

KROGER HILLS
SMALL MAMMAL SURVEY
III.

Submitted by

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December 1, 1988

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SUMMARY BUDGET EXPENSE

Trips to Kroger Hills	80
Distance from X.U. to park and back	24 miles
Total miles	(80 x 24) @ 0.15 per mile
	1920 miles
1) mileage reimbursement 0.15 x 1920	\$288.00
2) Peanut Butter bait	20.00
3) Oats	15.00
4) Honarium	\$100.00
5) Secretary	\$30.00
TOTAL	\$453.00
BUDGETED	<u>\$430.00</u>

HAMILTON COUNTY PARK DISTRICT	
DEPT. #	14 PARK
FACILITY	
AMOUNT	\$430.00
ENCUMBERED	
APPROVAL	<i>[Signature]</i>
APPROVAL	
VENDOR #	

Introduction

This study is the third phase of a mammal survey which was begun in the summer of 1986 in Kroger Hills Park. The 1986 phase was performed after the Kroger Hill meadow had been undergoing old field succession. The field was cut in the fall of 1986 after the initial summer sampling period. This study is part of a land management study supported by the Hamilton County Park Administration and may also become part of the State of Ohio's barn owl re-establishment program.

The study was continued in the summer and fall of 1987 after the 1986 cutting, and the most recent or 3rd phase of the study followed a partial cutting in the fall of 1987. The third phase was performed during the summer and fall of 1988. Changes in mammal species inhabitants and population densities have been followed as the Kroger Hill area slowly comes back to a meadow habitat.

Methods

Sherman live traps supplied by the Hamilton County Park Board were utilized. Trapping was carried out in grids or lines following the lay of the land. The traps were baited with peanut butter, oats, mixed bird seed or a combination. In order to reduce theft or the possibility of theft, traps were set in smaller groups at several different places in the park. If theft would have occurred, the trap loss would be minimized. Smaller numbers of traps per area made checking and baiting traps a bit easier during the heat of the summer.

Population density was determined by direct enumeration of marked individuals, mice/100 trap nights, or the Schnabel method (1938) and Peterson (1896).

The grid size was determined by calculating:

$$\text{Area} = \text{width (m)} \times \text{length (m)}$$

The distances, length or width, were determined by multiplying traps in rows or columns by 15 meter spacing.

Mammal density was normalized to numbers per hectare (10,000 square meters).

Seven plots or grids were utilized for data collection. Several of the plots were sampled during several seasons. The plots employed in 1988 were basically the same as employed in 1987 and conform to the vegetation treatment areas proposed by the county management in 1987. The basic

rationale for selecting the plot sites were; first, to sample areas where different vegetation treatment was to occur; second, to resample the 1987 sites as well as several of the 1986 sites; third, to maximize the chance of trapping representatives of all the small mammal species which occur in Kroger Hills Park.

The following is a list and description of the various sample sites:

Plot #1

Terrace Park (.3 mile in from Terrace Park Gate).

In 1987 a meadow area made up of a mix of sweet clover, wild carrot, Queen Anne's Lace, goldenrod, milkweed, poison ivy, mixed grass, thistle, honeysuckle, small maple, boxelder, and Sycamore trees.

In 1988 the vegetation diversity was markedly decreased. The species consisted of goldenrod, several species of sweet cover, thistle, patches of mixed grasses, ragweed, poison ivy, honeysuckle and some viney growth. The growth was much more sparce than in 1987.

Grid 4 x 5 = .4500 hectare
Trapping 6/1/88 to 6/13/88 = 12 nights
Trap nights = 240

Plot #2

In 1988: plot #7 (midway 1987)

An area composed of successional meadow basically the same as plot #1 with reduced sweet clover and grasses and sparcer distribution of the remainder.

Summer
Grid 4 x 5 = .4500 hectare
6/25 - 7/19 = 25 nights
Trap nights = 500

Fall
Grid 4 x 5 = .4500 hectare
9/19 - 9/24 = 5 nights
Trap nights = 100

Plot #3

In 1988: plot #3 1987 (barn meadow)

An area of mixed coarse grass approximately one hectare in size.

Grid 4 x 5 = .4500 hectare
6/10 - 6/19 = 9
Trap nights = 180

Plot #4

In 1988: Plot #4 1987

An area of short dense cut grass at the west end of Kroger Hills meadow. This area was a thicket of growth in 1987.

