# The effects of human-made disturbances on small mammal populations

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Picture 1 Burn Site 1

## Abstract

Since small mammals are important indicator of ecological health and also provide insight on tick populations and Lyme disease, it is important to understand the effects of human-made disturbances on white-footed mouse (*Peromyscus leucopus*) populations. This summer at Brookhaven National Laboratory (BNL), I conducted research on small mammals and the disturbances they encounter, specifically roads. The goal of the study was to determine if trap location and recapture rates are affected by the distance to roads. Each week, four separate 35 meter square plots (35 meters x 35 meters) were set with 64 Sherman traps at each site. Each trap was five meters apart and marked with a flag. The Global Positioning System (GPS) location of each plot was recorded and mapped with a Geographic Information Systems (GIS). The population density was determined and graphed according to the sites distance from the nearest road and then compared across each site.

## Introduction

Small mammals are good indicators of ecological health. It is important to understand the effect of anthropogenic or human-made disturbances on local animal populations. White-footed mice (*Peromyscus leucopus*) populations are effected by varying anthropogenic disturbances. Disturbances that are human-made cause stress, fragmentation of habitats, and create patches and isolation to other habitats. Increases in fragmentation can lead to high population densities in edge habitats (Mathis et al. 2004). Roads have been found to act as barriers to small mammal movement, including movement of white-footed mice *(Peromyscus leucopus*), the focal species in this study (Rytwinski, T. and Fahrig, L. 2007). High road densities can limit white-footed mice *(Peromyscus leucopus*) population densities and abundance. Brookhaven National Lab has roads that have been used since World War II. Since then the lab has grown. This study aims to document the effects of roadways on white-footed mice *(Peromyscus leucopus*) populations.

**Objective:** To determine how population densities of white footed mice (*Peromyscus leucopus*) populations are effected by roads.

**Site Description:** Brookhaven's 5,625-acre campus located in Long Island's Central Pine Barrens region consisting of pitch pine, oak-pine, pine-oak, and coastal oak forest types.

Picture 2 Forest Path between Burn site 1 and Control site 1

*Picture 3 Peromyscus leucopus*

Picture 4 Handling of *Peromyscus leucopus*

## Methods

**Study Area**: Brookhaven National Laboratory, Long Island, New York (figure 1)
**Study Period**: June 12th 2017 – August 4th 2017
**Small Mammal Surveys:** All mice were captured using Sherman live traps at sixteen study plots within BNL's campus over an eight week period. At each site an 8x8 grid (35 meters X 35 meters) was established of 64 traps each marked with a flag and spaced 5 meters apart. The GPS location of each site was recorded. Traps were baited with a peanut butter/oat mixture. Animals were trapped at each site over four consecutive nights during two alternate weeks for a total of 8 nights. The total trap nights were 8,192. Traps were checked each morning; captured animals were weighed, sexed, and marked with individual ear tags. Recaptured individuals were noted.

**Analysis:**

- Program MARK Version 8.1, robust design model was used for a parameter estimate of white-footed mice abundance at each site (Cooch and White 2006).
- 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).
- Distance to the road was determined using a Global Positioning System (GPS) and ESRI Arcmap 10.1.

