Assessing preference by white-footed mice (*Peromyscus leucopus*) for coarse woody debris

Eric Juers, Natural Science, Paul Smith's College, Paul Smiths, NY 12970
Jennifer Higbie, Environmental Protection, Brookhaven National Laboratory, Upton, NY 11973

Abstract

Research to expand current knowledge of habitat use by white-footed mice *(Peromyscus leucopus)* at fine spatial scales is needed given the species' widespread distribution in the United States and its prevalence as a reservoir for zoonotic pathogens like Lyme disease. Downed coarse woody debris, a structural component of forest floor habitat important for many small mammals, may be preferred by woodland dwelling *P. leucopus* because of its multiplicity of uses from cover to landmarks that aid in spatial memory for navigation. To assess the role that downed woody debris plays in facilitating habitat preference of *P. leucopus*, Sherman box traps were deployed for live trapping and tagging of *P. leucopus* and coarse woody debris was surveyed in grids across various types of forest at Brookhaven National Laboratory during the summer of 2017. A Pearson correlation analysis produced no significant correlation between abundance estimates of *P. leucopus* population size and total volumes of coarse woody debris. In order to inform wildlife and forest management practices of the importance of woody debris in facilitating *P. leucopus* populations, more long-term studies are needed that can account for the interacting effects of other habitat characteristics like patch size and understory vegetation density. Over the course of the study I became proficient and confident in handling and processing *P. leucopus*, a useful skill to have for future studies in wildlife ecology.

Introduction

The white-footed mouse (*Peromyscus leucopus*) (Figure 1 and 2), an abundant generalist mammal species, is one of the most successful host reservoirs for Lyme Disease (LD) on the east coast of the U.S. LD is a major public health issue in the United States with approximately 30,000 cases of LD being reported to the Center for Disease Control (CDC) every year, a number that has been increasing every year since 1995. Assessing the relationship between habitat characteristics that may be preferred by *P. leucopus* and *P. leucopus* abundance could inform wildlife and/or forest management by providing a quantifiable basis for forest areas to be designated as high-risk for LD because of their suitability for larger *P. leucopus* populations. Downed coarse woody debris (CWD) is a significant structural component of forest habitat important to small mammal species like *P. leucopus* and could represent a charactersitc useful for designating high-risk forest habitat. I hypothesized that *P. leucopus* populations are positively correlated with volume of CWD.

Field Methods

Trapping: Sherman traps (Figure 3) were deployed Monday-Thursday of each week between June 12th and August 4th 2017 to mark and recapture *P. leucopus* individuals and estimate their abundance at 16 different trapping sites around Brookhaven National Laboratory in Upton, New York (Figure 4). Trap grids were 35m^2 and included 64 traps each giving a total of 8192 trap nights. Traps contained a cotton square and a peanut butter and oat bait, and trapped *P. leucopus* were tagged and ticks were taken off and put into ethanol when found.

CWD Survey: Each grid was surveyed completely for CWD pieces at least 16cm in diameter and 60cm in length. Volume of CWD pieces were calculated based on the volume of a cylinder ($V = \pi r^2 h$) and summed for a total volume of CWD for each grid.

Statistical Methods

Population abundance estimates and 95% confidence intervals were produced by running a Huggins p and c robust design model in program MARK ver 6.1.7601. A Pearson correlation analysis was run in R Studio ver 1.0.136 to produce a correlation coefficient for CWD as an x variable and *P. leucopus* abundance as a y variable (Figure 5).

Figure 1. *Peromyscus leucopus*. Photo credit: Eric Juers

Figure 2. *Peromyscus leucopus* during processing. Photo credit: Scarlett Alvarez

