

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

PUBLISHED BY THE UNIVERSITY

THE MAMMALS OF WARREN WOODS,
BERRIEN COUNTY, MICHIGAN

BY LEE RAYMOND DICE

Few detailed studies of the mammal associations of the forests of the United States have been made. But if we are ever to know, for our different species of mammals, the natural environments under which their evolution and differentiation occurred, we must study and describe their habitats and habitat limitations before all the native areas in the country have been altered by the activities of mankind. As a contribution to this subject the following paper is presented.

The Warren Woods are a state preserve under the Edward K. Warren Foundation. They are located in Berrien County, Michigan, about three miles north of Three Oaks. The preserve consists of about two hundred acres, of which somewhat less than half is in clearing and the remainder mostly covered by forest, much of it still nearly in its primitive condition.

The topography is nearly level, though the area is cut by a number of ravines draining to the Galien River, which flows

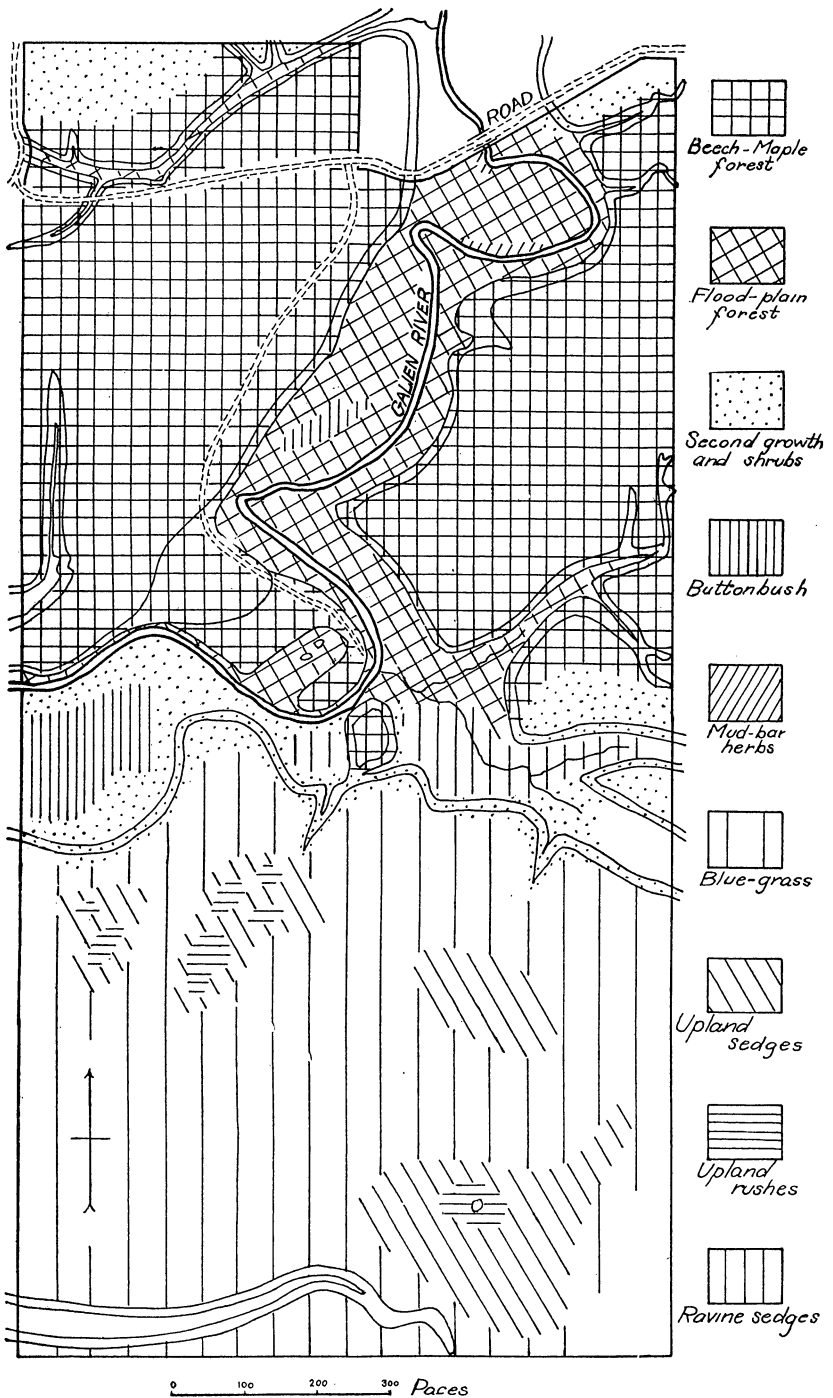


FIG. 1.—Sketch map of Warren Woods Preserve. The distribution of the various mammal habitats is indicated.

through the preserve. Along the river and in its bends there are moderate-sized flood-plains.

