WILDLIFE SPECIES ADAPT TO URBAN CHALLENGES

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ABSTRACT

To evaluate the importance of woodlot forest fragments for conservation efforts, we analyzed the relationships between mammals and human disturbance rates at SUNY Purchase College, Purchase, NY (41° 02 '50.23 `` N -73° 42' 7.65 `` W). Our results show that wildlife species at SUNY Purchase College Campus adapted to human disturbances at varying levels. The results of this study suggest that mammals' spatial patterns are adapting to varying human disturbance rates. The results of this study also suggest that conserving fragmented woodlots could be an effective conservation management action to promote biodiversity in urban ecosystems.

Key Words: Habitat Fragmentation, Human Disturbance, Biodiversity, Urbanization, Wildlife, Conservation, Urban Planning

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INTRODUCTION

Urban planning policies are focusing more on small, peri-urban, fragmented wood lots (Croci et al. 2008). The maintenance of habitats in woodlot fragments can serve as potential conservation areas for some mammal species, despite varying human disturbance levels (Markovchick-Nicolls et al. 2008). Owing to human influence and the destruction of habitual ecosystems, mesocarnivore species' diel activity patterns are altered. This indirectly affects less competitive scavenger communities who are forced to shift their temporal partitioning patterns for better survival rates. Urban systems contain abundant shelter and resources for mesocarnivore and scavenger communities. This issue likely maximizes the change of intraguild interactions in an ecosystem.

Prey species are often more diverse and abundant in moderately urbanized areas when compared to rural locations because of the accessibility of backyard resources (i.e., feeders, coops, water, compost, garden, or brush pile areas) (Hansen et al. 2020). Resident and transient coyotes in an urbanized landscape typically avoided habitats that are associated with human activities and focused mainly on natural areas in the region (Gehrt et al. 2009). Some wildlife species will alter their behaviors due to human disturbance rather radically. These animals will

avoid humans spatially and temporally whether the humans pose a risk or not. When this response occurs in a species, diel activities of local wildlife are significantly altered, indirectly affecting wildlife species' fitness and survival (Gaynor et al. 2016).

The goal of this wildlife study is to quantify the relative abundance of mammal occurrences and humans on the land at SUNY Purchase College, Purchase, NY. During this study, we surveyed wildlife occurrences and human occurrences in 6 different sites. Wildlife species that were focused on in this study were Bobcats, Domestic Gogs, Virginia Opossum, White-Tailed Deer, Striped Skunk, Raccoon, Coyote, Eastern Chipmunk, Eastern Gray Squirrels, and Eastern Cottontail. By sharing and discussing the results of this study, future generations will be able to quantify wildlife use of land using trail camera photos and point count surveys to assess wildlife and human occurrences and, and use of fragmented woodlots.

METHODS

Study Area. To determine potential field sites, aerial imagery using Google Maps was used to assess potential forest areas at SUNY Purchase Campus that could be used for this study. Once potential sites were located, we did a physical survey of the area to determine (1) ease of access, (2) if our aerial imagery observations were true, and (3) make preliminary observations of the habitat area. To standardize our data collection, each site location had a trail running through it. When site locations were chosen and confirmed by the team, we used the application Survey123 to record the exact GPS locations of each site (Figure 1). The 6 different sites differed in the type and abundance of invasive and noninvasive vegetation and also differed in varying anthropogenic noise and disturbance levels. When looking at the age (Table 1) and trail width size (Table 2) of all 6 forest plot locations, there is no significant difference between them, and are a general representation of what one would expect to find in a New England forest woodlot.