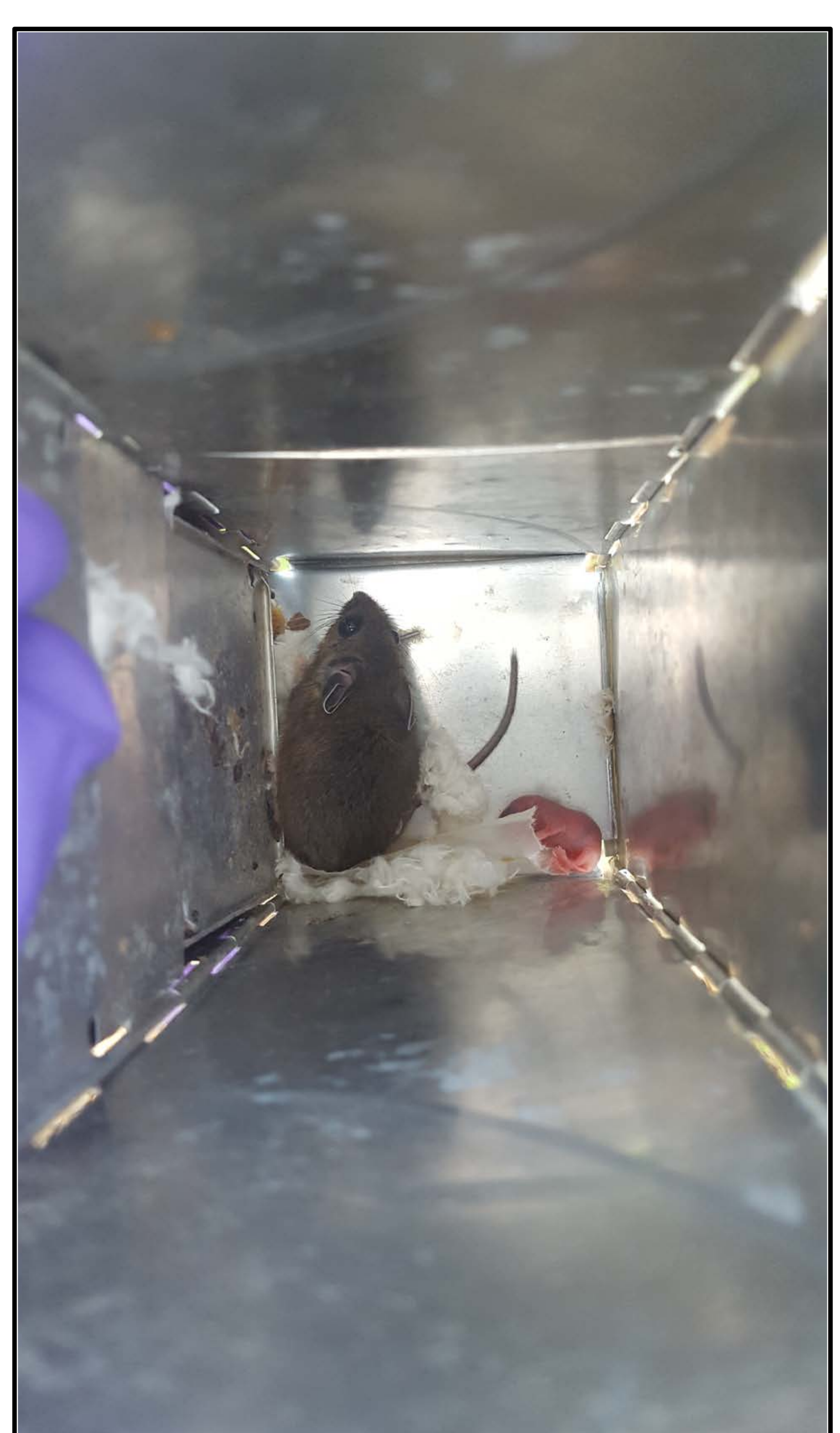

Figure 3. Female *Peromyscus leucopus* inside Sherman trap after giving birth. Photo credit: Eric Juers