On the flood-plains a few small buttonbush swamps occur; and along the margins of the river a few freshly formed mud bars have not yet become forested; but most of the flood-plains are covered by heavy forest. The higher ground, except that in the clearing, is covered by heavy beech-maple forest.

Several types of habitats are represented in the clearing: in a few of the cleared ravines a thick growth of sedges and iris occurs; on the higher ground small areas are dominated by rushes, other areas by sedges, while the greater part is covered by grass. In parts of the clearing blackberries and other shrubs have grown up to form thickets, and in many places, especially along the edges of ravines, second-growth trees of oak, maple, or beech grow in the thickets or form small groves.

The mammal habitats found on the preserve may be listed as follows:

<i>Natural habitats</i>	<i>Modified and artificial habitats</i>
Aquatic habitat	Second-growth forest and scrub habitat
Buttonbush-swamp habitat	Cleared-ravine sedge habitat
Shore habitat	Cleared-upland rush habitat
Mud-bar herbage habitat	Cleared-upland sedge habitat
Flood-plain forest habitat	Cleared-upland blue-grass habitat
Beech-maple forest habitat	Cultivated field habitat
Aerial habitat	Orchard habitat
	Edificarian habitat

It is unfortunate that all of the area in clearing and about half of the forested area on the preserve has been and is being heavily pastured by cattle and horses. The presence of stock has changed the native conditions so much that, so far as interpreting the primitive mammal associations is concerned, little dependence can be placed on studies made in that portion of the preserve. The grass and herbage is extensively eaten off, and

many of the shrubs and young trees eaten or badly mutilated. Under the pastured forest little underbrush or herbage remains, and the conditions are very poor for small mammals.

In all the forest, in the unpastured as well as in the pastured part, a number of trees have been cut out in former years, and although no trees are now being cut down, all the trees and branches which fall are being cut up for firewood. This results in there being few logs and little dead brush on the ground, and removes a favorite place for small mammal nests and runways, as well as largely eliminating as mammal food the insects and larvae which are dependent on decaying wood. However, with the exception of the removal of the logs and of a few trees, that part of the forest to the north of the river is still in practically its native condition, and it shows no evidence of ever having been pastured. It is thus a splendid place for the study of the native faunal conditions.

Although the whole area in the preserve is small there are other areas of adjoining forest along the Galien River, so that, for the smaller mammals at least, the results of the study and trapping should indicate the primitive habitat distribution. The relative abundance of the different species, however, is probably much changed by the decrease throughout the whole region of the carnivores, which have been much hunted and trapped by man.

The mammals of Warren Woods were intensively studied by the author from July 3 to September 3 in the summer of 1919. A camp was maintained near the edge of the Woods, and by trapping and hunting every effort was made to determine the mammal fauna of the preserve. From one hundred to two hundred traps for small mammals and about twenty traps for the larger species were kept constantly in operation. A small amount of trapping was done in the fields and along the roadsides immediately adjoining the Woods and a few records were secured from the camp house.

The work was supported by the Michigan Geological and Biological Survey. Dr. Alexander G. Ruthven directed the work and gave much assistance in securing the needed collecting equipment. Much help was given by George R. Fox, Director of the Warren Foundation, not only in getting to and from the camp at the Woods and in numerous other courtesies, but also in information about the Woods and about the mammals there. The plant identifications were made by Mr. C. Billington.

The figures following the specific names in the lists of mammals from each habitat indicate the number of individuals trapped, shot, or seen and positively identified in that habitat.

NATURAL HABITATS

Aquatic habitat:

Mustela vison mink. Mink. Reported.

Fiber zibethicus zibethicus. Muskrat. Reported.

Mink and muskrat are reported by residents to occur in the Galien River in and near Warren Woods, but I was unable to secure any specimens though traps were set for them; neither did I see any signs of their presence.

Buttonbush-swamp habitat:

Peromyscus leucopus noveboracensis. Northern white-footed mouse. 8.

Mus musculus musculus. House mouse. 2.

