Impact of pine barrens forest vegetation on population density of small mammals at Brookhaven National Laboratory

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Abstract

White-footed mice play an important role in the ecosystem. White-footed mice help spread various kinds of fungi by eating the sporing bodies and excreting spores. Forest trees' ability to take up nutrients is enhanced by the mycorrhizal associations formed by these fungi. The abundance of vegetation, and how it varies across a landscape, may be decisive to habitat use by small mammal populations. This study addressed the relative importance of vegetation types and their abundance/heights to small mammal population density. During summer, we collected data on mouse populations and vegetation structure at 16 experimental sampling plots. We hypothesized that mice density would be higher in areas where the vegetation is taller than 35 centimeters. We collect data at 16 locations over an 8 week period in the pine barrens forest of BNL. We concluded that there is a significant linear relationship between vegetation heights and mice density at sites with vegetation higher than 35cm. There was no linear significant relationship between mice density and vegetation heights less than 35cm.

Introduction

Mice are a diverse group and exist all over the world except Antarctica, and their overall ecological range is extremely broad and complex. Each mouse species has specific adaptations to various environments within its feeding and living habits (USAID/Tchad, 1997). The white- footed mouse (*Peromyscus leucopus*) is a habitat generalist and a permanent resident of shrub land, forest and grassland (Adler & Wilson, 1987). Observations show that it is found generally at higher densities in hardwood forests with a large volume of stumps and logs, and dense ground cover (Brannon, 2002).

The spatial distribution of small mammal species is influenced by interaction of various factors including food availability, water and predators (Poulin et al., 2002; Pinzon et al,. 2005; Elmhagen & Rushton, 2007; Oosthuizen & Bennett, 2009; Bateman et al., 2010). Climate change allows reservoir hosts and vectors to expand their range into new territories (Brownstein et al. 2005). In addition, fragmentation of forested landscapes due to human activities affects local biodiversity by favoring habitat generalists and species that experience high population densities and small home ranges.

Hypotheses:

H_1: White-footed mice density will be greater in areas with vegetation higher than 35 centimeters.


Pic 1. *Peromyscus leucopus*


Pic 2. *Microtus pinetorum*


Pic 3. Sherman live trap

Methods

Study Area: Brookhaven National Laboratory, Long Island, New York

Study Period: June 12, 2017 to August 4,2017

Small Mammal Surveys:

- At each of the 16 sites we established an 8x8 grid of Sherman traps spaced 5 meters apart, 64 traps per grid. Traps were baited with a peanut butter/oat mixture.
- Animals were trapped at each site over four consecutive nights during alternate weeks for a total of 8 days (or 512 trap nights/site, 8,192 total trap nights).
- Traps were checked each morning, captured animals were weighed, sexed, and marked with individual ear tags.
- All attached ticks were removed and preserved.

Vegetation Measurements:

A 35 meter linear transect was placed down the middle of each grid. Vegetation heights were measured at every 5 meters, 8 measurements were taken along each transect.

Analysis:

- Program DENSITY Version 5.0 was used to predict the size of white-footed mice population within the surrounding hectare using the spatially explicit capture-recapture data collected (Efford 2012).