Grid 3 x 4	=	.27 hectare
6/3 - 6/11	=	8 nights
Trap nights	=	96

Plot #5

In 1988: Plot #2, 2a, 2b 1987 (lake)

This area appears to be a dried out old pond with assorted growth of coarse grasses, reeds and goldenrod.

Grid 4 x 5	=	.4500 hectare
7/25 - 8/4	=	10 nights
Trap nights	=	200

Plot #6

In 1988: Plot #8 1987

An area west of barn approximately in middle of the Kroger Hills acreage. The vegetation here is sparse stands of goldenrod, milkweed, honeysuckle, with patches of viney growth, poison ivy, sweet clover and grasses. Basically this is a very sparse area. No tree seedlings.

Summer		
Grid 4 x 5	=	.4500 hectare
7/10 - 8/12	=	27 nights
Trap nights	=	540

Fall		
Grid 6 x 5	=	.675 hectare
10/23 - 10/29	=	6 nights
Trap nights	=	180

Plot #7

In 1988: Plot #5 1987 (Terrace Park gate)

This area was basically goldenrod, honeysuckle, some patches of grass, viney growth, thistle, poison ivy, milkweed, ragweed in 1987. This area was uncut and grew up with young Sycamore trees in 1988.

Fall		
Grid 4 x 5	=	.4500 hectare
10/3 - 10/8	=	5 nights
Trap nights	=	100

RESULTS

During the summer of 1988 the Kroger Hills Park property began to look more like a meadow. The old field succession which had been occurring is halted. Apparent changes in species composition and species density have been noted, and many of the changes are statistically significant. The fall cuttings of 1986, 1987 and now 1988 seem to be causing a significant ecological alteration. No new species were caught during last summer's sampling, but individuals of all the species already known to inhabit the area were caught.

The results of trapping with respect to predominant animals in the park: Peromyscus leucopus and Microtus pennsylvanicus are shown in Table 1.

Table 2 shows the fall trapping results. These three plots reflect the late summer cutting of Kroger Hills. It is apparent that cutting reduces the number of Peromyscus utilizing the area, shown by plots II and VII. Plot VI was uncut and still has Peromyscus inhabiting it with fewer Microtus.

TABLE I

Plot	I	II	VI	III	IV	V
Peromyscus marked	17	17	48.0	1	0	1
Microtus marked	8	14	9.0	1	6	0
Blarina marked	2	0	2*	1	0	0
Lincoln Index if possible						
(A) Microtus	31.66	21	15*	-	-	-
(B) Peromyscus	22.75	13.79	46.67*	-	-	-

Peromyscus/ 100 trap nights	15	15.2	26.48	0.55	0	0.5
Microtus/ 100 trap nights	6.66	3.6	1.85	0.55	6.25	-
Peromyscus density/hectare (calculated from Lincoln Index)	50.55	30.64	103.7	-	-	-
	37.77	37.77	106.66	2.22	-	2.22
(calculated from direct count)						

Microtus density/hectare (calculated from Lincoln Index)	70.35	46.66	33.33	2.22		-
	17.77	31.11	20.00		2.22	
(calculated from direct count)						
Trap nights	240	500	540	180	96	200
Area hectare	0.45	0.45	0.45	0.45	0.27	0.45
Plot number key:	1) Terrace Park, II) Midway, III) barn, IV) west plot, V) lake, VI) barn west plot					

SUMMER PLOTS

TABLE 2

	II Fall	VI Fall	VII Fall
Peromyscus marked	0	5	5
Microtus marked	5	1	3
Blarina marked	0	0	2
* * * * *			
Lincoln Index if possible			
Peromyscus			9.0
Microtus	7.5		
* * * * *			
Peromyscus/100		2.7	5
Microtus/100	5.0	0.55	3
Peromyscus density/hectare calculated from Lincoln Index	0		
calculated from direct count	0	7.4	11.1
* * * * *			
Microtus density/hectare calculated from Lincoln Index	16.6		
calculated from direct count	11.1	1.48	6.66
* * * * *			
Trap nights	100	180	100
Area	0.45	0.675	0.45

Plot number key:

- II midway
- VI Terrace Park gate
- VII Summer plot #8

FALL PLOTS

RESULTS

In addition to the predominant animals Microtus and Peromyscus as summarized in Tables 1 and 2, several other species of small mammals were trapped. Three specimens of Zapus were caught in each of plots 1 and 2. One specimen of Mus was caught in plot 2. During the summer of 1988 no specimens of Peromyscus maniculatus were caught.