A large buttonbush swamp occurs in the preserve just south of the Galien River, but around this the native trees have been cut away and over its accessible edges it has been heavily pastured, so that it is not at all in its natural conditions, and it was not trapped. In the unpastured flood-plain north of the river there is another buttonbush swamp of several hundred yards extent. This latter area was the one selected for study.

In this typical swamp the buttonbush, *Cephalanthus occidentalis*, is practically the only plant present. It thickly covers the area with its tangled branches, which grow to heights of four

to ten feet. The water had drained away in August, leaving the ground bare, though still wet and soft. Under the cover of the buttonbush there is no herbage whatever, and upon the ground there are only a few decaying logs and a few small sticks, which often carry a light growth of moss.

Around the edges of this swamp there is a narrow belt of thick herbage, closely encroached upon by the typical forest of the flood-plain.

Fifty mouse traps set in this habitat took eight northern white-footed mice and two house mice the first night, August 5.

Shore habitat:

Procyon lotor lotor. Raccoon. Tracks.

Peromyscus leucopus noveboracensis. Northern white-footed mouse. 1.

Along the shores of the Galien River a narrow strip of bare ground was exposed in July and August. The ground of this strip is mostly mud, but in a few places it is sand or gravel. Usually the habitat is narrow, but in some places it is five to ten feet wide.

Tracks of raccoon were frequent on the shore along the river. From a few mouse traps set on the bare mud shore one northern white-footed mouse was taken August 4 beside a drift log.

Mud-bar herbage habitat:

Peromyscus leucopus noveboracensis. Northern white-footed mouse. 4.

A few small recently formed mud bars occur along the Galien River in its outer bends. These bars have not yet had time to become forested, and on their outer edges nearest the river there is usually no vegetation, this part being included in the shore habitat. On their older portions next the forest of the flood-plains occurs a thick growth of herbs, several annual grasses, and rarely a willow, *Salix* sp., or a seedling tree of white elm, *Ulmus americana*, cottonwood, *Populus deltoides*, maple, *Acer rubrum* or *saccharinum*, and others of the typical flood-plain species. The vegetation during August is very thick, and reaches a height of

four to six feet. The soil is either mud or in a few places fine sand, and the ground is quite moist.

In this habitat four northern white-footed mice were trapped August 3-4.

Flood-plain forest habitat:

- Scalopus aquaticus macrurus*. Prairie mole. Ridges.
Blarina brevicauda talpoides. Short-tailed shrew. 4.
Procyon lotor lotor. Raccoon. 1.
Mustela noveboracensis noveboracensis. New York weasel. 1.
Peromyscus leucopus noveboracensis. Northern white-footed mouse. 52.
Microtus pinetorum scalopsoides. Northern pine vole. 5.
Mus musculus musculus. House mouse. 2.
Zapus hudsonius hudsonius. Hudson Bay jumping mouse. 1.
Erethizon dorsatum dorsatum. Canada porcupine. Tooth marks.
Marmota monax monax. Southern woodchuck. 4.
Sciurus hudsonicus loquax. Southern red squirrel. 4.
Sylvilagus floridanus mearnsii. Mearns cottontail. 1.

There are considerable areas of flood-plain along the Galien River, and except for the recently formed mud bars the flood-plains are heavily covered with a mixed forest in which the linden, *Tilia americana*, white elm, *Ulmus americana*, and sycamore, *Platanus occidentalis*, are conspicuous species. Under this forest there are a few small trees, but there is very little underbrush. The herbage also is sparse and, though in a few places there is a considerable growth of ferns, grasses, and sedges, and of other herbs, there are also many bare areas.

One of the significant features of the flood-plains, so far as the mammals are concerned, is the flooding to which these areas are subjected during the spring high-water. At that time the flood-plain for a number of days or weeks may be covered with several feet of water.

During the period between July 29 and August 28 a total of one hundred and seventy mouse traps set in the flood-plain forests along the Galien River took for the first nights' trapping, twenty-two northern white-footed mice and one house mouse. Short-tailed shrews, more white-footed mice, pine voles, and a jumping mouse

were secured on nights after the first. Larger traps took during the whole period one raccoon, one New York weasel, and two woodchucks. Several other woodchucks and a number of red squirrels were seen. Ridges of moles were numerous, but no specimens were secured. Tooth marks on an old, partly fallen linden were probably made, perhaps a number of years ago, by a porcupine.

