Small Mammal Survey Finds Strong Inverse Spatial Relationship with Forest Canopy Cover

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Introduction

The eastern deciduous forest covers portions of 26 of the United States and is comprised of a great variety of tree, plant, and animal species. In southwest Ohio many forests exist as patches rather than the dominant land cover as it once had been. In addition to this habitat loss, many forest are highly fragmented such that the habitats while being patches of trees do not act as contiguous forest habitat. This has a variety of consequences, especially for the animal community that occupies these patches.

Internal to each forest, or forest patch the tree canopy architecture plays an important function in establishing the light environment and resulting habitat below the canopy. Specifically, understory plants fair better in thinner, or open, canopies. In contrast a thick forest canopy allows less light penetration and understory plant growth. Along this spectrum exists a variety of habitats impact animal diversity and behavior within these forest patches.

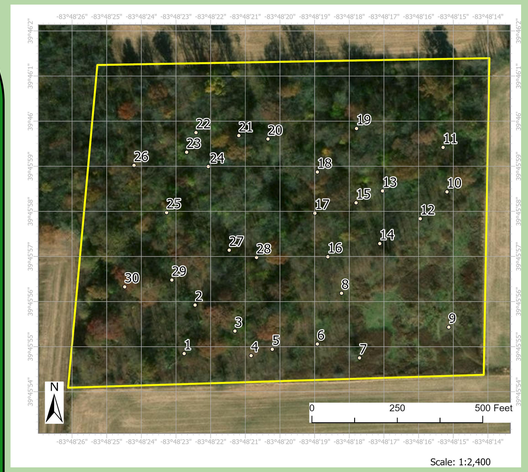
Objective

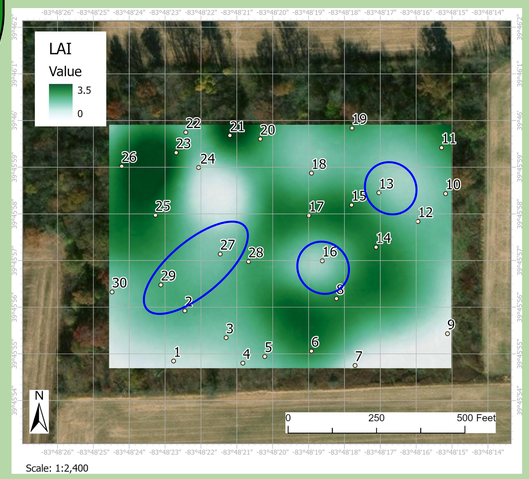
The objective of our study was to produce a survey of small mammals at this site and evaluate if forest canopy cover estimates (LAI, leaf area index) were a good predictor of small mammal presence.

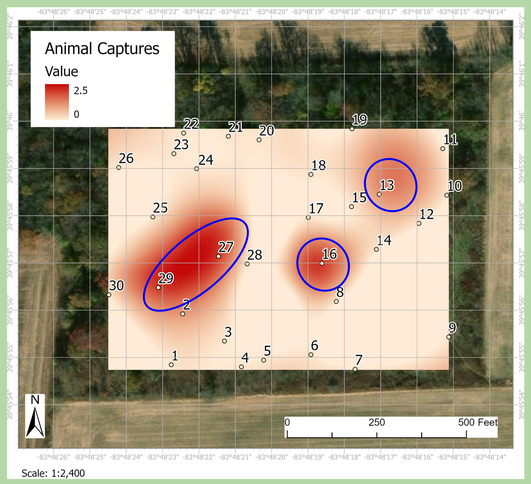
Methods & study site

We sampled at 30 randomly points inside at 15.6 acre forest plot in Cedarville, Ohio. We set Sherman traps at each point and baited them with a mixture of peanut butter and oats. The traps were covered with debris from the surrounding forest floor. Traps were set the evening prior and checked early in the morning between 20 October - 10 November. We set traps six nights during this period with 167 total traps nights (just 17 traps were set one night). After each trap night, data was recorded, animals were released, and the traps were reset with new bait on the next trap night.

We also used hemispherical photographs from a paired study that calculated LAI and forest canopy openness using Gap Light Analyzer (GLA, v.2.0, Simon Fraser University, BC, Canada & Institute of Ecosystem Studies, NY, USA). These values were georeferenced to the sample point locations using ArcGIS Pro (Esri, Inc. Redlands, CA). We used this data to perform a Kernel Density Estimation to visualize and assess the intensity of both LAI and animal captures within this forest patch.







Results

Over a total of 167 trap nights, we capture 8 individuals representing two species, yielding a 4.8% success rate.

Point	Captures	Common name	Species
2	1	Deer mouse	Peromyscus maniculatus
13	1	Eastern gray squirrel	Sciurus carolinensis
16	2	Deer mouse	Peromyscus maniculatus
27	2	Deer mouse	Peromyscus maniculatus
29	2	Deer mouse	Peromyscus maniculatus

We used the hemispherical photographs and GLA to estimate mean % (min - max) openness of 20.6 (12.2 - 45.5) and LAI of 2.1 (1.0 - 3.1) for the forest plot. Leaf area index was not homogenous through the forest, but rather had distinctly thicker and thinner forest canopy structure (see middle image). This was prevalent centrally and in the northwest corner.

Using the same technique we mapped our small mammal trap locations to reveal a distinct clustering (see bottom image). We highlighted these clusters and overlaid them onto the LAI image for comparison.

This overlay revealed two interesting patterns. First, was that our captures occurred closer to the core of the forest plot. Second, was the strong inverse relationship between the captures and LAI. That is to say that where LAI was lowest - and forest canopy was thinnest - the number of small mammal captures was highest.

Conclusion

The study found a strong inverse correlation between Leaf Area Index (LAI) and small mammal captures. Our data from this site reveal that small mammals were more abundant in areas with lower canopy cover and closer to the forest plot interior. It seems likely that these observations are likely the result of small mammals using this forest patch as a refuge. Our study suggests that there is refuge dimensionality both in the horizontal (using forest interior) as well as vertical (lower canopy LAI may allow for greater shrub/understory protection). We look forward to expanding upon this project to further evaluating this relationship.

Acknowledgements

Thanks to Cedarville University and the Department of Science and Mathematics for site access and material support. Finally, we also offer our thanks to Scott Huck for use of the fisheye lens.