Survey of Ft. Daniel Conservation Area:

Year 1 – Relationship Between Small Mammal Communities and Habitats

Year 2 – Trap Placement Study and Mammal Survey

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ABSTRACT

Year 1: Surveys of flora and faunal are important to conservation districts, especially when trying to assess their biodiversity and when applying for federal grants. The Macon County Conservation District (MCCD), in central Illinois, has not conducted a small mammal survey since the 1970's. Therefore, my objective was to conduct a small mammal survey for the MCCD at Ft. Daniel's Conservation Area. In addition, vegetation data was collected in order to relate small mammal communities with specific habitat features. The results indicated that mice were caught more frequently than shrews and voles. Furthermore, mice were significantly less abundant ($F=8.964$, $p=0.001$) in prairie habitats than in forest or other (combination of edges and creek sites). The vegetative data also supported these results, with mice being more abundant with increased canopy cover and fern presence. In the second year of the project, a study was conducted to analyze trap usage when trap placement was varied between the ground and debris/trees. The results showed no preference between the two trap placements, with individuals utilizing both placements within the same trapping site. Finally, over the two years various methods, including live trapping, track boxes, visual encounters, and plaster casts of tracks, were used to identify species utilizing the conservation area. Sixteen species were identified, ten of which were previously unverified for Macon County.

INTRODUCTION

For conservation departments, surveys of the flora and fauna found on their holdings are vital to adequately assess the biodiversity of their parks and to apply

for federal grants and aide. Unfortunately, many departments have gone decades without even a preliminary survey being conducted. During the years since the prior surveys, new techniques and technologies have been developed to aide biologists in the process of capturing and recoding faunal occurrences. Additionally, human impact has had drastic effects on many communities and past surveys may be inaccurate.

Results recently obtained by the state of Texas display the usefulness of conducting current mammal surveys. As of 1995, it had been 100 years since a biological survey of Texas had been completed. In 1996 a faunal survey was conducted of all state-owned properties with the intention of providing an updated comparison to the biological diversity reported 100 years ago and to document biological diversity on state-owned properties. The results of the survey showed new mammal species being present in all but one county, with many counties having more new species found and recorded than the number known previously to inhabit the area. (Biological Survey of Texas, 1996)

Locally, the Macon County Conservation Department (MCCD) is encountering problems when applying for federal grants due to their lack of knowledge of mammals located in their parks. The last survey conducted of the area was a preliminary list of all types of mammals done in the 1970's. As a result, the MCCD has asked that any student from Millikin University interested in mammal studies assist them by adding to their mammal species list.

Small mammal communities are relatively easy to survey and have become important indicators of environmental health and faunal diversity. In addition, they are highly sensitive to, and respond quickly to disturbance (Avenant 1999).

Pearson and Pearson (1982) showed that small mammal species composition also can change substantially over even short geographic distances in association with pronounced environmental gradients. The information obtained from a clear understanding of habitat selection criteria of small mammal communities in fragmented landscapes could reveal conservation and management strategies useful to land managers (Bellows et al. 2001). For these reasons small mammals were chosen as the target mammal group for the proposed survey.

The objectives of this study were to conduct a small mammal survey for use by the MCCD. Additionally, vegetation data was collected with the purpose of correlating small mammal abundances with specific habitats. We expect that our results from this study will show similar species in the different landscapes, but relative abundances may change in response to habitat.

METHODS AND MATERIALS

Study area – Our study was conducted at Ft. Daniel Conservation Area, a part of the MCCD, in the summer and fall of 2002 and 2003 (June – November). Ft. Daniel Conservation Area is a 200-acre park that lies near Mt. Zion in southeastern Macon County, Illinois. The park's terrain includes oak-hickory forests, a sugar maple grove, open grasslands, and floodplain forests. These varied terrains provide a perfect setting in which to conduct a study comparing different species, and their respective population sizes, within varied habitats.

Year 1

Small mammal collection – We used a stratified random design to select trapping sites in each of three environmental habitats: forest, prairie, and other (edges

between prairies and forests or trails, and sites on creek banks). Sites designated as forest or prairie were at least 30 m from a trail or other habitat, in order to minimize any edge effects.

At each site a trapping array was constructed, similar to a design utilized by Bellows et al. (1999). At the center of the site a plant pot with a diameter of 30 cm was buried so that the top of the pot was flush with the ground. This acted as a center pitfall. Three side pitfalls consisting of two 2-liter pop bottles with their tops cut off were located at 120^0 from the center pitfall and 3.5 m away (Figure 1). All pitfalls were covered with a square section of plywood supported by stakes, which were intended to keep rain, sunlight, and debris out of the pitfalls. In each 120^0 section, three large Sherman snap traps were placed (7.5 x 9 x 23 cm). The Sherman traps were baited with a combination of peanut butter and oats placed on small aluminum squares. During the fall months cotton batting was added to the traps for warmth.