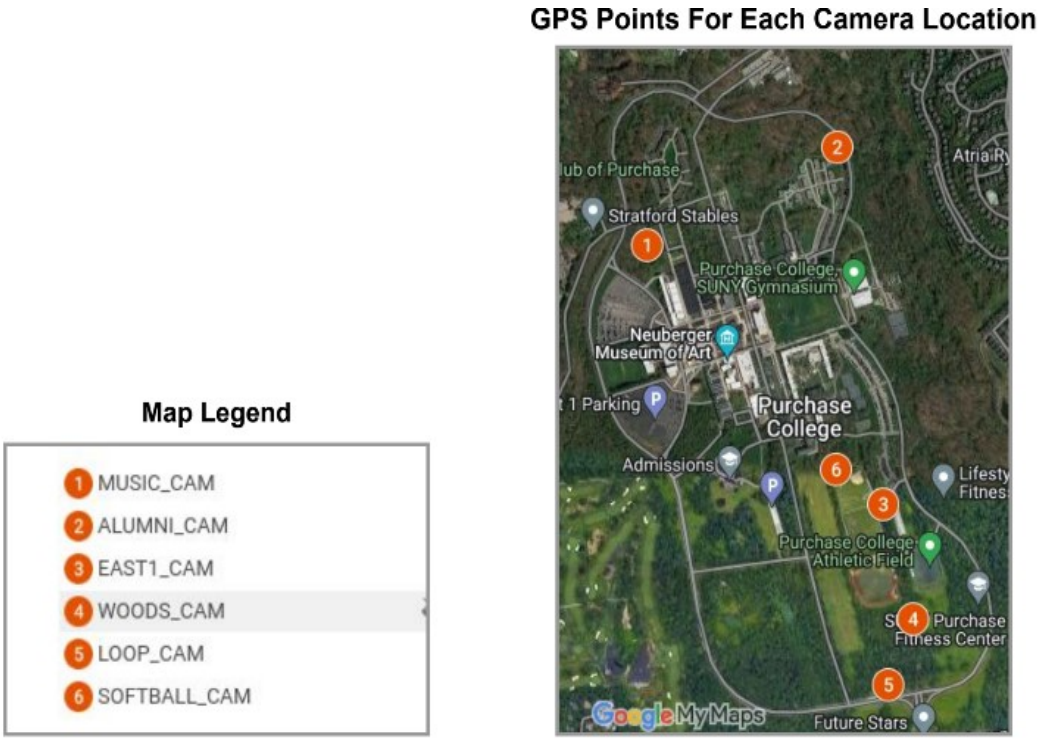

Figure 1: Google Satellite imagery map showing where each trail camera location is at Purchase College, State University of New York, Purchase, NY (41°02'50.23" N -73°42'7.65" W). GPS points were taken using Survey123 applications standing parallel to the trail camera set-up. Camera locations were chosen following a standardized sampling protocol.

Table 1. Represents the approximate age of the forests at each site location. Age was calculated by viewing Google Earth Pro and watching for changes through the years in the vegetation of the forests at each site location. SUNY Purchase Colleges, Google Earth Pro imagery had only started being recorded in 1985-current 2022.

Approximate Age of Forest at Each Site	
Site Name	*Approx. Age (Years)*
Alumni	~37 years old
East 1	~37 years old
Loop	~28 years old
Music	~37 years old
Softball	~32 years old
Woods	~37 years old

Table 2. Average number of trail width averages at each site location. Alternatively, this figure shows the size of forest fragmentation (m) at each site location that has occurred from the trail.

Trail Width Averages At Each Site (Forest Fragment Size)	
Site Name	*Trail Width Avg. (meters)*
Alumni	3.4 m
East 1	2.6 m
Loop	4.5 m
Music	7.8 m
Softball	4.0 m
Woods	3.1 m

Field Sampling. To survey mammals at SUNY Purchase College Campus, 6 Browning trail cameras (HD Pro-Model BTC-5HDP) were set up at each location and attached to a tree at breast height (about 1.37 m high). Each camera was secured to the tree with a lock and each camera had an empty SD card placed inside with the necessary batteries inserted into the camera. Cameras were secured to a tree at each site with the intention of having cameras pointed down horizontally. If we encountered difficulty positioning a camera this way, we would use a stick to hold up the camera in the position we wanted it in, and then secure it while the stick held the camera. Settings for each of the 6 trail cameras were all the same. The capture delay that sets the "timeout" between motion-activated images was set to a short delay (1s to 5s). Multishot mode, which is in control of taking multiple shots each time the camera is triggered, was set to the 4-shot standard (the camera will take 4 pictures, spaced 2 seconds apart). The adjustable infrared flash was set to power save mode which is perfect for wooded areas, where the target is within 70ft of the camera, and fast motion, which is also perfect for trails where mammals (game in particular) may be moving fast. Trail cameras were deployed for one month (September 2022 - October 2022) to capture and record mammal data. Every week, our team would visit each trail camera location to remove the full SD card and replace it with an empty SD card and check camera positions and battery levels.