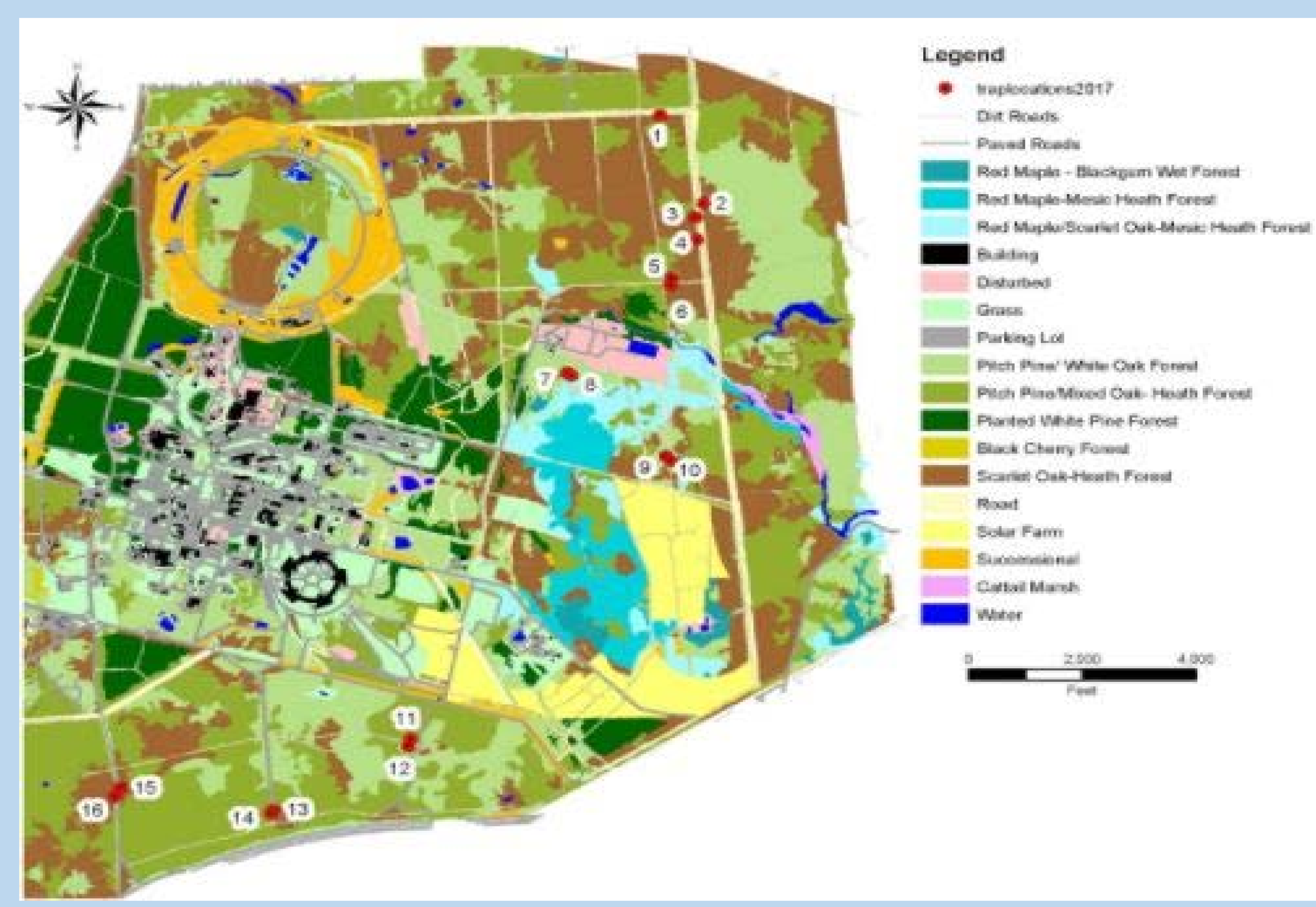

Fig 1. Map of BNL showing the 16 sites used in this study. GPS coordinates (Universal Traverse Mercator units) were used to locate the sites.