The decision to use a combination of pitfall traps and live snap traps was based on studies such as that by Bury and Corn (1987), which found that pitfall traps caught relatively few rodents, and snap traps were under representing insectivores (shrews). Therefore, they concluded that both methods should be employed in order to assess completely small mammal communities.

Trapping was conducted during the summer of 2002 (June – August) at 30 different sites (5 rounds of 6 sites). The fall sampling included 9 sites (3 rounds of 3 sites). All trapping was conducted over an 8-day period, with traps being checked daily. All captured mammals were identified to species and marked on the ear with a colored Sharpie marker – recaptures were recorded separately from

new individuals. After identification, all mammals were released within the same site that they were captured.

Vegetation data collection – Diameter at breast height (DBH) was recorded for all trees within a 10 m radius of the center pitfall (DBH > 4.4cm). All woody debris within the same radius was measured for length and diameter. Vegetation, debris, and canopy data was collected at 1 m intervals for 20 m from the center pitfall; this was repeated at 60^0 intervals for a total of 120 points sampled. At each point the present vegetation was reported as either grass, forb, shrub, vine, fern, moss, or sapling; the ground cover was classified as either deciduous, pine, both, or bare, and the canopy cover was either present or absent.

Statistical analysis – As a result of a low capture rate of both vole and shrew species, analyses were run on the mice only. Additionally, the two species of mice caught are difficult to identify to species and have similar habitat preferences. As a result, they were all grouped as one species. Abundances of mice were high enough that habitat analysis was run in order to determine habitat preference and to find any vegetation factors that correlate with mice abundance.

To determine the effects of habitat, an ANOVA on mouse abundance as a function of habitat location was performed. A stepwise regression was run to see what environmental factors have an influence on the mouse abundance.

Year 2

Trap placement – A trap placement study was conducted using identical Sherman traps to those used in theYear 1 study. Forested sites were randomly selected, with a total of 16 sites being trapped during the summer of 2003 (June – August). Each site contained five traps placed on the ground and five that were set on top

of debris or attached to trees. Each site was trapped for 5 days, with traps checked daily, and individuals of species *Peromyscus leucopus* recorded according to whether they were trapped in a ground or debris/tree trap and marked on the ear with a Sharpie marker.

Mammal survey – Medium and large mammal species were verified using a combination of methods. The first entailed the construction of a track plate box where the animals tracks were collected via chalk left behind on the sticky side of contact paper. The second method entailed visual verification of mammals that were either found dead, trapped in Sherman traps or pitfalls, or observed in their natural habitat for periods long enough to ensure proper identification. The third method utilized plaster that was poured in tracks and then removed once dry.

RESULTS

Year 1

Survey results – Three shrew species, *Blarina brevicauda* (northern short-tailed shrew), *Sorex longirostris* (southeastern shrew), and *Cryptotis parva* (least shrew), two vole species *Microtus pennsylvanicus* (meadow vole), and *Microtus ochrogaster* (prairie vole), and one mouse specie, *Peromyscus leucopus* (white-footed mouse), were caught at Ft. Daniel Conservation Area. A total of 170 *Peromyscus leucopus* were caught, with 94 being caught in the 17 forest sites, 26 in the 12 prairie sites, and 50 in the 9 sites categorized as other. Seven shrews and eight voles were caught. The notable fact for data on the voles is that both species were caught solely in the prairie habitats (Table 1).

Statistical results – Due to the low number of individual shrews and voles that were caught, analysis were performed on the data collected for the *Peromyscus leucopus* only. There was a significant effect ($F=8.964$, $p=0.001$) of habitat on mouse abundance. Mice were less common in prairies than the edge and forest habitats (Figure 3). Mouse abundance was also related to percent canopy cover and fern abundance (Abundance=1.12+ 4.84*% Canopy+44.8*%Ferns, $R^2=0.44$).

Year 2

Trap placement results – Twenty individuals were captured in ground traps (41 total captures) and twenty-four individuals were captured in traps placed on debris/trees (55 total captures). No significant difference was found between the two trap placements.

Mammal survey – A total of ten species was identified, six of which were new records for Macon County. Those species that had previously been recorded in Macon County included: *Odocoileus virginianus* (deer), *Procyon lotor* (raccoon), *Sciurus niger* (fox squirrel), *Scalopus aquaticus* (eastern mole). The new records for Macon County were *Sylvilagus floridanus* (eastern cottontail), *Mustela vison* (mink), *Tamias striatus* (eastern chipmunk), *Marmota monax* (woodchuck), *Canis latrans* (coyote), *Didelphis virginiana* (opossum).

