Landscape composition effects on small mammal richness and abundance in northern Massachusetts

Eric Lindemann, Jonathan Harris and Greg Keller
Gordon College, Wenham MA 01984

Deer Mouse (*Peromyscus maniculatus*) http://www.cedarcreek.umn.edu/mammals/midsize/peromyscus-maniculatus.jpg

White-footed Mouse (*Peromyscus leucopus*)
http://i.pbase.com/u39/tmurray74/upload/25349963.DSC00119.jpg

Abstract

In southern New England forests, *Peromyscus maniculatus* (deer mice), P*eromyscus leucopus* (white-footed mice), and *Clethrionomys gapperi* (red-backed voles) are essential to food-web interactions and seed dispersal for overall ecosystem health. This region has been exposed to extensive fragmentation due to residential and agricultural development, resulting in a considerable amount of edge creation, in addition to natural landscape heterogeneity. Yet limited research has been conducted relating species abundance to the different types of edge habitat in this region. We predicted that small-mammal richness, total abundance, and abundance of *Peromyscus maniculatus,* P*eromyscus leucopus,* and *Clethrionomys gapperi* would be affected by edge sites; specifically, we expected that human-edge sites would have reduced abundance compared to natural edges and interior forest habitat. In order to test this hypothesis, we selected twelve sites total with four of each edge type. We used Sherman live traps to survey small-mammal populations. We baited 75 traps for 4 nights at 12 sites for two trapping seasons, resulting in 7200 total trap nights. Each morning, captured animals were identified and tagged with a unique number to document recaptures. Abundance of *Clethrionomys gapperi* and *Peromyscus leucopus* were higher at natural edge sites than at human edge. *Peromyscus maniculatus* appears not to discriminate between human or natural edges and interior forest.

Introduction

Small mammal populations of *Peromyscus maniculatus, Peromyscus leucopus*, and *Clethrionomys gapperi*, are very important species for the forests of northeastern Massachusetts because of their food web interactions and seed dispersal for the local fauna. Extensive fragmentation of the forests due to residential development and agriculture may be threatening these small mammal populations. Bayne and Hobson (1998) found that *Peromyscus maniculatus* occurred in lower frequency in patches surrounded by clear cutting, but higher frequency in edge habitat than interior sites. This suggests that *Peromyscus maniculatus* is an edge species but prefers natural edge. The purpose of this research is to compare natural edge with human induced edge in terms of total richness, total abundance, and abundance of individual species. Our overarching question is what type of influence is fragmentation of natural habitat having on populations of small mammals.

Methods

Twelve different sites were chosen on the North Shore of Massachusetts, Essex County. Each of these sites fit into three categories: natural edge, human edge and interior forest habitat. Natural edge was mixed forest that directly bordered a pond or a wetland. Human edge was mixed forest that bordered a human-made field. Interior forest was mixed forest at least 150 m from an edge. Edge sites were 30 m from the edge of the forest.

At each site Sherman live traps were baited with an oatmeal and peanut butter mixture, and 2 or 3 cotton balls. Each site had a total of 600 trap nights, 75 traps for 4 nights for 2 trapping seasons. Each morning traps were checked and captured animals were identified, measured and tagged with a unique number so that recaptures could be identified. We analyzed vegetation at each point, including canopy cover, and density of snags, deciduous trees, and coniferous trees. GIS analysis was also done using ArcGIS9.3 to measure landscape level features including patch size, amount of human edge, amount of natural edge and amount of forest in a 500m radius circle illustrated in Figure 3.

ANOVA tests were run for edge types, abundance and richness and abundance of target species. ANOVA tests were also run to show correlations with abundance and richness in relation to percent ground cover and understory vegetation. ANOVA was also used to determine correlations in the landscape scale.