Throughout the woods there are a number of small ravines. These ravines are forested with trees mostly of the flood-plain type, and there is evidence in many of the ravines, at least in their lower parts, that flooding occurs in the ravine bottom during the spring.

Fifty mouse traps set August 26 in a large ravine north of the county road took on the first day five northern white-footed mice and one house mouse. Short-tailed shrews, more white-footed mice, and pine voles were trapped on following days. Here also red squirrels and a cottontail were seen, and tracks of raccoon noted. Evidently the fauna is the same as that of the flood-plain, with which it is here included.

Beech-maple forest habitat:

- Blarina brevicauda talpoides*. Short-tailed shrew. 7.
- Procyon lotor lotor*. Raccoon. Tracks.
- Peromyscus leucopus noveboracensis*. Northern white-footed mouse. 86.
- Microtus pinetorum scalopsoides*. Northern pine vole. 5.
- Zapus hudsonius hudsonius*. Hudson Bay jumping mouse. 1.
- Marmota monax monax*. Southern woodchuck. Burrows.
- Tamias striatus lysteri*. Northeastern chipmunk. 1.
- Sciurus hudsonicus loquax*. Southern red squirrel. 10.
- Sciurus niger rufiventris*. Fox squirrel. 7.
- Sylvilagus floridanus mearnsii*. Mearns cottontail. 1.

The climax forest of the region is dominated by the beech, *Fagus grandiflora*, and the sugar maple, *Acer saccharum*. The trees in this forest are very large, so that the forest crown is high and the shade dense. Only a few small trees occur and these are mostly young beeches and young sugar maples. The

underbrush varies much in height and denseness; mostly it is quite open, so that one can easily walk through the forest, but in a few places the growth is more dense. Common members of the underbrush on the higher ground are the small beeches, sugar maples, and the spice-bush, *Benzoin aestivale*; while on the lower benches along the river seedlings of the paw-paw dominate the undergrowth. The ground is heavily covered by decaying leaves and a little dead brush and fallen branches, but nearly all the logs have been removed. Early in the spring a thick growth of herbs covers the ground, but by July the herbs are mostly gone, only a few remaining, and there are many small bare areas covered only by leaves. The soil under this forest seems to be mainly clay; in spring or after heavy rains pools of water are formed, and these remain for a long time.

Between July 21 and August 27 a total of two hundred and eighty-five mouse traps set in the upland forest took on the first nights one short-tailed shrew and thirty northern white-footed mice. In addition to these species pine voles and a jumping mouse were trapped on days after the first. One shrew was caught alive August 30, as he was running about on the forest floor at 7:30 A.M. A few tracks of raccoon were seen from time to time on the road leading through the woods. A few fresh burrows of woodchucks were noted at the edges of benches and of ravines. A few red squirrels were seen at different times and two collected. Fox squirrels were rare, being noted only a few times; Mr. Norman A. Wood also saw these squirrels on two occasions in May. One cottontail was shot, in the climax forest. Mr. Wood collected a chipmunk in the climax forest on May 15, 1918, and saw another in the same habitat in May, 1919.

Aerial habitat:

Bats were seen on a few evenings, flying about over the climax forest, and over the adjacent region, but they were extremely rare, and efforts to shoot a specimen failed.

MODIFIED AND ARTIFICIAL HABITATS

Second-growth forest and scrub habitat:

- Mustela noveboracensis noveboracensis*. New York weasel. 1.
Mephitis nigra. Eastern skunk. 1.
Peromyscus leucopus noveboracensis. Northern white-footed mouse. 5.
Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole. 4.
Mus musculus musculus. House mouse. 1.
Marmota monax monax. Southern woodchuck. 1.
Sciurus hudsonicus loquax. Southern red squirrel. 1.
Sylvilagus floridanus mearnsii. Mearns cottontail. 5.

Small trees and brush have grown up along the edges of many of the ravines in the cleared fields in and surrounding the preserve. Many of the trees are oaks, but beech and hard maple also occur, a few of them being relics from the original forest. Considerable brush is present, formed by a large variety of species. A few other small patches, especially in ravine bottoms and on floodplains have been allowed to grow up to brush and small trees. In nearly every case these areas are heavily pastured.

The conditions here included in the second-growth forest and scrub habitat are not homogeneous, but differ in each different location where the habitat is found, tree and shrub species abundant in one situation not being present in another. The habitat is usually narrow in extent, being often confined to the width of the steep ravine wall.