It is very clear from looking at the comparisons table III and the summary table IV that there has been a significant increase in Microtus pennsylvanicus in Kroger Hills park. A Z test on the proportion of Microtus caught in 1987; i.e., 0.06, and the proportion of Microtus caught in 1988; i.e., 0.31, is highly significant, $Z = 3.84$ and $P < .01$. Microtus specimens in 1988 were captured approximately 7.5 times as often as in 1987; i.e., 2.16 Microtus/100 trap nights in 1988 and 0.29 Microtus/100 trap nights in 1987. Microtus also has significantly spread or increased throughout the park, since 5 out of 6 plots yielded Microtus in 1988, but only 2 out of 6 in 1987. The most dramatic increase and spread is illustrated by the west plot which yielded 0 mice of any species in 1987 but 6.25 Microtus per 100 trap nights in 1988.

The proportion of total mice/total trap nights in 1987 and 1988 were statistically compared with a Z test. Here $Z = 3.00$ $p = 0.01$. We can infer from this that the total number of mice in the park has increased.

Trapping results also show interesting trends which may be associated with the drought in the 1988 summer. During the July-August period when there was an absence of rain, the trapping success of Peromyscus as revealed by percent capture increased from the usual 15% to 25%, to 75% or 80%, while the trapping success with respect to Microtus decreased to zero.

Another interesting observation of the 1988 summer is that at the barn and lake plots, we still are not catching Microtus or Peromyscus in significant numbers. These areas should be prime Microtus habitat. (See discussion).

TABLE III

	To Park Gate 1	Midway 2	Barn 3	West 4	Lake 5	Barn West 6
1988						
P. leucopus	17	17	1	0	1	48
Microtus	8	14	1	6	0	9.0
P. leucopus/ 100 trap	15	15.2	.55	0	0.5	26.48
Microtus/ 100 trap	6.66	3.6	.55	6.25	0	1.85
Trap nights	240	500	180	96	200	540
1987						
P. leucopus	13	13	5	0	11	16
Microtus	0	0	1	0	0	3
P. leucopus/ 100 trap	8.9	35	3.33	0	13.15	7.05
Microtus/ 100 trap	0	0	0.66	0	0	0.64
Trap nights	336	80	150	150	190	468

MICROTUS AND PEROMYSCUS COMPARISON
BETWEEN 1987 and 1988

TABLE IV

1988	
Total P. leucopus	84
Microtus	38
Trap nights	1756
P. leucopus/100 trap nights	4.78
Microtus/100 trap nights	2.16
1987	
Total P. leucopus	58
Microtus	4
Trap nights	1374
P. leucopus/100 trap nights	4.22
Microtus/100 trap nights	0.29

FURTHER COMPARISON DATA 1987 to 1988

DISCUSSION

Kroger Hills park is slowly changing into a meadow as revealed by the reduced species diversity, density of meadow plants and a significant increase in Microtus pennsylvanicus.

At present we can assume that the reason Microtus is increasing is that the habitat has been altered. Another possible explanation of the Microtus increase is that the original 1986 trapping caught Microtus at a population low and we are just seeing the normal population increase cycle. Microtus density per hectare estimates range from 0 to 17.77 utilizing direct count numbers with an average of 11.85, and 0 to 70.35 using the modified Schnabel method (Lincoln index) with an average of 25.42. These density estimates have two main sources of error; first, some of the mice are not residents; second, the built in problems with the math of the Schnabel method. If the present trend continues, the Microtus density could increase tenfold from next spring to summer.

The change from successional woodland or old field succession could really be insured if the Kroger Hills property were seeded with mixed grasses (Timothy, Blue). The Microtus increase as shown at present is occurring in viney or grassy clumps with significant surface litter. Seeding would increase and stabilize this type of habitat.

The study so far has produced very little data on the shrew population which inhabit Kroger Hills. Since Blarina is a significant Microtus predator, it would be interesting to be able to track its population, but its numbers in the park are either extremely low or the Sherman trap size which we are employing is too large to catch Blarina efficiently, the truth being a combination of low Blarina density and low efficiency due to trap size.