DISCUSSION

Of the seven species identified in the Ft. Daniel Conservation Area, all but the *Cryptotis parva* (least shrew) and *Microtus ochrogaster* (prairie vole) are new records for Macon County – according to the most recent addition of *Mammals of Illinois* (1989). None of the unverified species, though, are rare or unexpected in

Macon County. This shows the inadequacy of previous surveys and the need of a thorough survey of all fauna for MCCD's lands.

The high capture rate of mice compared to shrews and voles can be assumed to be an effect of the trapping methods utilized. The mice had nine baited Sherman traps at each site; the voles and shrews had only seven pitfall traps, none of which were baited. The mice, therefore, had an incentive to enter the traps (get to the food), while the voles and shrews only entered the pitfalls by accident. These results are supported by studies such as that conducted by Cameron (1997), who sampled small mammals in Uganda and had captures comprised of 96% rodents and 4% shrews.

Additionally, while not specifically measured, species richness would appear to be higher in the prairies (5 species identified) versus the forest (3 species). Conversely, the abundance of small mammals was higher in the forest than the prairies (97 versus 36). This is due to the significantly lower abundance of *Peromyscus* in the prairies than the forests. Cameron (1997) encountered similar results when he found abundance of small mammals to be highest in forest where it coincided with the lowest value for species richness. He found high species diversity, though lower abundance, in burn bushland habitats. He attributed this difference in species richness to the regenerating vegetation, due to yearly fires, providing new and rich nutrients, and thus being able to support a larger number of species. These findings could be attributed to our prairie sites in that they are mowed seasonally. This mowing could regenerate the foliage enough that more species can be supported. This hypothesis is supported by Tasker et al. (1999), who found that plant communities were more diverse at sites

that were moderately grazed by cattle than those that were ungrazed. As a result, a significantly higher abundance of small mammals was found at the ungrazed sites, but higher species diversity was encountered at the grazed sites.

Errors in trap functioning and site set-up could also have had effects on the species' abundances. Some of the Sherman traps were prone to snapping at the slightest disturbance, leading to closed traps with no mammal inside. While others did not snap even after a mammal entered, ate the bait, and exited. As far as the pitfalls, the ground was sometimes very difficult to dig through. This may have led to all of the pitfalls not being flush with the ground at times. Therefore, a small mammal crawling on the ground might be less prone, or unable, to climb over the portion of the pitfall jutting above the surface of the ground.

The *Peromyscus* were found in all sampled habitats, but in lower abundances in the prairie than the forest and other sites. The results of the vegetation data that correlate higher mouse abundance with increased canopy and fern abundances supports the finding of more mice in forested sites. While few ferns were found among the sampled sites, the majority were identified in the forested sites. An increased canopy cover is inherent in the very definition of a forest – having trees, especially in contrast with the mainly treeless prairies. Duesser et al. (1978) found that the white-footed mouse (*Peromyscus leucopus)* was associated primarily with wooded habitats, particularly pine and mixed forest sites. The same study concluded that while the white-footed mouse was found in most vegetation zones, it was most abundant in shrub and forest zones. It was seldom caught in areas having sparse herbaceous vegetation or in disturbed grasslands. This study also supported the findings of voles only in prairie habitats.

They found the meadow vole to be most abundant in salt marshes and prairie areas where adequate ground cover was available.

There are several possibilities to enhance the study that could be implemented if it was repeated. The first would be to install drift fences from the center pitfall out to the side pitfalls. The reasoning for this stems from studies such as Yahner (1986), who found that some small mammal species prefer areas containing aboveground features, such as stumps, brush, and ground debris. As described in a study by Williams et al. (1983), drift fences create obstructions to free movement of small mammals and thereby direct traffic to the pitfall. These fences are especially useful in capturing burrowing animals and those that orient primarily by non-visual senses, including shrews and voles. The reason drift fences were not implemented in this study was the inability to create affordable, moveable drift fences. Most of the previous studies that implemented drift fences had permanent sites, and were thus able to use a material such as galvanized aluminum roofing metal buried in trenches (Bury and Corn, 1987). Another improvement would be to find bait that attracts voles and shrews to place in the pitfalls and Sherman traps. Also, smaller Sherman traps might make it possible to trap shrews, if appropriate bait was found. Of course another improvement would be to conduct the survey on a larger scale with more traps, more trapping sites, and to expand the study to other parks within the MCCD's jurisdiction.

The six small mammal species identified, four being new records for the county, support the conducting of extensive fauna surveys on MCCD parks. Through our survey we were able to conclude that *Peromyscus leucopus* exhibits a habitat preference. This was shown by the decreased abundance in the prairie

sites as compared to the forest and other sites, which had increased abundances of canopy cover and ferns, both significant environmental factors in mouse abundance.