Owing to its poor development and uncertain characteristics no intensive trapping was done in this type of habitat. A weasel was trapped in open beech-maple-oak forest at the edge of a cleared ravine, and a woodchuck was shot in the same type of habitat. Another woodchuck and a skunk were trapped at different times in low willow brush on the banks of the river just north of the woods. Northern white-footed mice, Pennsylvania voles, and a house mouse were trapped in thick oak brush and trees alongside a road north of the woods. A red squirrel was shot in second-growth oak and aspen woods in the north part of the preserve, and they were seen in open woods along ravines.

Cottontails were noted a few times in blackberry thickets, in brush in ravines, in clearings along the river, and in beech-maple-oak forest along ravines.

Cleared-ravine sedge habitat:

- Blarina brevicauda talpoides*. Short-tailed shrew. 1.
Peromyscus leucopus noveboracensis. Northern white-footed mouse. 3.
Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole. 5.

A large ravine south of the river had been cleared of trees evidently several years previously, and it has now grown up mostly to sedges, grass, and iris in its more moist parts. Along the little brook which flows through the ravine there is a fringe of willows, and among the sedges a number of shrubs and small trees occur, mostly thorns and a few young sycamores and black walnuts.

Fifty mouse traps set in this habitat took on the first day, August 16, three northern white-footed mice and three Pennsylvania voles. More voles and a short-tailed shrew were taken on later days.

Cleared-upland rush habitat:

- Mephitis nigra*. Eastern skunk. Den.
Peromyscus maniculatus bairdii. Prairie white-footed mouse. 1.
Synaptomys cooperi. Cooper lemming-vole. 1.
Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole. 7.
Microtus ochrogaster. Prairie vole. 1.
Citellus tridecemlineatus tridecemlineatus. Thirteen-striped ground squirrel. 2.

In the shallow, poorly drained depressions of the cleared upland the vegetation is dominated by rushes, which grow in clumps and form a thick growth, reaching a height of about one meter as a maximum. At the edges of the habitat and in places not thickly covered by the rushes a growth of sedges, grasses, and moss covers the ground; but under the thickest growth of rushes the ground is bare and is evidently covered by water during a part of the year. On this upland one small pond surrounded by rushes did not dry up until late in August. In a

few places small blackberry thickets occur in the areas of rushes and dominate all other plants.

Fifty traps set in this habitat, on August 8, took on the first night one prairie white-footed mouse and one Pennsylvania vole; the prairie white-footed mouse was taken just at the edge of the growth of rushes. Other Pennsylvania voles as well as a lemming-vole, a prairie vole, and several young ground squirrels were secured on later nights by the same trap-line. A skunk den was situated in a blackberry thicket in the midst of the largest patch of rushes.

Cleared-upland sedge habitat:

Peromyscus maniculatus bairdii. Prairie white-footed mouse. 3.

Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole. 1.

Microtus ochrogaster. Prairie vole. 9.

Mus musculus musculus. House mouse. 1.

Citellus tridecemlineatus tridecemlineatus. Thirteen-striped ground squirrel. Burrows.

Sedges are dominant over a part of the cleared upland, occurring on the moist gentle slopes which are too well drained for rushes, but not in any numbers on the drier and higher parts of the upland. With the sedges there are a few grasses, and the ground is sometimes covered by a moss, but the sedges are by far the most abundant plant.

Fifty mouse traps set in this habitat took on the first night, August 15, one prairie white-footed mouse and one prairie vole. Other prairie voles and white-footed mice were taken on later nights, as well as one Pennsylvania vole and one house mouse. Burrows of the thirteen-striped ground squirrel were numerous in the sedges.

Cleared-upland blue-grass habitat:

Peromyscus maniculatus bairdii. Prairie white-footed mouse. 12.

Mus musculus musculus. House mouse. 1.

Citellus tridecemlineatus tridecemlineatus. Thirteen-striped ground squirrel. 23.

The most widespread habitat of the cleared upland on the south part of the preserve is the blue-grass habitat. In this

habitat the blue-grass, *Poa*, is the dominant plant, growing to a height of usually not over 0.5 meter. With the blue-grass are associated a few thistles, yarrow, and several other herbs. During the whole period of my stay in the region, July and August, the habitat was very dry, and the grass and herbs had mostly dried up. This habitat and all the other habitats of the clearing were being heavily pastured by stock.