Results

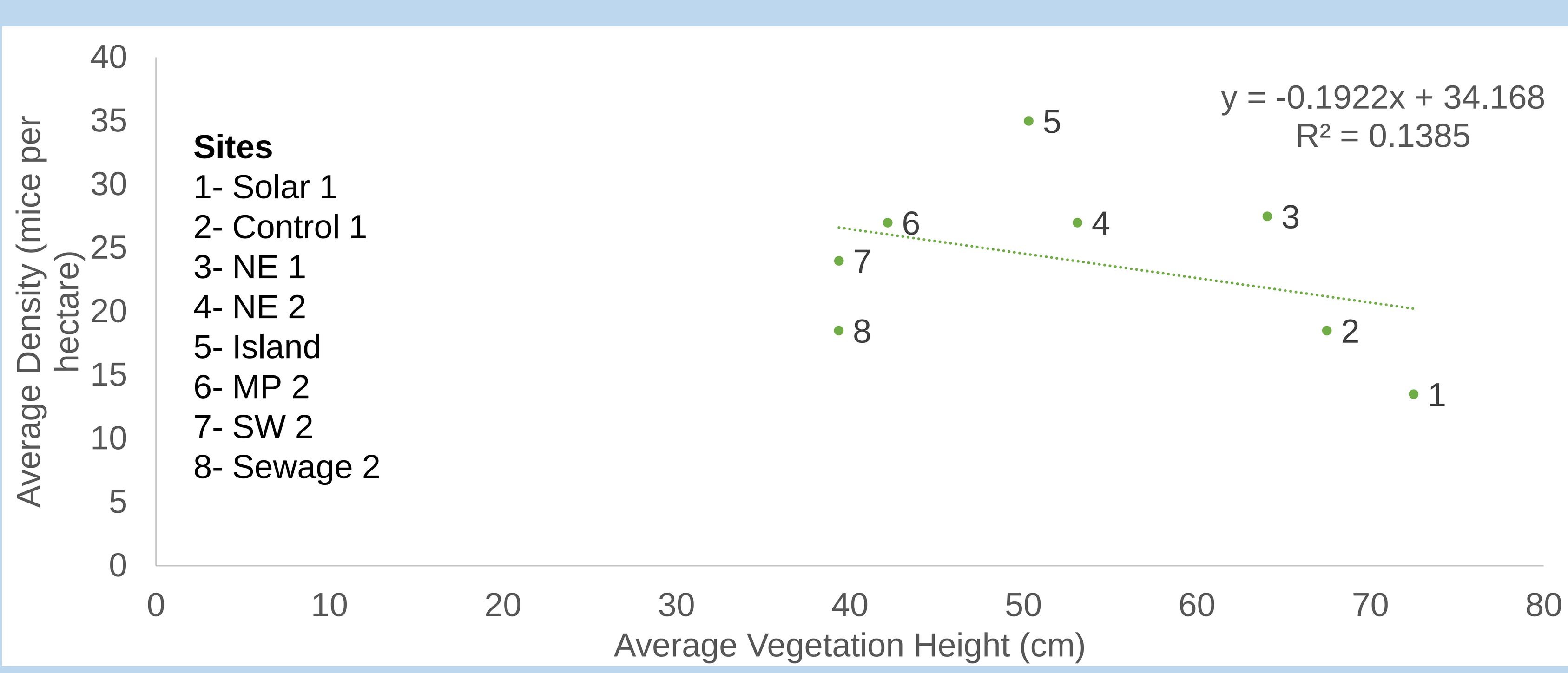

Fig2A. Density of mice in relation to vegetation heights greater than 35cm (1-8).