The deer population as observed by eye seems to be increasing in number. The number of spottings increased from 1987 to 1988 and the number of fawns seen increased in 1988.

Predators in the park are becoming more apparent. There is a family of foxes inhabiting the park. They seem to range from the barn area to the west end of the park, and at times have let me see them. Bird predation is composed of a family of Redtails, numerous sparrow hawks, and occasional Coopers hawks. Owl predators have not been observed, but probably are present.

Observations made during the 1988 study have prompted several questions which I would like to answer by further research. One question is: Is there a significant difference in behavior between Microtus and Peromyscus with respect to drought behavior and what is their source of water when drought stressed?

Another question relates to the theoretical sympatric species competition between Microtus and Peromyscus. The full nature of their competition and species exclusion characteristics are unknown so it will be interesting to see if Microtus can displace Peromyscus from the Kroger Hills meadows. Peromyscus can be displaced from strictly Microtus type grasslands. However, will Microtus displace Peromyscus as the predominant small mammal in habitat similar to the 1988 meadow habitat? (i.e., goldenrod, field clover, ragweed, with some honeysuckle).

There are two areas which should be very good *Microtus* habitat which up to now have produced very few mice of any kind. These areas are in particular the barn meadow and the lake meadow. Both of these areas are mixed grasses and more typical meadow. There are two possible explanations to explain *Microtus* absence. One hypothesis is that these areas were the areas of highest *Microtus* density at the last *Microtus* peak which would make them the first to die out and the last to repopulate. The other hypothesis is that the soil substrate is not liked by *Microtus*. The barn meadow is deeply rutted by deep furrows that were never disked and the lake meadow seems to consist of a very hard surface as compared to other areas of Kroger Hills. The hard surface may be due to increased rockiness or pebbles. It will be interesting to see whether these areas will permit eventual *Microtus* utilization.

The small mammal population numbers are within the normal range for the *Peromyscus* and *Microtus* (Gottschang, Hamilton). Over the past three years I have compiled much data which is slowly amounting to a pretty informative paper. I believe I will be able to eventually discuss matters relating to species competition and exclusion, certain behavior characteristics of these mice, and environmental parameters relating to these mice behaviors or habitats.

From the beginning of this study we have been thinking in terms of introducing a pair of Barn owls *Tyto alba* into this area when the number of *Microtus* reach a density which will support them. Evans and Emlen (1947) determined that a Barn owl consumes 25% of its body weight of 1.5 lbs per day. Over a period of a year this amounts to 57,204 gms of prey. Golley (1960) utilized some creative mathematics to estimate *Microtus* productivity. Employing this type of analysis, the Kroger Hills meadow could produce sufficient *Microtus* grams to sustain a pair of Barn owls in the spring of 1989. If the *Microtus* population grew at their potential as reported in the literature, we could be up to our chins in voles in the summer of 1989. Seeding the area with mixed grasses would increase the probability of *Microtus* success. Since Barn owls like grassy meadows, they might have difficulty with the honeysuckle and tree seedlings at Kroger Hills.

From the standpoint of sufficient food, Barn owls would probably have enough to eat, but from the viewpoint of ecologically preferred habitat the meadow may not be grassy enough.

There is also another problem with Barn owl introduction. There is already a population of predators in the area; i.e., the hawks and possible owls, mentioned previously, the mammalian predators, and also an unknown number of large pilot black snakes. Introduction of the Barn owl would certainly shake up the troops.

SUMMARY

- 1) Kroger Hills is vegetatively more like a meadow.
- 2) The *Microtus* population has spread through most of the park.
- 3) The *Microtus* population has increased sevenfold since 1987.
- 4) There are more mice in 1988 as compared to 1987.
- 5) The introduction of Barn owls is now made possible by the *Microtus* increase. Barn owl introduction is discussed.
- 6) *Peromyscus* numbers are fluctuating; however, no significant change.
- 7) Density of each species may have changed but original 1986 species still present.
- 8) Behavioral differences in *Peromyscus* and *Microtus* noted during drought.
- 9) *Microtus* density increase has not excluded or affected *Peromyscus* density.
- 10) Fall populations after cutting much reduced. *Peromyscus* has generally left field.
- 11) Possible future research topics are mentioned.

Literature Cited

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