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Distribution of Mice Populations in the Winona Area

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INTRODUCTION: Six mice habitats in Winona County, Minnesota, were censused by means of snap traps. Examples of marsh, dry meadow, and woods habitat in an upland environment were selected in East Burns Valley south of Winona. Corresponding habitats in a flood plain environment were located on Prairie Island northwest of the city. These are representative of the non-agricultural habitats of Winona County.

METHODS: 49 "Museum special" mouse traps baited with a mixture of peanut butter and oatmeal were used to do the study. The 6 selected habitats were trapped two nights each, with the traps being set on Tuesday and Thursday evenings. As much as possible the traps were set between three o'clock and five o'clock in the afternoon and picked up again at eight o'clock in the morning to insure an equal mouse catching time for each area. The traps were set in a grid pattern seven traps on a side, at intervals of about 10 feet, giving a total of 49 traps set two nights a week, or a total of 98 trap nights on an area of approximately 4,900 square feet or .11 acres in each habitat.

DESCRIPTION OF HABITATS: The upland marsh was trapped on September 19th and 21st, 1961. This area was spring fed, with water standing on the ground about two inches deep. The vegetation consisted mainly of tall grass and cat-tails, about 5 feet high. In the middle of the area there was a small clump of willow trees. Four *Zapus hudsonius*, one *Mus musculus*, three *Peromyscus leucopus noveboracensis* and four *Microtus pennsylvanicus* were caught.

The flood plain marsh was trapped on September 26th and 28th, 1961. The vegetation in this area was the same as that found in the upland marsh. One *Mus musculus* and one *Zapus hudsonius* were caught.

The upland dry meadow was trapped on October 3rd and 5th, 1961. This area was an old-field habitat. The vegetation for this area consisted of very thick and dense grass, which was about one and a half to two feet tall. Nineteen *Microtus pennsylvanicus* were caught.

The flood plain dry meadow was trapped on October 17th and 19th, 1961. The vegetation in this area was also made up of grass, but was also surrounded by river birch trees. One *Microtus ochrogaster* and two *Peromyscus leucopus noveboracensis* were caught.

The upland woods was trapped on October 24th and 26th, 1961. The vegetation in this area consisted of trees and small shrubs or bushes. There was very little grass. The types of trees were dogwood, oak, elm and black locust. There were fallen trees and tree stumps scattered, with a thick layer of fallen leaves on the ground. This area was located on a steep hillside. Six *Peromyscus leucopus noveboracensis* were caught.

The flood plain woods was trapped on October 31st and November 2nd, 1961. The vegetation consisted, again, mainly of trees and shrubs, with more grass than the corresponding upland area. The trees were: ash, river birch, and boxelder, with fallen trees and tree stumps scattered. This area was level. In this area three *Peromyscus maniculatus* were caught.

DISCUSSION: In considering species composition of each area, it can be seen that the upland marsh supports the greatest variety of mice (Table I). *Zapus hudsonius*, *Peromyscus leucopus noveboracensis* and *Microtus pennsylvanicus* were the most prevalent species in this area. The flood plain marsh was very sparsely populated, with only two species found living in it—*Mus musculus* and *Zapus hudsonius*. The upland dry meadow, definitely was the area that supported the largest population. One might think that this area would therefore be the most desirable for mice, but the fact that only one species (*Microtus pennsylvanicus*) was found there also indicates that this area is not a desirable one for all mice. The upland marsh was the second most populated area, with four different species found in it. This indicates that this area must be more desirable for most mice in general, of those found in the Winona area. The flood plain dry meadow was also a thinly populated area. This was the only area that *Microtus ochrogaster* was found. *Peromyscus leucopus noveboracensis* was also found in this area, and in more abundance than *Microtus ochrogaster*. In the upland woods *Peromyscus leucopus noveboracensis* was found again. It was the only species caught in this area, and of all the areas in which it was caught, it was caught in this area in the largest number. The flood plain woods was the only area in which *Peromyscus maniculatus bairdi* was found and was the only species found there.