Data Analysis. To analyze the mammal data that was collected on each trail camera, our team of scientists scored each trail camera picture that was captured during our study. The following trail camera picture scoring strategy was used among the team- (1) If nothing occurred during an hour, a zero was recorded so, the team knew that this day was observed and accounted for. (2) For time periods that occurred, both before and after changing a camera's SD card, areas were left blank on the data sheet and no score was recorded. (3) If the same mammal was captured more than once in the same minute, that mammal was only scored as 1 mammal on the data collection sheet. 4. If a human was captured more than once in the same minute, that human was scored as 1 human on the data collection sheet. (5) If a human or dog passed through more than once over one minute apart, they were scored and counted as separate events. (6) Vehicles were scored separately. Human occurrence counts in the vehicles were not recorded due to an increased chance of incorrect scoring counts. Alternatively, vehicles were recorded in a separate score category and each vehicle was counted as 1 vehicle. A list of any issues that were encountered during the photo-scoring process was noted. These issues were discussed by the group and then resolved using an agreed-upon solution. It is also worth noting that there were a few days at a few sites where the human occurrences went well over 100 people in one day when the average amount of people per day was somewhere in the 40s or 50s maximum at each site. To avoid this data looking skewed on a graph, I used a specific r-code to prevent the Y-Axis in my graphs from representing data numbers above 100.

Programs Use For Analysis. Programs that were used during this study included Google Maps systems for satellite imagery of SUNY Purchase Campus. Google sheets (Excel) were used to pull data from field data sheets and used to review the accuracy of our data. Data was then put into CSV.files to easily use on R-studio Cloud. R-studio Cloud was used to produce graphs that represent the data collected. When graphs were complete, they were pasted into a Powerpoint slide to create one figure.

RESULTS

The total number of human occurrences at each site was significantly greater than the total number of wildlife occurrences at each site during the duration of the study (Figure 2-A). This could be because the study area is a college campus and is abundant with humans. Interestingly, the total number of human and wildlife occurrences was both significantly lower at the Music site than at any other site location during the length of the study (Figure 2-A&B).

The total number of wildlife occurrences at each site was relatively constant throughout the study (Figure 2-B). Despite a high number of human occurrences at the Alumni, East 1, and Softball sites (Figure 2-A), the total number of wildlife occurrences remained about the same (Figure 2-B). This result could be an indication that wildlife species at SUNY Purchase College Campus have adapted to the high numbers of humans disturbing the woodlot areas. It is clear that there is a much greater number of wildlife occurrences in sites with a lower number of human occurrences. The loop site had relatively low human occurrences (Figure 2-A) but showed to have a higher number of wildlife occurrences throughout the study (Figure 2- B). The woods site also had relatively low numbers of human occurrences (Figure 2-A) but showed to have a higher number of wildlife occurrences throughout the study (Figure 2-B).

The total number of human occurrences seemed to occur in the same time periods, with higher numbers of human occurrences all at once (Figure 3-A). These results could be because of events that were scheduled during the duration of our study, bringing in large amounts of humans to these sites at one time.

The total number of wildlife occurrences remained scattered throughout the study (Figure 3-B). The total number of wildlife occurrences is lower than the total number of human occurrences (Figure 3-B). When observing the total number of occurrences specifically once a week at all sites, there is no relationship between the total number of human occurrences (Fig. 3 - A) and the total number of wildlife occurrences (Figure 3-B). Due to the scatter (Figure 3-B) of total wildlife occurrences present throughout the study, these results indicate that most mammals at SUNY Purchase College Campus are spatially avoiding humans when the total number of human occurrences is higher (Figure 3-A).