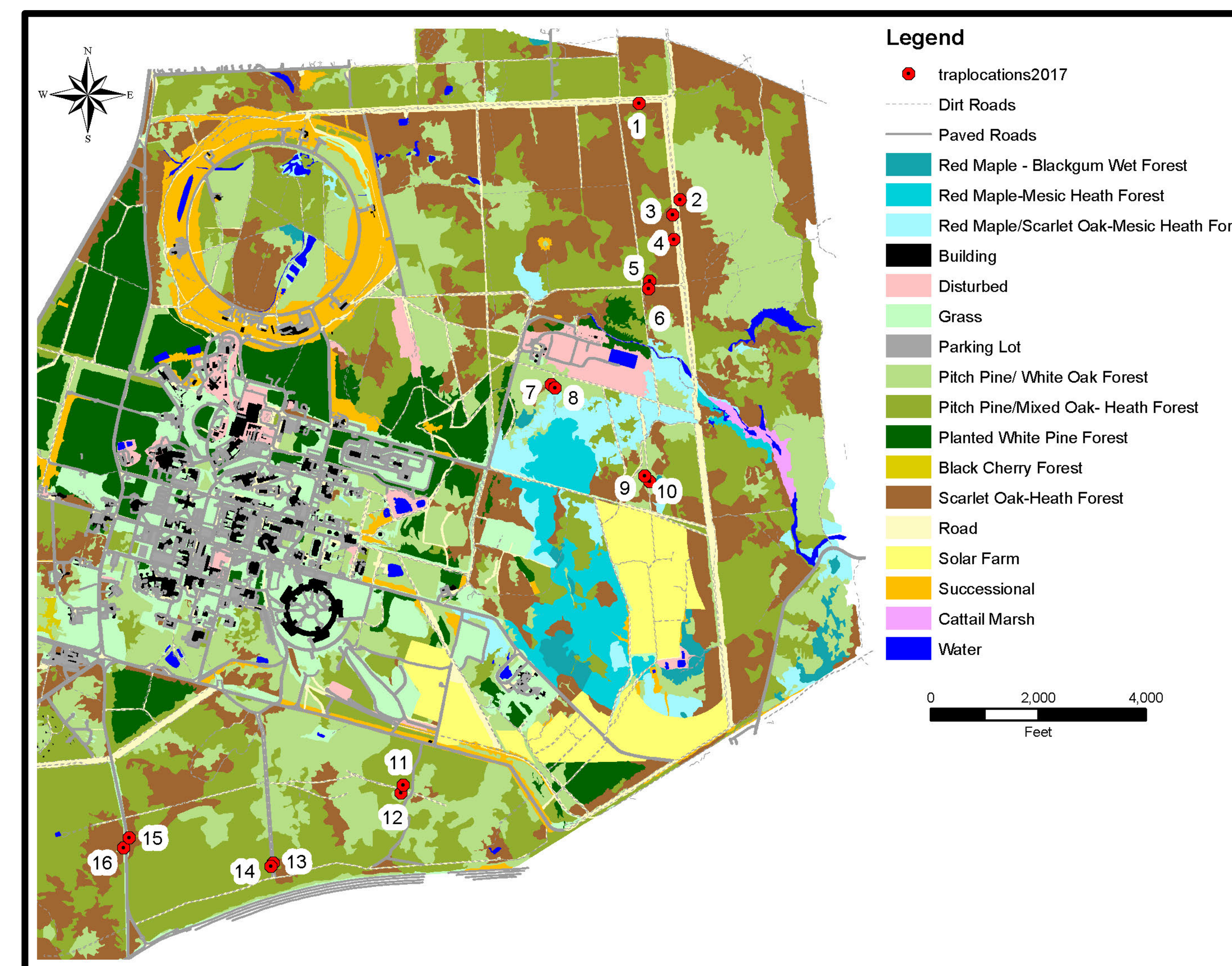

Figure 4. Map of Brookhaven National Lab including land cover types and the 16 trap sites for the study. Courtesy of Leanna Thalmann.

Results

The correlation between *P. leucopus* abundance and total volume of CWD was weakly positive ($r = 0.09$) and not statistically significant ($p = 0.37$). Some sites with high abundance had high volumes of CWD while others had low abundance and relatively high CWD or relatively high abundance and low CWD (Figure 5).