In considering habitat preference for each species (Table II), it can be seen that *Zapus hudsonius* and *Mus musculus* prefer the marsh areas. Although whether or not *Mus musculus* really has a preference for the marsh area is questionable. *Peromyscus leucopus noveboracensis* showed up in three areas, with the largest population being in the upland woods. This tends to indicate that this mouse does not have a definite area which it prefers, but rather a group of areas in which it can do well, with the upland woods being the ultimate. *Peromyscus maniculatus bairdi* showed a definite preference for the flood-plain woods area. This is unusual, seeing that this species is supposed to be restricted to a meadow habitat. This

TABLE I

	Upland						Flood plain						%	%	%	%	%	TOTAL	
	marsh		meadow		woods		marsh		meadow		woods		Total	Total	Total	Total	Total		
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	marsh	meadow	woods	upland	f. plain	no.	%
Zapus hudsonius	4	33.3	0	..	0	..	1	50.0	0	..	0	..	35.7	0	0	10.8	12.5	5	11.1
Mus musculus	1	8.0	0	..	0	..	1	50.0	0	..	0	..	14.9	0	0	2.7	12.5	2	4.4
Peromyscus leucopus noveboracensis	3	25.0	0	..	6	100	0	..	2	66.7	0	..	21.4	9.1	66.6	24.3	25.0	11	24.4
Peromyscus maniculatus bairdi	0	..	0	..	0	..	0	..	0	..	3	100	0	0	33.4	0	37.5	3	6.2
Microtus pennsylvanicus	4	33.3	19	100	0	..	0	..	0	..	0	..	28.5	86.4	0	62.2	0	23	52.7
Microtus ochrogaster	0	..	0	..	0	..	0	..	1	33.3	0	..	0	4.5	0	0	12.5	1	2.2
Total no.	12	100	19	100	6	100	2	100	3	100	3	100	100	100	100	100	100	45	100
Total %	26.6		42.2		13.3		4.4		6.7		6.7		31.1	48.9	20.0	82.2	17.8		

TABLE II

	Zapus hudsonius	*Mus musculus*	*Peromyscus leucopus noveboracensis*	*Peromyscus maniculatus bairdi*	*Microtus pennsylvanicus*	*Microtus ochrogaster*
Marsh upland	80	50	27.3	..	17.4	..
f. plain	20	50	..	..	..	..
Meadow upland	..	..	..	..	82.6	..
f. plain	..	..	18.3	..	..	100
Woods upland	..	..	54.5	..	..	..
f. plain	..	..	..	100	..	..

area was a small woods with a meadow surrounding it, which at the time of trapping had just been harvested. This might explain the fact that *Peromyscus maniculatus bairdi* was found in the woods. Microtus pennsylvanicus dominated the upland dry meadow area, but was not restricted to it, seeing that it was found in the upland marsh also. *Microtus ochrogaster* was found only in the flood plain meadow. Therefore one might think that this was the preferred area, but the fact that only one species was caught in this area and none in any of the other areas indicates the general Winona area is not suitable for this species.

In comparing the total upland with the total flood plain, it was found that to every one mouse caught in the flood plain four were caught in the upland. The variety of mice found between these two groups of areas was very similar, except for *Microtus pennsylvanicus* which was found only in the upland and *Microtus ochrogaster* which was found only in the flood plain. This is a very convincing indication that the upland is more suitable for mouse occupation than the flood plain in the Winona area.

In comparing the total populations of the marshes, dry meadows and the woods, the dry meadow was found to be the most desirable area of the three, with one half of the total population and four of the six species found in it.

Density comparisons were calculated in a number per square mile in proportion to the area size trapped. This was done to give an idea as to how many of each species could be found in the different areas and groups in relation to the amount of land trapped and studied. Also, in order to predict how many traps would have to be set to catch a desired amount of mice or species, in different areas, a table was calculated in traps per night, based on

TABLE III

	Per Square Mile	Per Trap Night
UPLAND MARSH:		
Zapus hudsonius	35.6	.04
Mus musculus	8.9	.01
Peromyscus leucopus noveboracensis	26.7	.03
Microtus pennsylvanicus	35.6	.04
FLOOD PLAIN MARSH:		
Zapus hudsonius	8.9	.01
Mus musculus	8.9	.01
UPLAND DRY MEADOW:		
Microtus pennsylvanicus	168.9	.20
FLOOD PLAIN DRY MEADOW:		
Microtus ochrogaster	8.9	.01
Peromyscus leucopus noveboracensis	17.9	.02
UPLAND WOODS:		
Peromyscus leucopus noveboracensis	53.3	.06
FLOOD PLAIN WOODS:		
Peromyscus maniculatus bairdi	26.7	.03
UPLAND	329.0	.13
FLOOD PLAIN	71.2	.03
MARSH	124.7	.02
DRY MEADOW	195.6	.11
WOODS	80.0	.05

the success had with catching mice. These two tables were combined into Table III.