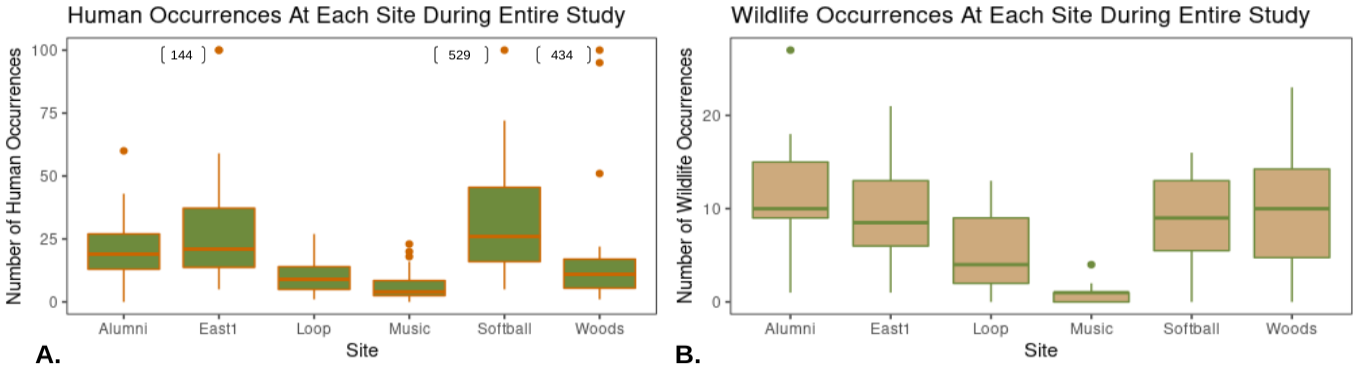

Figure 2: Figure 2 (A) is the total number of human occurrences at each site during the entire study. Note: Human occurrences are labeled to the left of the data point in parenthesis to represent the actual number of human occurrences when human occurrences were greater than 100 people. Figure 2 (B) is the total number of wildlife occurrences at each site during the entire study.

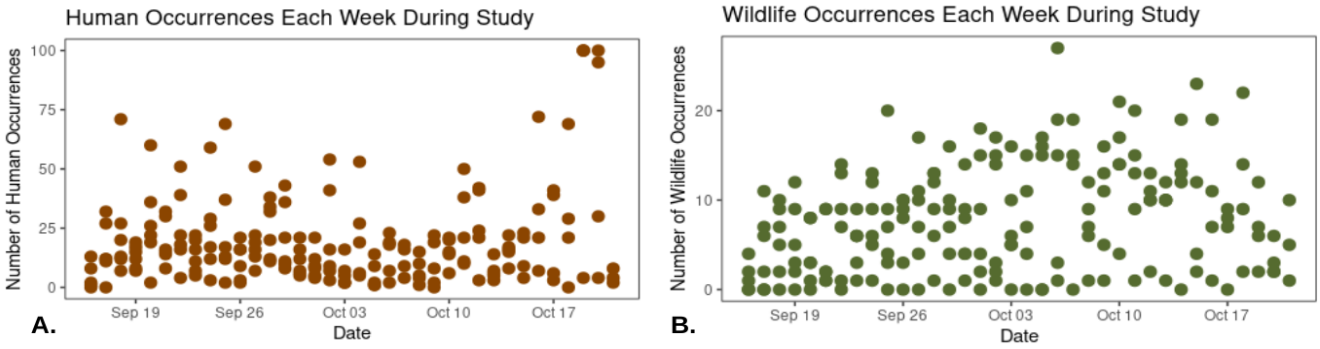

Figure 3 Caption: The X-axis represents every Monday of the 5-week study. The Y-axis is the total number of occurrences. Figure 3 (A) is the total number of human occurrences each week of the study at all sites. Note: The exact human occurrences that were greater than 100 are labeled in Figure 2 (A). Figure 3 (B) is the total number of wildlife occurrences each week of the study at all sites.

