Journal of Ecological Research, 1, 35-38 (1998)

RODENT-POPULATION DENSITY IN RELATION TO HABITAT STRUCTURE

Catherine M. DeJohn, Jerry F. Partica and Matthew L. Kandefer

ABSTRACT

The purpose of our project was to test if habitat-structure affects rodent-population density. We compared two sites near the Juniata College campus (Huntingdon, PA), one with high habitat structure and another with low habitat-structure. Our first site was at the Swigart house and it had high habitat structure. There was an abandoned house, bushes, and trees at this site which would all supply habitat structure. The second site was at the Peace Chapel and it consisted of bushes and thin forest. Therefore, this site has low habitat structure. We estimated habitat structure to be high because of the house and brush at the Swigart house and low at the Peace Chapel because of the thin forest and few bushes. Our hypothesis was tested by using small mammal live traps and mark-and-recapture techniques. As expected, the site with more habitat structure had a higher population density of white-footed mice (*Peromyscus leucopus*), than the site with the lower habitat structure. We believe this to be true because habitat structure provides three things: protection from predators, possible nesting sites, and protection from the elements.

INTRODUCTION

This project was designed to test whether the population density of rodents is affected by habitat structure. We predicted that rodents would be more common in areas with complex habitat structure than in those with less complex habitat structure. This hypothesis is based on the assumption that increased habitat structure provides more nesting sites and enhanced protection from predators and inclement weather, all of which should increase rodent-population density.

There have been other studies done on the effects of habitat structure on rodent population densities. One such study was performed in Kansas by Kaufman and Kaufman (1990). They found a high population density of rodents in woodland areas, whereas the lowest population density was found in mowed hayfields. The trees and shrubs of woodland areas provide considerable habitat structure, whereas a mowed hay field does not. In Texas, Seamon and Adler (1996) also showed that rodents were more abundant in areas with shrubs and trees than in areas lacking these structures. Both of these studies give supporting evidence to our hypothesis that rodent-population density will be higher in areas that provide more habitat structure.

Results from this study may prove useful for managing and controlling rodent populations. They may also provide useful background preliminary estimates of rodent population densities that can be used in future investigations.

FIELD SITE

We conducted our study at two separate locations in Huntingdon, PA. The first site was located on the grounds of Juniata College. The Swigart site consisted of an old dilapidated house located behind the Juniata College ceramics shop. There were many signs that indicated the presence of small mammals, including runways worn into the grass surrounding the house, a patch of vole holes, and tunnels dug under boarded up doors. These observations suggested that there could be a sizable rodent population at this site. The site surrounding the house consisted of a few trees including long needle pine and a walnut tree. There was a row of overgrown bushes that encircled most of the house; and approximately seventy feet from the house, in each direction, bushes were very thick and almost prevented access to the house. This study was done in late winter and early spring so there were no leaves yet and the long grasses were still dead. Including the porch, the house was 45' X 45' in area. The total area over which the traps were placed was approximately 2500 square feet surrounding the house.

The second field site was located near the Juniata College Peace Chapel. The Chapel site was along a stretch of woodland, with the nearest house approximately one half mile away. The wood lot consisted of trees common to this area and very little vegetative undergrowth. The forest line consisted of about twenty feet of thick brush from the tree line out. Outside of the brush line there were various patches of bushes dividing up the long grasses. This area did show some signs of human impact because there were several car tires strewn about the site. There was also definite signs of small mammals at this site. The signs included rabbit droppings and a fairly large animal (ground hog?) burrow. We placed the traps in a trap line approximately 100 feet long. The total area over which the traps were placed was about 2500 square feet in area.

METHODS AND MATERIALS

Rodent-population density was estimated by using live traps and mark-and-recapture techniques. There are many techniques used for mark-and-recapture including toe clipping, ear notching, paint spotting, and fur clipping (Wilson, 1996). The technique we chose was fur clipping because it is the most humane way and is not permanent. We clipped the fur on the back of each rodent's neck between the ears. This clipped area was easily spotted on recaptured rodents.

To capture the rodents, we set 22 small mammal traps in each of the two locations. The traps ranged in size from six to 12 inches long and some were made of wood while others were made of metal. Before setting them, they were cleaned thoroughly with water and soap to remove any mammal scents still present. Next, we set the triggers so that a tab on the trap would cause the door to spring up. Then, we stuffed each trap with a small wad of cotton and spoonful of bait. For bait we used a mixture of peanut butter and oat meal. The traps were then ready to be set out at the sites.