Trap-lines totaling one hundred mouse traps, set on August 6 and August 18, took on the first nights two prairie white-footed mice, one house mouse, and one young thirteen-striped ground squirrel. More white-footed mice were taken on later nights. Many ground squirrels were taken in larger traps at the mouths of their burrows; most of these were young of the year, and all of them were very fat in preparation for their approaching hibernation.

Cultivated field habitat:

- Scalopus aquaticus machrinus*. Prairie mole. 1.
- Peromyscus maniculatus bairdii*. Prairie white-footed mouse. 23.
- Microtus ochrogaster*. Prairie vole. 1.
- Mus musculus musculus*. House mouse. 2.
- Sylvilagus floridanus mearnsii*. Mearns cottontail. 2.

Cultivated fields occur throughout the region about the woods, but the only ones in which trapping was done were wheat stubble-fields. After the wheat was cut off these stubble-fields grew up rather thickly to weeds. On the ground there were a number of fallen heads of wheat and some shelled-out grain, furnishing abundant food for mice.

Seventy mouse traps set in a wheat stubble-field just north of Warren Woods, caught on the first nights, August 13 and August 29, sixteen prairie white-footed mice. Other white-footed mice and two house mice were taken on later nights. Several cottontails were seen in this field, and a few mole ridges were noted. A prairie mole was taken by Clifford Reid in a grassy patch at

the edge of a garden. In another wheat field the Helming boys picked up a prairie vole.

Orchard habitat:

Peromyscus leucopus noveboracensis. Northern white-footed mouse. 1.
Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole. 2.

No especial study of the mammal life of the orchard was made, and no intensive trapping was done in the habitat. However, the orchard cannot be included in any of the other habitats recognized in the region.

A northern white-footed mouse was caught alive by the Helming boys in an orchard on July 16. A vole was seen to cross a road in a small orchard on July 15; a trap was set and two Pennsylvania voles secured, one a young of the year.

*Edificarian habitat:*¹

Blarina brevicauda talpoides. Short-tailed shrew. 1.
Peromyscus leucopus noveboracensis. Northern white-footed mouse. 2.
Rattus norvegicus. Norway rat. 4.
Mus musculus musculus. House mouse. 22.
Sylvilagus floridanus mearnsii. Mearns cottontail. 2.

From time to time a few traps were set in the old farmhouse and in the barn and other outbuildings of our camp. In these buildings northern white-footed mice, Norway rats, and house mice were taken. Several cottontails were seen in and under the old barn. The Helming boys trapped a short-tailed shrew and also house mice and a white-footed mouse in the basement of their house.

RECORDS OF THE NUMBER OF EMBRYOS

All the females taken were examined for embryos, and the results are here tabulated by species and dates. The term *sub-adult* is used to indicate an individual which has reached adult size, but which is still immature as shown by the pelage, unworn

¹ L. R. Dice, *Occasional Papers, Mus. Zool.*, No. 65.

condition of the teeth, and weakness of the skull sutures. For each individual the age is first stated, next the number of embryos if any, and last the length of the embryos in millimeters measured as they lie rolled in the fetal membranes. For embryos too small to measure with field equipment the term *small* is applied.

These records indicate the breeding period of the different species and the number of young.

Mephitis nigra. Eastern skunk

August 19: subadult, 0 embryos.

Peromyscus leucopus noveboracensis.

Northern white-footed mouse

July 16: adult, 3 embryos, size small.

July 21: adult, 0; adult, 0.

July 22: adult, 5, 10.5 mm.; subadult, 0.

July 23: subadult, 0.

July 25: juvenile, 0; juvenile, 0; juvenile, 0; subadult, 3, small.

July 30: adult, 0; adult, 0; adult, 0; subadult, 0.

August 2: adult, 0; subadult, 2, small; subadult, 0; subadult, 0.

August 5: adult, 5, small; subadult, 0.

August 23: subadult, 0; adult, 5, 10 mm.

August 24: adult, 5, 8 mm.; adult, 0; adult, 0; adult, 3, small.

August 25: adult, 5, 23 mm.; adult, 0; adult, 4, small; adult, 3, small.

August 26: subadult, 4, 8 mm.; adult, 0.

August 29: adult, 4, 17 mm.

Peromyscus maniculatus bairdii. Prairie

white-footed mouse

August 7: subadult, 0.

August 10: adult, 5, 8 mm.

August 13: adult, 3, 8 mm.; adult, 0.

August 20: adult, 5, small.

