Say Cheese: Using Camera Traps to Explore Mammal Composition and Human Density Relationships in Cincinnati's Urban Parks

Madison C. Hartman, David A. Leicht and Iris Pratt

Urban Ecosystem Ecology BIOL/EVST 4093

Introduction

Human encroachment has been shown to have multivariate (and occasionally curious) impacts on biodiversity. Continued Anthropocene development will inevitably reduce, fragment, and deteriorate natural habitats, reducing species richness. Measurements of human density can have interesting positive correlations with wildlife, however. Mammal population densities have been found to increase with human development (Tucker et al., 2021). While these patterns can change drastically with scale (Dornelas et al., 2019), clearly some opportunists have found their niche within our increasingly human landscapes. Identification via photography is becoming increasingly viable as an alternative to traditional physical trapping (Glen et al., 2013; McCleery et al., 2014) as a response to trap mortality rate, which has been measured as high as 93% (Tennant et al., 2020). In consideration of the importance of biodiversity to ever-diminishing urban green space, and the curious effects of human population density on overall mammal composition, we deployed cameras to investigate six urban parks and test our prediction that mammal species richness negatively correlates with human population density.

Methods

Study sites were chosen based on varying population density according to census tract, and microhabitat heterogeneity (wooded and non-wooded). Census tract population density (persons per km^2, Source: US Census 2020 Data) was applied to any park that fell entirely within a census tract (or averages in the case of Mt. Airy Forest). The six parks chosen fell across a spectrum of density among 88 total green space options. (See fig. 1). A wooded and non-wooded microhabitat was selected in each park based on low floor debris, field of vision, and inconspicuousness. We then armed one automatic motion-detection trail camera (BlazeVideo Model A252) in each microhabitat. Peanut butter bait was placed one meter from the camera. Once armed, cameras were deployed for a total of 2152 hours. Motion detection was initially set to high sensitivity, though later reduced to low sensitivity after initial deployments resulted in a large amount of false noise captures. All sightings were logged based on "burst-per-hour", with one "burst" equaling a single encounter of a single mammal regardless of the number of photos taken.

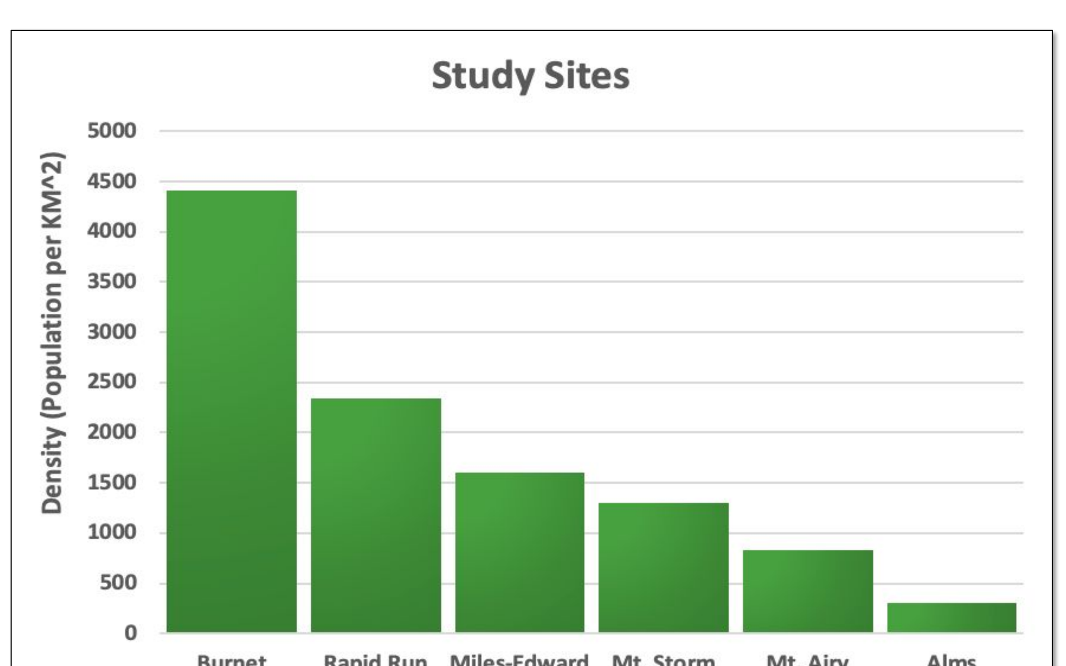

Figure 1, Our six chosen study sites and their accompanying human population density (Source: US Census 2020 Data).