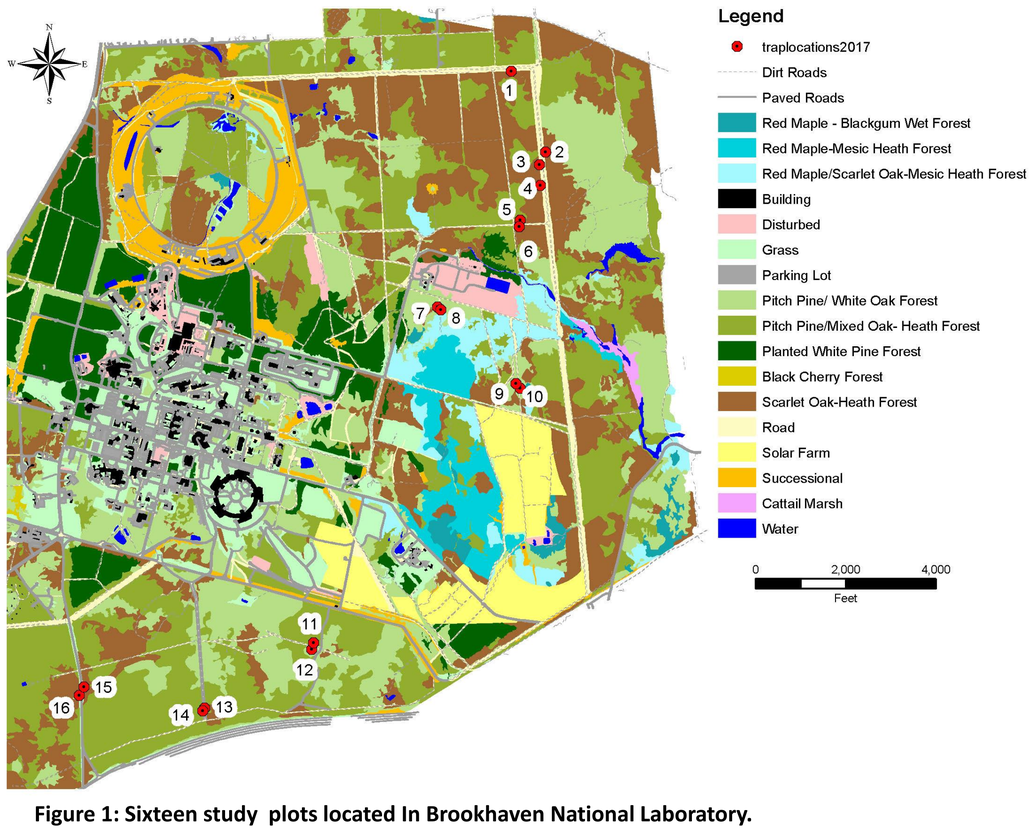


**Figure 1: Sixteen study plots located In Brookhaven National Laboratory.**

## Results

- A bar graph to show the non significant relationship between the distance to the road and the abundance of mice (Figure 2).
- A linear regression was performed and showed there was no significance between the distance to the road and the abundance of mice at each site (Figure 3). The $R^2$ value is .86.

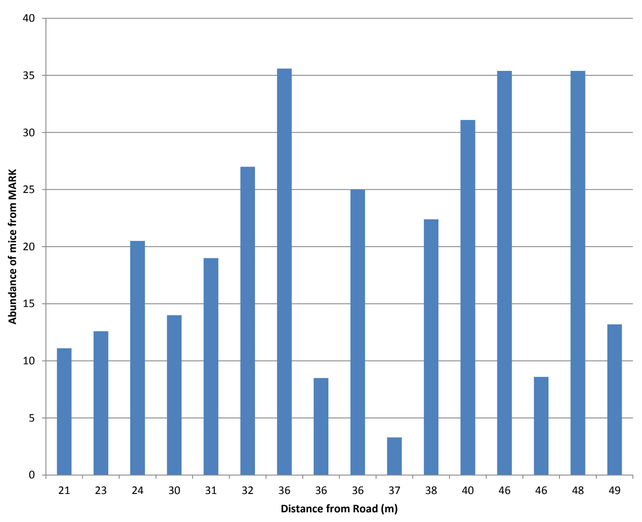


Figure 2: Bar graph of the distance from the road in relation to the abundance of mice from MARK recapture analysis at each site.

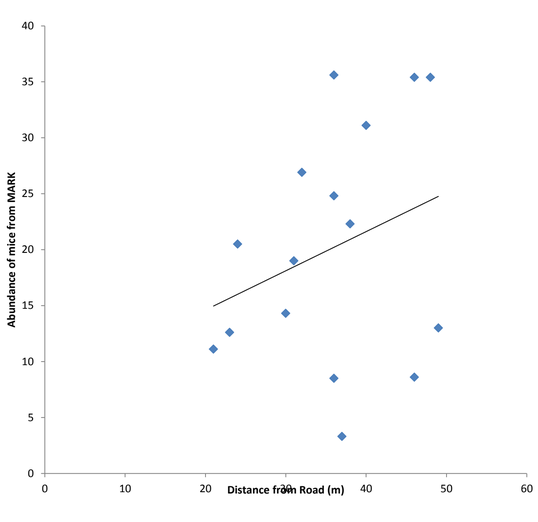


Figure 3 : Linear regression of the distance from the road in relation to the abundance of mice from MARK recapture analysis at each site. $R^2$ = .86

- A linear regression was performed and showed there was no significance between the distance to the road and the density of mice at each site (Figure 3). The $R^2$ value is .71.
- A bar graph to show the insignificant relationship between the distance to the road and the density of mice (figure 4).