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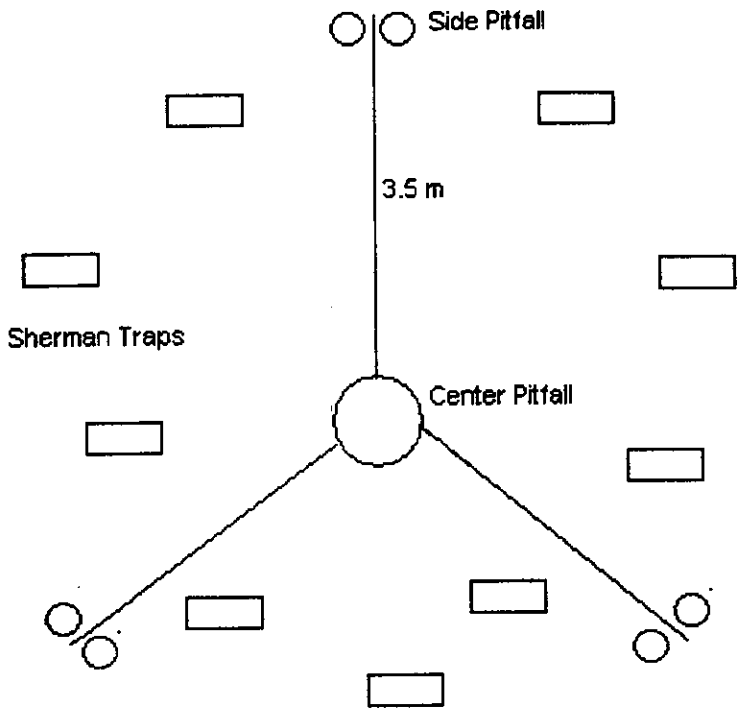

Figure 1. Schematic of a Trapping site showing the orientation of center and side pitfalls and the generic placement of Sherman snap traps.

	White-footed mouse	Least Shrew	SE Shrew	N. Short-Tailed Shrew	Prairie Vole	Meadow Vole
Prairie	**26**	1	0	1	2	6
Forest	**94**	0	2	1	0	0
Other (Edge and Creek)	**50**	0	0	2	0	0
Totals	**170**	1	2	4	2	6

Table 1. Summary data of number of individuals of each species caught in each habitat. Mouse data are in bold – statistical analysis ran on these results.

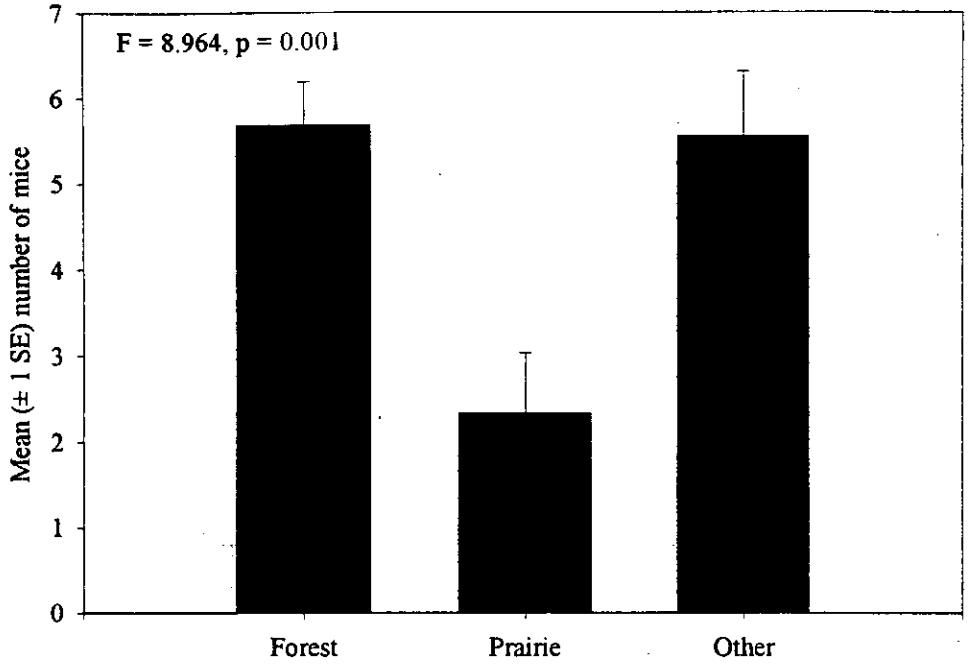

Figure 3. Mean number of *Peromyscus leucopus* caught in each habitat type (forest, prairie, and other – edges and creek sites) in summer and fall of 2002. The data are from captures in large Sherman folding traps.

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