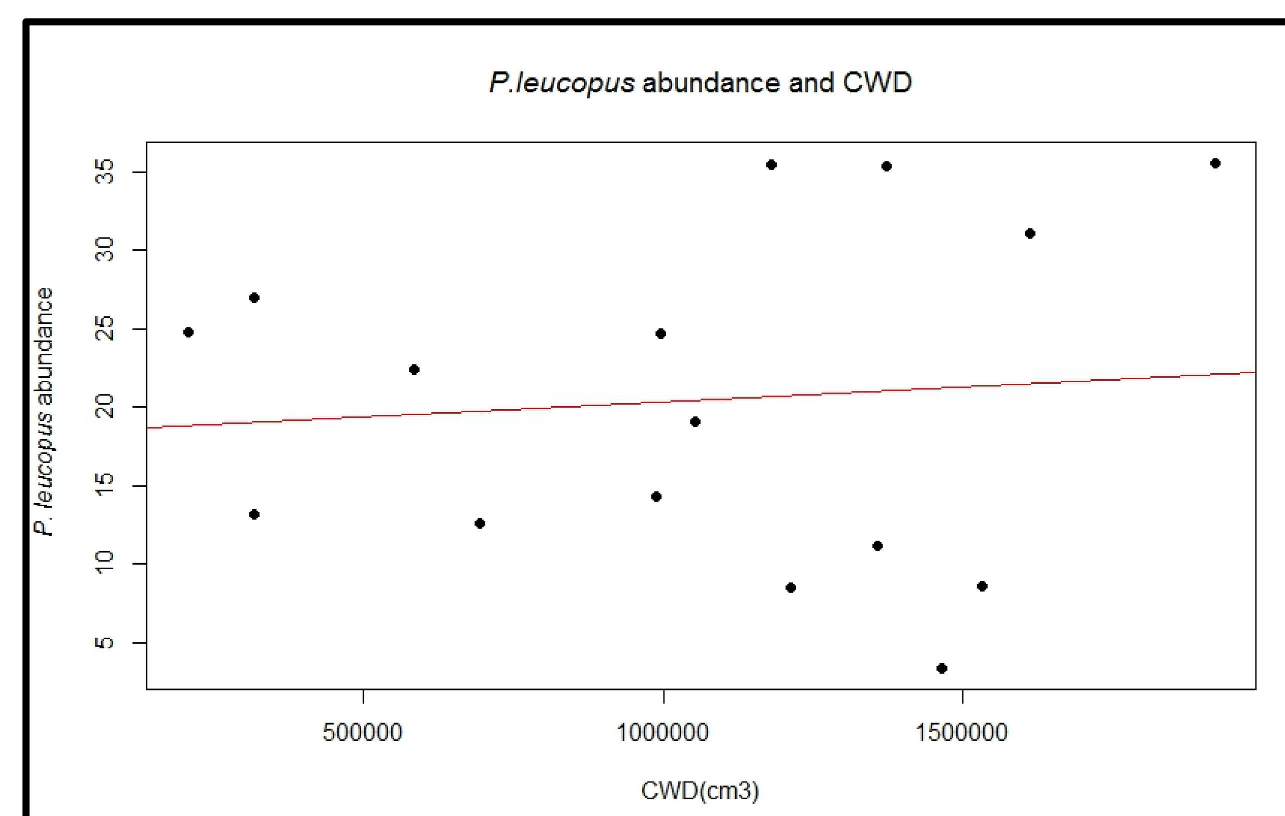

Figure 5. Correlation analysis of volume of CWD in cubic centimenters (x-axis) against *P. leucopus* abundance (y-axis). Black circles represent different trap sites. R coefficient = 0.09 (red line), p-value = 0.37.

Discussion

The structural and functional complexity of forest habitat makes focusing on one characteristic independent of all others difficult. Although CWD has been shown to be an important aspect of habitat for small mammals, the simultaneous and possibly interacting effects of other habitat components like understory vegetation type and density, overstory type and density, patch size, patch edge to interior ratio, and mast production all work to influence small mammal abundance. The time and resource restrictions of this study limited CWD surveying to larger pieces (≥ 16cm diameter and ≥ 60cm length) and also did not survey decay class of CWD pieces, another factor known to influence species specific preference for CWD. Furthermore, trapping occurred only twice at each site, limiting the accuracy with which local populations of *P. leucopus* could be estimated and also did not allow much time between trapping sessions at each site, stretching the assumptions of a robust design. Future studies must take place over longer spans of time to allow for more trapping sessions with greater amounts of time between each, as well as survey for multiple habitat characteristics that might influence *P. leucopus* abundance by using multivariate statistics to analyze the interacting effects between variables.

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