At the Swigart site, we set up at least four traps on each side of the house. We set them close to the house and near cracks in the foundation. We did this because there were signs of rodents in these areas. At the Peace Chapel site, we scattered the traps among the bushes and grass. There were no apparent places where rodents could be located, so we set the traps at random.

In order to set the traps, we would go out to our sites about one hour before sun set (approximately 6:00 p.m.), bait the traps, set them out in the appropriate areas, set the door, and wait till morning. At approximately 6:00 in the morning, we would go out to the sites again to gather our data. If a trap was tripped, we would open the door just enough to peak in and see if there was a rodent inside. If there was, we would put on a pair of gloves, open the trap into an empty garbage can, and separate the

rodent from the trap. We then would carefully grab the rodent and hold it for another person to clip the fur from between its ears. Once this was done, we let the rodent go back into its environment.

We used mark-and-recapture methods to estimate the population density at each site. The Lincoln Index equation for the mark-and-recapture is as shown below:

$$N = \frac{nM}{m} \quad ,$$

where N is the total number of animals in the population; n is the number of animals caught, including the marked animals; M is number of individuals captured, marked and released; and m is the number of marked animals caught. In this equation we see that if the number of marked animals that are recaptured is small in comparison with the total number of animals captured the second time it will give a large N, while if the proportion is very close it will give a smaller population density.

RESULTS

Throughout this month-long study, white-footed mice (*Peromyscus leucopus*) were the only rodents that we captured (Table 1). We trapped seven times, on nights that were overcast, warm, and/or raining because mice are most active at this time. The first six times we captured only a few mice and marked them before releasing them. On the seventh day we were fortunate enough to recapture some mice at both sites. These recaptures allowed us to use the Lincoln Index to calculate the population densities at both sites, which is recorded in Table 2. It appears that *P. leucopus* was more abundant at the the Swigart site than at the Peace Chapel site.

Table 1. Capture data from study sites. All mice were Peromyscus leucopus.

Raw Data	number of mice that were marked	number of mice caught plus number of mice recaptured	number of marked mice recaptured
Swigart	12 mice	7 mice	3 mice
Chapel	5 mice	3 mice	2 mice

Table 2. Calculated population densities for both field sites.

Population Density	
Swigart	28 mice
Chapel	8 mice

DISCUSSION

The assumptions underlying the Lincoln Index are critical to our estimates of population density. Two of the assumptions are that marked animals mix freely with the entire population, and that marked animals have the same probability of being caught again as the unmarked animals. Without further knowledge we simply assumed that these conditions were true in this study. Two more assumptions we had a certain amount of control over. First, it is assumed that no marks are lost from any of the marked animals, which was no problem in this study because we used the technique of fur clipping over a short

enough period of time that fur growth would not be a factor. Second, it is assumed that there is no deaths, immigration and emigration during the trapping period, which again seemed to be a safe assumption during the short warm period during which this study was carried out (William, 1996).

During our project we shifted the placement of traps to places where signs of mice were found (e.g., runways, burrows, etc.). As we did this, we captured more mice. Three traps were destroyed and one was lost.

Table 2 suggests that that there were more *P. leucopus* at the Swigart site than at the Chapel site. This is consistent with our hypothesis which stated that increases in habitat structure should favor increased rodent population densities. However further samples are required to test whether this result is statistically significant. The preliminary data that we have collected are suggestive enough to warrant further study of the effects of habitat structure on rodent density in our area. In doing so, more reliable methods of habitat description should be used, e.g., habitat-capacity models, habitat suitability index models, and habitat-evaluation procedures, as reviewed in Bookhout (1994). Due to budget and time constraints we were unable to proceed with this type of study, but the background information presented here may help future investigators wishing to undertake a more intensive study of the effects of habitat structure on rodent-population densities.

ACKNOWLEDGMENTS

We thank Josh Wolf for help with the initial project proposal, Douglas Glazier for supplies and field-site information, and Jason Sharpe for information on trapping techniques.

LITERATURE CITED

Bookhout, T.A. 1994. Research and management techniques for wildlife and habitats. The Wildlife Society, Maryland, USA.

Kaufman, D.W. and G.A. Kaufman. 1990. House mice (*Mus musculus*) in natural and disturbed habitats in Kansas. Journal of Mammalogy 71: 428-432.

Seamon, J.O., and G.H. Adler. 1996. Population performance of generalist and specialist rodents along habitat gradients. Canadian Journal of Zoology 74: 1130-1139.

William, J.S. 1996. Ecological census techniques. Cambridge University Press, Cambridge, England.

Wilson, D.E., F.R. Cole, J.D. Nichols, R. Rudran, and M.S. Foster. 1996. Measuring and monitoring biological diveristy. Smithsonian Institution Press, Washington, USA.