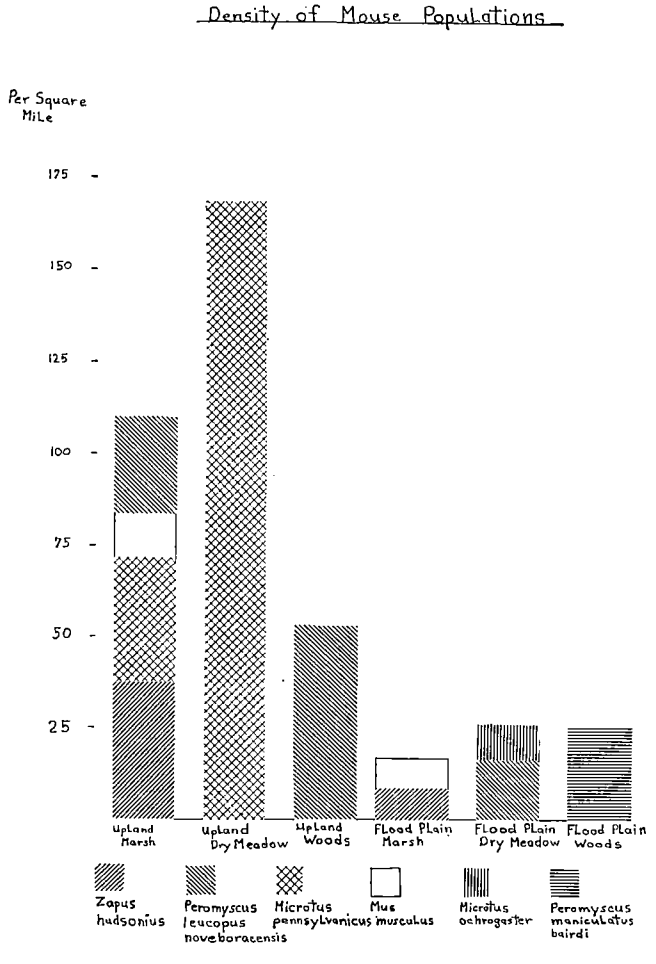
In considering density, (Table III) it again can be seen that the upland group of areas were the most densely populated. It again was found that the upland dry meadow only supports one species of mouse – *Microtus pennsylvanicus.* The rarest species found in all the areas trapped, was *Microtus ochrogaster,* which was found only in the flood plain dry meadow. *Mus musculus* also was a rare species, although it was caught in two areas.

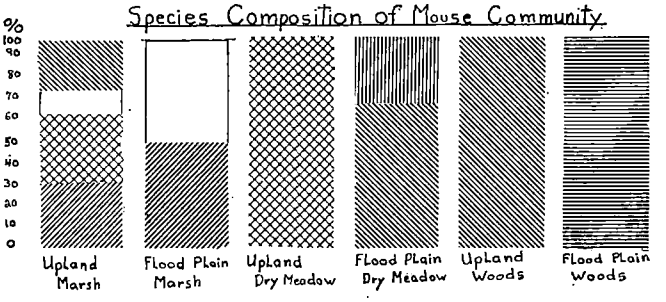
It was concluded from calculations of percent composition of species of total mice caught in all areas, (Table I) that *Microtus pennsylvanicus* and *Peromyscus leucopus noveboracensis* were the most prevalent mice in this region.

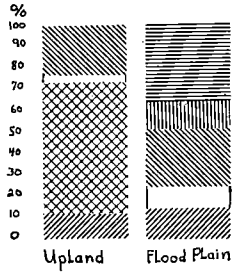
SOURCES OF ERROR: The accuracy of some of the calculations is questionable when one takes into consideration outside uncontrollable elements. The first of these elements is weather conditions. On September 26th, October 26th, and November 31st, nights of trapping, it rained. It was noticed the following mornings of each of these trappings that a larger number of traps than usual had been sprung.

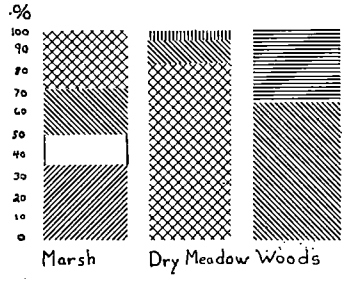
Similarly, on the night of November 2nd, it rained and the temperature dropped below freezing. The following morning almost all of the traps were frozen open. This lowered the efficiency in the flood plain woods area.