Results

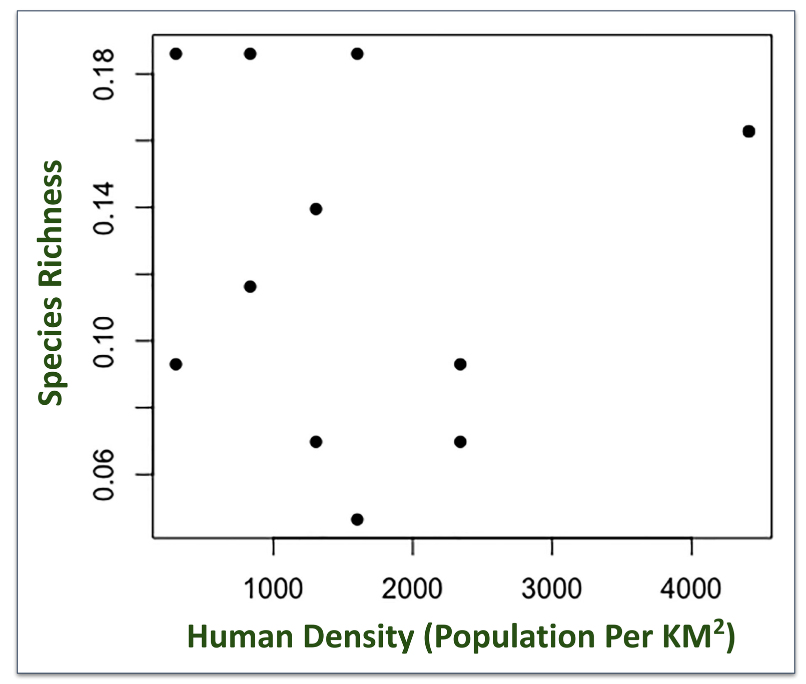

Figure 1, species richness as a function of population density, $\beta = 2.735e-05 \pm 8.489e-05$, t value = 0.322, p = 0.754

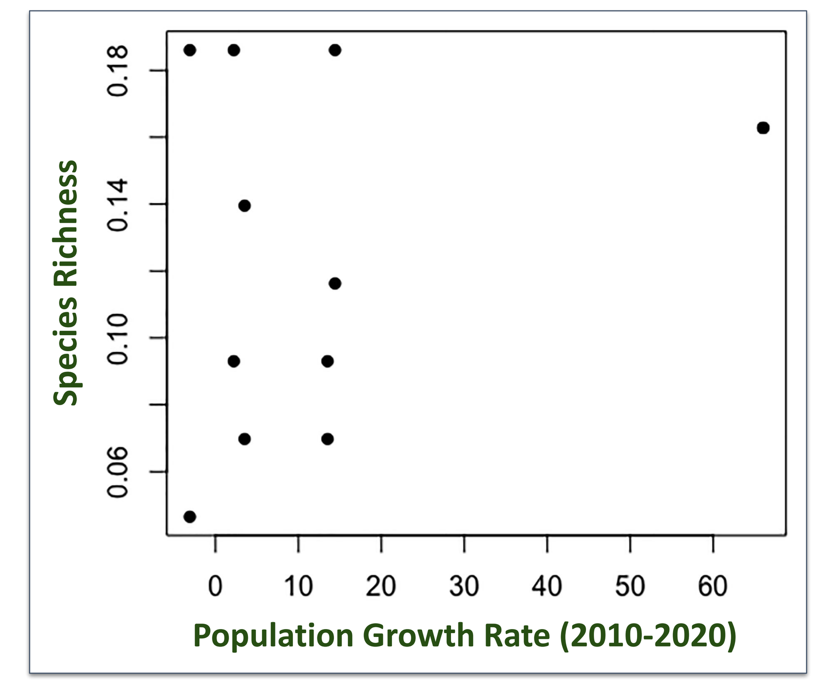

Figure 2, species richness as a function of 10 year growth percentage, $\beta = 0.004625 \pm 0.004495$, t value = 1.029, p = 0.328

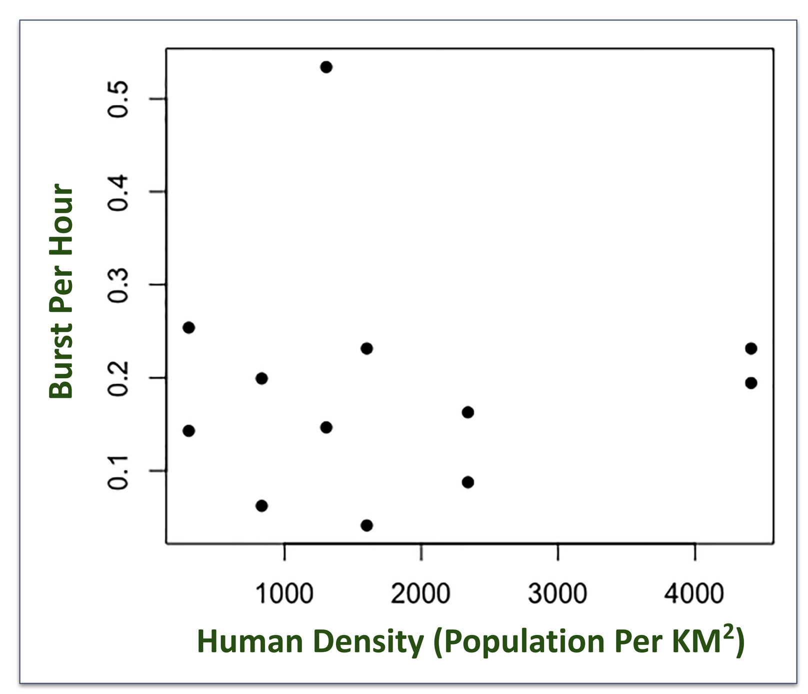

Figure 3, bursts per hour as a function of population density, $\beta = 5.633e-07 \pm 2.917e-05$, t value = 0.019, p = 0.9850