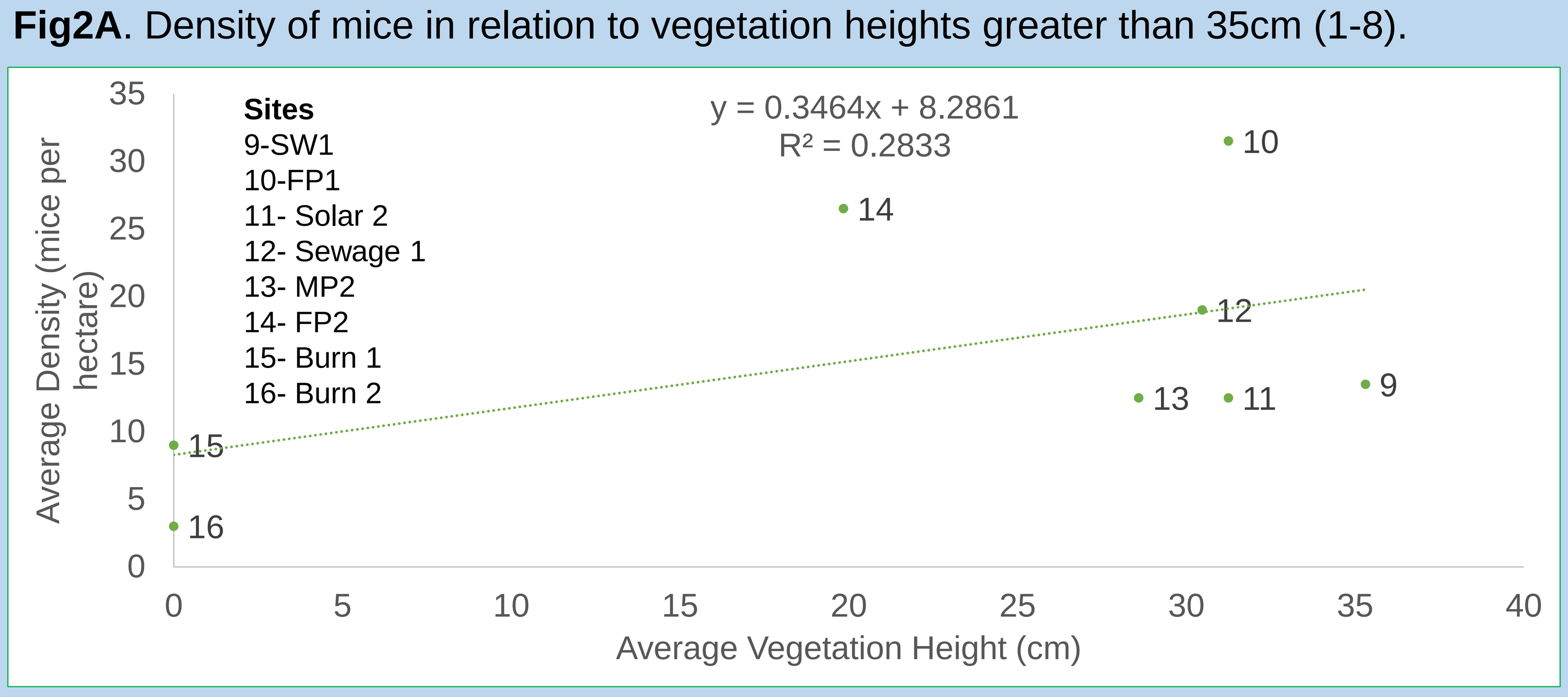

Fig2B. Density of mice in relation to vegetation heights less than 35cm (9-16).

Using program DENSITY for calculation, the basic linear regression in Figure 2A showed that there was a significant relationship between the density of mice to heights of vegetation at sites 1-8 (Fig2A; R^2= 0.13, t(14) = 5.68, p=0.05, n=8). Conversely, using the same program for Figure 2B, there was no significant correlation between density of mice and heights of vegetation at sites 9-16 (Fig2B; R^2 = 0.28, t(14) = 1.02, p=0.13, n=8)

Discussion

- Mice optimum habitat is dense shrub-land
- At sites with vegetation higher than 35cm, more mice were captured over the one week span of trapping at that site.
- As the vegetation height decreased to below 35cm, mouse populations plummeted.
- Low vegetation heights are subject to change overtime due to growth.
- Population size in areas of low vegetation will change subsequently to vegetation growth and mice reproduction.
- Contrarily, mouse populations may decrease in areas with vegetation higher than 35cm due to vegetation fragmentation.
- Predation affects low population of mice in areas lacking dense vegetation.


Pic4. Female Peromyscus leucopus gave birth inside trap

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