August 28: adult, 4, 17 mm.; adult, 4, 13 mm.

August 29: adult, 5, 17 mm.

August 30: adult, 0; adult, 4, 11 mm.

Synaptomys cooperi. Cooper lemming-vole

August 11: adult, 2, 10 mm.

Microtus pennsylvanicus pennsylvanicus. Pennsylvania vole

July 15: adult, 4, not measured; juvenile, 0.

August 9: subadult, 0.

August 10: subadult, 0; subadult, 0.

August 13: subadult, o.
 August 16: adult, o.
 August 24: adult, 4, 11 mm.

Microtus ochrogaster. Prairie vole

July 25: juvenile, o.
 August 15: adult, 4, small.

Microtus pinetorum scalopsoides.
 Northern pine vole

July 22: juvenile, o.
 July 25: juvenile, o.
 July 31: adult, o.

Rattus norvegicus. Norway rat

July 11: adult, 7, 37 mm.
 July 12: adult, 9, 26 mm.
 July 14: juvenile, o.

Mus musculus musculus. House mouse

July 9: subadult, o.
 July 10: juvenile, o; subadult, o.
 July 11: adult, o (was nursing 3 or more half-grown young).
 July 17: adult, 11, 6 mm.
 July 22: adult, 7, 3.5 mm.

Zapus hudsonius hudsonius. Hudson Bay jumping mouse

July 27: subadult, o.

Marmota monax monax. Southern woodchuck

July 11: adult, o.
 July 28: juvenile, o.
 August 3: adult, o.
 August 22: juvenile, o.

Citellus tridecemlineatus tridecemlineatus. Thirteen-striped
 ground squirrel

August 14: adult, o.

Sciurus hudsonicus loquax. Southern red squirrel

July 24: adult, o.
 July 27: juvenile, o.

Sciurus niger rufiventer. Fox squirrel

August 11: subadult, o.

Sylvilagus floridanus mearnsii. Mearns cottontail

July 21: adult, 4, 70 mm.

NEW STATE RECORD OF THE PRAIRIE VOLE

The specimens of prairie vole, *Microtus ochrogaster*, listed above from the sedges and rushes of cleared upland in the Warren Woods preserve and from a nearby wheat field constitute the first authentic record of the species from Michigan. The prairie vole had previously been erroneously reported to be abundant in Washtenaw County by Covert², who evidently mistook the Pennsylvania vole for this species.

OTHER MAMMALS OF THIS REGION

The following notes on mammals formerly or at present living in the region but not found by me in Warren Woods are based mostly on information furnished by George R. Fox, Director of the Edward K. Warren Foundation, and by William Schmidt, a trapper and hunter.

Didelphis virginiana virginiana. Virginia opossum. Three were seen and one captured in Three Oaks in the winter of 1919-20, and another was found in a granary on the outskirts of the town. The previous winter one was shot just southwest of town, and another was seen in a ravine north of Harbert. One was killed in Warren Woods some time ago.

Condylura cristata. Star-nosed mole. Mr. Hans captured one four miles south of Three Oaks, near the Indiana line in 1919, and brought the skin to Mr. Fox. One was taken by Dr. Parker at Lakeside in June, 1919.

Ursus americanus americanus. Eastern black bear. Formerly occurred in the region.

Canis lycaon. Timber wolf. About eleven years ago three were killed from a pack of nine wolves at Lakeside. About 1910 a pack of eight were seen at various times during the winter on

² Adolphe B. Covert, *Natural History—History of Washtenaw County*, p. 194. 1881.

the marsh between Three Oaks and Galien. The following winter the same pack, or another of the same number, was seen southwest of Three Oaks, and four of the pack were killed just over the Indiana line.

Vulpes fulva. Eastern red fox. Common in the region. One was killed in December, 1919, after having been chased from the Warren Woods by dogs. Another was seen in January, 1920, half a mile north of Three Oaks. In preceding winters a number have been killed south of Sawyer where they evidently come from the sand dunes.

Lutra canadensis canadensis. Canada otter. Formerly occurred along the streams, but are now apparently all gone.

Felis couguar. Cougar. One was killed a few miles northeast of Three Oaks many years ago. Another was killed near New Buffalo in the early days.

Lynx ruffus ruffus. Bobcat. One was killed a few years ago near the Galien River a few miles northeast of Three Oaks.

Erethizon dorsatum dorsatum. Canada porcupine. Found here in the early days.