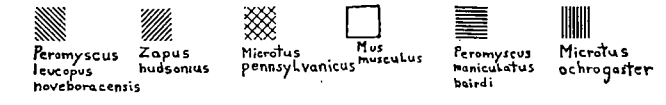
Another weather element that affected the efficiency of trapping was the fluctuation of temperature. There were nights when the temperature dropped 15 to 20 degrees

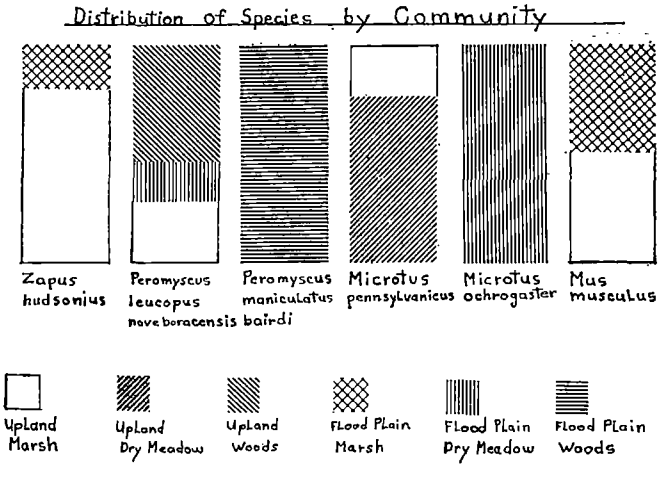












from what it was during the day. This probably had an effect on the activity of the mice, perhaps making them less active and not as susceptible to being trapped. Because of this, the total catch probably was less than the true number that would have been caught on an average night in terms of temperature.

The density calculations should be considered as indices of abundance and not as absolute population densities. There are two reasons for this: 1. an entire population was not caught in any of the areas; 2. that the areas expanded to a square mile would not have the same representation. Also, there is the factor of perimeter of a square mile, making relatively more mice susceptible in the individual areas than would be in a square mile.

No *Zapus hudsonius* were caught after September 26th. This was the last trapping in a marsh area. The fact that the weather was getting colder and that *Zapus hudsonius* is a hibernator might be the reason that none of this species was caught in the other areas.

Conclusions: In considering which environment of the six trapped was best suited for the species caught, the following was concluded, based on the number caught per area:

Zapus hudsonius	—	upland marsh
Mus musculus	—	marsh
Peromyscus leucopus noveboracensis	—	upland woods
Peromyscus maniculatus bairdi	—	flood plain woods
Microtus ochrogaster	—	flood plain woods
Microtus pennsylvanicus	—	upland meadow

In this study it was found that *Microtus pennsylvanicus* was caught in the greatest number, making up 63% of the total population of the upland, 82% of the dry meadow population and 100% of the upland dry meadow population.

Peromyscus leucopus noveboracensis lived in the greatest variety of habitats.

The upland was the general area that supported the largest number of mice, four of the six species and 83% of the total mice being found there.

General Conclusions:

1. The most numerous mouse was *Microtus pennsylvanicus.*
2. The best habitats for mice were in the upland.
3. The mouse with the widest distribution was *Peromyscus leucopus noveboracensis.*
4. The upland dry meadow supported the largest number of mice.
5. The upland marsh supported the greatest variety of mice.
6. The flood plain marsh was the least populated area.

ZOOLOGY

Evidence of Amitosis in Mouse Liver

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INTRODUCTION: The theory of amitosis has had a long and interesting history, and has been a proposed method of cell division almost as long as we have studied the problem of how cells divide. Hertwig, reporting in 1909, gives us a summary of the early theories of cell reproduction. Reichart, in 1847, proposed that as the time for division approached, the nucleus of the cell would break down, the nuclear membrane dissolve, with the nuclear material being dispersed equally to all parts of the cell. The cytoplasm would then constrict into two daughter cells, and following this, the nuclear material would reassemble into two daughter nuclei. This theory became accepted because it accounted for the observation that during the process of division, the cell nucleus was not present as such. Another theory, proposed by Remak in 1852, with some later modifications became the present day definition of amitosis, that is, the direct division of the nucleus, without evident separation of sister chromosomes (Brachet: 1961). According to Remak, as the cell was made ready for division, the nucleus became greatly enlarged. After attaining the macronuclear state, the nucleus would elongate and constrict in a plane which would be the plane of the later cytoplasmic cleavage. After the establishment of the daughter nuclei, the cytoplasm would cleave, resulting in two cells. This theory gained adherents mainly because it preserved the idea of the continuity of the nuclear substance.

In 1882, however, with the work of Flemming on the theory of mitosis (Hughes, 1959), both these theories faded rapidly into the background. At the present time, the essence of mitosis of the nucleus has been defined as the anaphase separation of sister chromosomes (Brachet, 1961). Since nothing of this sort occurs in amitosis, its application has been excluded from almost all types of plant and animal cell division. A recent study of amitosis in plant and animal cells has been carried out by Bucher (1959), where it was found to be almost always associated with a pathogenic condition. The amitotic theory was not completely lost, but was applied by pro-