DISCUSSION

Our results indicate that wildlife species at SUNY Purchase College Campus have adapted to the high numbers of humans disturbing the woodlot areas and that most mammals are spatially avoiding humans when the total number of human occurrences is higher (Fig. 2- A). It is important to note a few key factors for this study. (1) While we have a good diversity of local wildlife species, some important mesocarnivore species (such as Foxes) may be missing from our data collection. Foxes have never been observed on SUNY Purchase College Campus but that does not confirm that they do not occupy the area. (2) There were a few days at some sites (East 1, Softball, and Woods Sites) where the human occurrences went well over 100 people in one day (due to pre-scheduled events) when the average amount of people per day was somewhere in the 40s or 50s count maximum at each site. To avoid this data looking skewed on my graph, I used a specific r-code to prevent the Y-Axis in my graphs from representing data numbers above 100. (3) It is also worth noting that our Music location most likely has flaws in the data. The trail width at the Music location is very wide so there is a significant chance that the trail cameras did not detect nor capture certain wildlife species.

Some wildlife species are better equipped to alter how they behave in urban environments than other species. Behavior in Coyotes from urban to rural areas revealed that Coyotes generally became more hostile and audacious in urbanized environments when compared to natural environments (Breck et al. 2018). Lombardietal et al. (2017), observed mesocarnivore species that did not show a significant difference in their behavior due to urban environments and anthropogenic change. This response was true in both small and large peri-urban areas in the study. Hence, the results of these studies suggest that these predators will adapt and thrive in most urban environments.

A survival challenge less often spoken about is the idea and importance of considering animal cognition and conflict with humans in urbanized areas. A possible mitigation consideration is an idea that resilient mesocarnivore animals will struggle to coexist with humans in urbanized areas. A study observing this idea (Barrett et al. 2019) reports that these same species that are able to adapt to anthropogenic changes are in conflict with humans. These species are likely to be considered a nuisance and so, cognitive survival skills such as adaptation and behavioral flexibility may, ultimately, lead to the demise of these species. Spatial and temporal avoidance of certain wildlife species may be instinctual, but may also be an evolutionary ecological change. In a study observing the behavior of ungulate species, specifically, Key Deer that have been endangered and without non-human mammalian predators for about 4,000 years, ungulates still avoided humans spatially and temporally (Maurer et al. 2022).

We standardized the trail cameras by making sure each trail location had a trail going through it so that we would also get humans in the cameras. In the future, if other scientists are interested in observing only the wildlife species on campus, I would suggest that they should put cameras in more animal-focused areas. Maurer et al. (2022) methods section reflects these goals. Due to our limited sampling approach, we suggest that the findings from this study are to be used as a pilot study for further mammal and human interaction in fragmented forest areas.

CONCLUSIONS

Habitat loss poses major risks to the survival of many species. Direct effects of habitat degradation include but are not limited to, the prevention of safe animal movement across a landscape and denying animals access to basic needs such as food, water, and shelter. Other impacts that are often less spoken about include stress, injury, illness, pain, and psychological distress, which could potentially alter a species' behavior. Some wildlife species like Coyotes, White-Tailed Deer, and Raccoons are able to adapt to anthropogenic changes over time, while other species like herbivorous reptiles, large-bodied herbivores, and many marine life organisms, such as Seals, Sea Lions, Whales, Dolphins, and Sea Turtles struggle to survive due to anthropogenic changes.

Habitat generalists in scavenger communities such as Squirrels, and Mice often thrive in fragmented forest areas, similar to the areas observed in this study. We urge ecologists and environmental scientists to conduct other studies investigating the use of fragmented forest areas by mammals, and human species to supply more information about the abundance and impact that anthropogenic changes have on urban mammals. In the future, the greatest conservation efforts will be supported by accurate scientific data focusing on how certain species adapt to anthropogenic changes.

ACKNOWLEDGEMENTS

I would like to thank Dr. Jackson and Dr. Taylor for all of their advice and support this semester. You guys rock! I would also like to thank my partner, Paul, and our dog, Waldo for all of their love and support while I worked on this.

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