Red-backed Vole (*Clethrionomys gapperi*)
http://www.hubbardbrook.org/image_library/images/redbackvole-051102.JPG

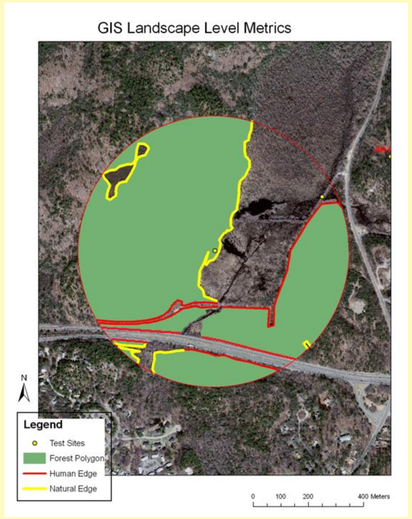

Figure 1: GIS map showing a single site and the GIS analysis that was performed.

Literature Cited

Bayne, E.M and K.A., Hobson. 1998. The effects of habitat fragmentation by forestry and agriculture on the abundance of small mammals in the southern boreal mixedwood forest. Canadian Journal of Zoology 76:62-69.

Yahner, R.H. 1992. Dynamics of a Small Mammal Community in a Fragmented Forest. American Midland Naturalist 127:381-391.

Results and Discussion

For abundance and richness, the data was broken into field season and analyzed with an ANOVA test to determine if the years were significantly different. Because they were not significantly different they were combined for future correlations using ANVA and Tukey's test. We did not experience annual fluctuation in population size like Yahner in 1992. There was no significance when total abundance was analyzed based on habitat types or the habitat level metrics. As a patch got larger abundance increased. This makes sense because a larger patch would be able to support more individuals. The target species responded more than the overall abundance and richness. Peromyscus maniculatus was not significantly different between habitat types and did not respond to any habitat level or landscape level features. This suggests that they may be habitat generalists and are able to sustain their populations in multiple types of environments. With Peromyscus leucopus there was a strong trend (see figure 4) that they preferred natural edge to humans edge. Clethrionomys gapperi statistically preferred natural edge to human edge (see figure 4). C. gapperi also responded on the habitat level and the landscape level.

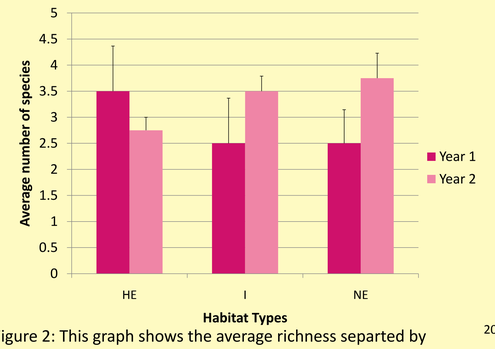

Figure 2: This graph shows the average richness separated by field season . There were not significant results from this data

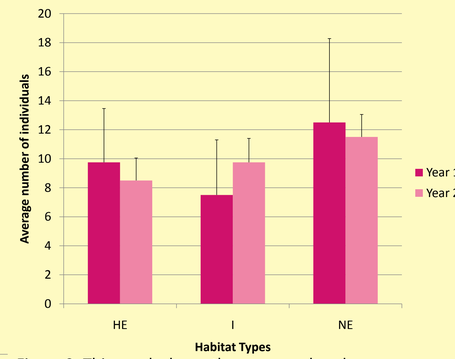

Figure 3: This graph shows the average abundance separated by field season. There were no significant results in the data

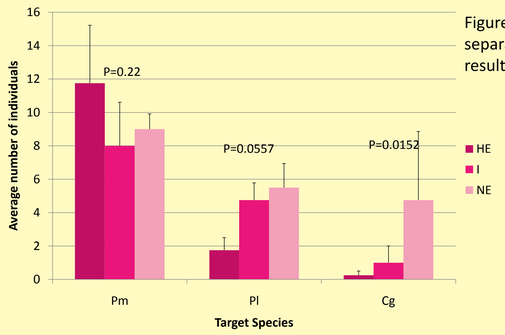

Figure 4: Average abundance of *Peromyscus maniculatus* (Pm), *Peromyscus leucopus* (Pl), and *Clethrionomys gapperi* (Cg) at three habitat types. P values represent the different between Natural edge and Human edge.