Environment Cabinet. 2019. Frequently Asked Questions – Kentucky Energy and Environment Cabinet. KY.gov. [accessed 2019 Apr 17]. https://eec.ky.gov/Nature-Preserves/conserving_natural_areas/Pages/faq.aspx

Nature Conservancy, The. Boone County Cliffs State Nature Preserve. Nat Conserv. [accessed 2019 Apr 10]. https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/boone-county-cliffs-state-nature-preserve/

South Carolina Department of Natural Resources. 2015. SCDNR - Mammal Species - Red Fox. S.C. Dep Nat Resour. [accessed 2019 Apr 27]. http://www.dnr.sc.gov/wildlife/species/redfox.html

U.S. Census Bureau QuickFacts: Kentucky. [accessed 2019 Apr 17]. https://www.census.gov/quickfacts/ky

Video:

https://www.youtube.com/watch?v=LT2Qn8ti_wQ&feature=youtu.be