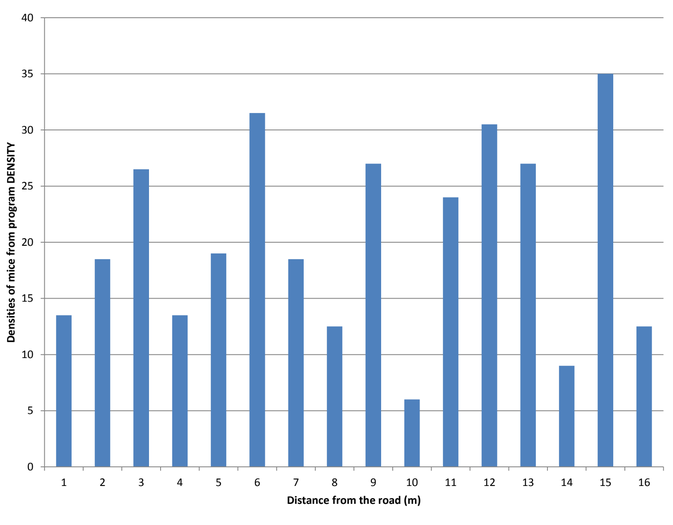


Figure 5:Each sites distance from the road in relation to the density of mice calculated from Program DENSITY at each site as a bar graph.

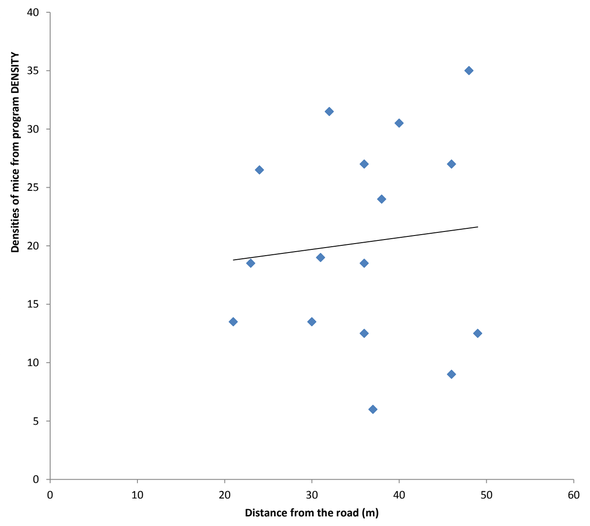


Figure 4:Each sites distance from the road in relation to the density of mice calculated from Program DENSITY at each site as a linear regression $R^2$ = .71.

## Discussion

- It is important to study *Peromyscus leucopus* populations and the role humans play in impacted their natural habitats.
- There are many factors playing into the abundance of mice is this area such as vegetation, prescribed fire burns, and tree cover.
- Future research should design the experiment with more varying distances to the road.
- Experimental Problems
  - Raids by other animals
  - Trap failure or escapees
  - Misreading of ear tags

## Acknowledgements

I would like to give a special thanks to Jennifer Higbie for all of her support on this project. I would also like to thank the rest of the environmental department interns for their help and insight.
This project was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTS) under the Visiting Faculty Program (VFP).

## References

Cooch, E., & White, G. (2006). Program MARK: a gentle introduction. *Available in. pdf format for free download at http://www. phidot. org/software/mark/docs/book*.
Efford, M. G. (2012). DENSITY 5.0: software for spatially explicit capture–recapture. *Department of Mathematics and Statistics, University of Otago, Dunedin, New Zealand http://www. otago. ac. nz/density*.
Forman RTT (2000) Estimate of the area affected ecologically by the road system in the United States. Conserv Biol 14:31–35
Mathis, C., Blalock, R., Virk, M., Compton, S., Coe, S, Derting, T. 2004. The effect of anthropogenic disturbance on the health of white-footed mice *(Peromyscus leucopus). Journal of the Kentucky Academy of Science.* 65: 62-63.
"Our Natural Resources." *BNL | Natural Resources*, www.bnl.gov/about/sustainability/naturalresources.php
Rytwinski, T. & Fahrig, L. Landscape Ecol (2007) 22: 1501. https://doi.org/10.1007/s10980-007-9134-2