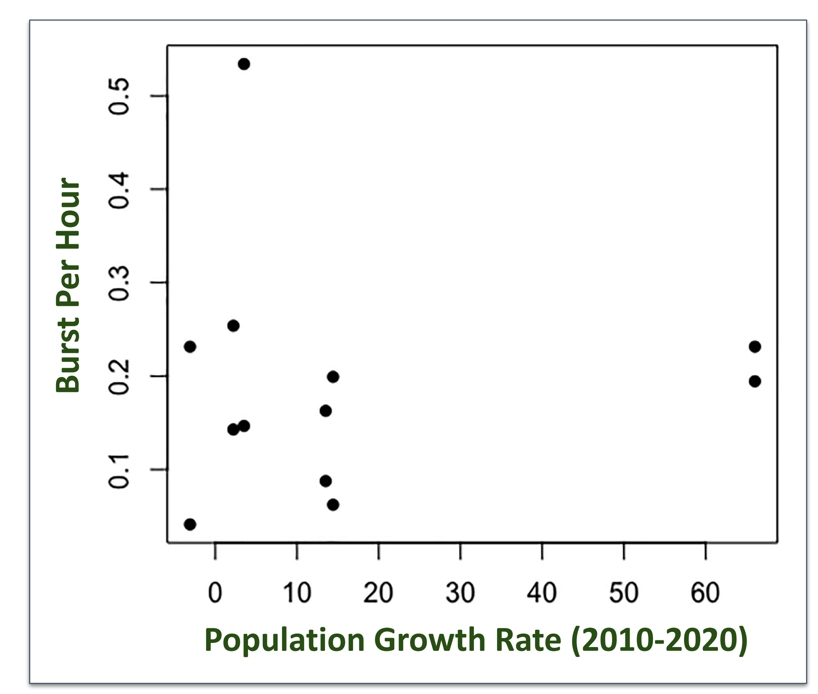

Figure 4, bursts per hour as a function of 10 year growth percentage, $\beta = 0.0001348 \pm 0.0016703$, t value = 0.081, p = 0.93726

A total of 378 sightings from 16 species were photographed from all parks. Camera resolution prevented us from differentiating between *Peromyscus maniculatus* and *Peromyscus leucopus*, so these were recorded as a combined species complex. *Sciurus carolinensis* and *Peromyscus Spp.* were the most commonly photographed species, with 92 bursts each.

Figure 5, *Peromyscus Spp.*, photographed at Mt. Storm Park.

Figure 6, *Didelphis virginiana*, photographed at Mt. Storm Park.

Figure 7, *Sciurus carolinensis*, photographed at Miles-Edward Park.

Figure 8, *Procyon lotor*, photographed at Mt. Airy Forest.

Discussion

We found no significant relationships between total species richness or bursts per hour as a function of either of human population density or human population growth rate. This outcome could imply that local human density would have little impact on the biodiversity of urban parks, hopefully benefitting dense urban environments that require additional green space. Ultimately, it appears that cameras are a moderately successful method of quantifying small mammal composition. Baiting preference will no doubt compel more omnivores than carnivores. Size limitations and image resolution also prevented us from differentiation between very similar species. Additionally, the theft of two cameras left us unable to complete a full duplication of methods within our given time frame. Nonetheless, we remain satisfied with this preliminary test of small mammal camera identification. Our initial species richness data can hopefully be expanded upon to produce broader-scale attention to the temporal state of Cincinnati's urban mammals. This concept might be especially important as our developments expand beyond the habitability of most opportunists and our parks become increasingly rare oases of ecological breathing room.

Acknowledgments

We would like to thank Garrett Dienno, Drew Goebel, and all other partners with Cincinnati Parks for their accommodation and support. We would also like to thank Stephen F. Matter and Ken Petren for their enduring mentorship (and assistance with site travel).

References

Dornelas, M., Gotelli, N. J., Shimadzu, H., Moyes, F., Magurran, A. E., McGill, B. J., & Williams, J. (2019). A balance of winners and losers in the anthropocene. *Ecology Letters*, 22(5), 847-854.

Glen, A. S., Cockburn, S., Nichols, M., Ekanayake, J., & Warburton, B. (2013). Optimizing camera traps for monitoring small mammals. *PloS One*, 8(6), e67940-e67940.

Tennant, E. N., Cypher, B. L., Saslaw, L. R., Westall, T. L., Mohay, J. L., Kelly, E. C., & Van Horn Job, Christine L. (2020). Evaluation of noninvasive survey methods for detecting endangered shrews. *Wildlife Society Bulletin, 44*(3), 610-616.

Tucker, M. A., Santini, L., Carbone, C., & Mueller, T. (2021). Mammal population densities at a global scale are higher in human-modified areas. *Ecography (Copenhagen)*, 44(1), 1-13.a