Sciurus carolinensis leucotis. Northeastern gray squirrel. Black squirrels were found in numbers in the early days.

Glaucomys volans volans. Eastern flying squirrel. Said to be common. A large number were seen by Mr. Schmidt on one old stub in Warren Woods some years ago. Several were seen in 1918 by Mr. Fox in second-growth oak woods in a little ravine about one and one-fourth mile west of Warren Woods. One was caught in Three Oaks in the fall of 1919.

Cervus canadensis canadensis. American elk. One horn from a large swamp in Berrien County is in the Chamberlain Memorial Museum of Three Oaks.

Odocoileus virginianus borealis. Northern white-tailed deer. Formerly abundant in the region. Several molars were picked up in Warren Woods.

FOSSIL MAMMALS OF BERRIEN COUNTY

The records of fossil mammals from Berrien County here published have been collected by George R. Fox, who has also kindly loaned from the collections under his care several specimens for identification. Dr. E. C. Case assisted with the identification of the mammoth teeth.

Mammot americanum. Mastodon. (1) About 1897 the teeth of a mastodon were dug up by a dredge within the village limits of Eau Claire. Their disposition is unknown.

(2) At Snow, in section 36, Lake Township, a tooth was found. This came into the possession of Frank Striker of Buchanan.

(3) A portion of a tusk and part of a skull were found on the Beebe Farm near Baroda. These were sent to Washington, D.C.

(4) In the excavation of a ditch through a small marsh lying near Bakerstown in Section 3, of Bertrand Township, the dredge uncovered in the distance of between two and three miles bones, teeth, and other evidences of six mastodons. Of these remains the most important was a nearly complete skull with teeth in place and disintegrated parts of the tusks. The skull was secured by Dr. E. H. Crane, who restored parts; the tusks he did not attempt to restore. This skull is now on exhibition at the Ward Museum, Rochester, New York.

The skull lay about seven feet deep. It was under a bed of matted oak brush on top of which lay a huge stone slab, estimated to weigh two or three tons. Above was a layer of silt, then gravelly clay; above were more silt beds, three in number. W. Hillis Smith, who helped Dr. Crane secure the skull, furnished the above information.

(5) On the Avery marsh, two miles east of Three Oaks, a badly decayed mastodon skull and several teeth were excavated in 1884. Dr. Bonine, Sr., of Niles, assisted at the excavation. The bones and teeth were in the muck about twenty inches below the surface. Other teeth, making seven in all, were found near

the same place. Some of the teeth from this locality are on exhibition at the Chamberlain Memorial Museum of Three Oaks.

In addition to the above there are several indefinite records of mastodon remains from the county.

Elephas columbi. Columbian mammoth. (1) One-half of the tooth of a mammoth was found in the spring of 1917 on the Beeson and Holden farm in Section 6, NE. $\frac{1}{4}$, Township of Galien, by D. H. Beeson while cultivating corn. Two weeks later the other half of the tooth was found. The specimen is now in the Chamberlain Memorial Museum of Three Oaks.

The specimen is a well-worn lower third molar having twenty ridge-plates, but some of the ridge-plates have been worn out and lost. Seven and a half ridge-plates are included in a 100 mm. line. The greatest length of the tooth is 280 mm. and its greatest breadth 95 mm.

(2) A complete set of mammoth teeth with some portions of the bones was found about the year 1900 on a farm two miles southeast of Three Oaks owned by E. K. Warren. They were discovered while digging post holes. The specimens are on exhibition in the Chamberlain Memorial Museum.

One of the teeth sent us for identification proves to be a partly worn lower third molar having twenty-four ridge-plates. There are seven and a half ridge-plates in 100 mm. The greatest length of the tooth is 350 mm. and its greatest breadth 95 mm.

(3) There is another record of a mammoth tooth which was found at an unknown location in Berrien County. It was at one time owned by Mr. Smith, who gave it to Dr. Crane. Its present whereabouts is unknown.

PLATE I

A mud bar beside the Galien River in Warren Woods. A growth of mud-bar herbs adjoins the flood-plain forest on the left. August 29, 1919.

Flood-plain forest in Warren Woods. There are few shrubs; but a considerable amount of herbage is present. August 29, 1919.



PLATE II

Buttonbush swamp in Warren Woods. The swamp is surrounded by flood-plain forest. August 29, 1919.

Climax beech-maple forest on the higher ground in Warren Woods. August 29, 1919.

