U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY

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No. 49

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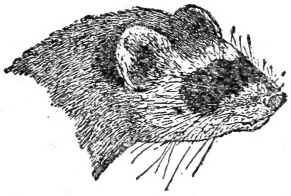

A BIOLOGICAL SURVEY OF NORTH DAKOTA

I. PHYSIOGRAPHY AND LIFE ZONES
II. THE MAMMALS

BY

VERNON BAILEY

BIOLOGIST

DIVISION OF BIOLOGICAL INVESTIGATIONS

BUREAU OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

NORTH AMERICAN FAUNAS

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(Continued on page 3 of cover)

LIFE ZONES OF NORTH DAKOTA

BY VERNON BAILEY

BUREAU OF BIOLOGICAL SURVEY

U. S. DEPARTMENT OF AGRICULTURE

CANADIAN ZONE

TRANSITION ZONE

UPPER AUSTRAL ZONE

Scale of Miles: 10 0 10 20 30 40 50

Longitude West from Washington

Longitude West from Greenwich

DOMINION OF CANADA

SOUTH DAKOTA

MINNESOTA

NORTH DAKOTA

MONTANA

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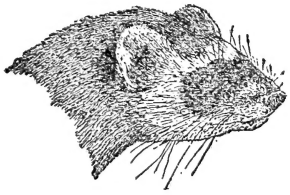

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., December 11, 1925.

SIR: I have the honor to transmit herewith, recommending that it be published as No. 49 in the series of the North American Fauna, a report on the biological survey of North Dakota, prepared by Vernon Bailey, biologist of this bureau. This report is in two parts, the first treating of the physiography and natural life zones of the State, accompanied, as in similar reports, by a map of the life zones; and the second, the mammalian life, consisting of notes on the distribution, abundance, and habits of the mammals of the State. Both are based on natural-history explorations conducted by the bureau and cooperating State organizations in North Dakota over many years, the work on the mammals having begun in 1887, and preliminary reports thereon having been published in the annual report of this bureau in 1888, when it was known as the Division of Economic Ornithology and Mammalogy, and in a circular of the North Dakota Agricultural Experiment Station, in 1914, the latter being in the nature of a cooperative report of progress and an appeal for additional local detailed information. The present report comprises a valuable contribution to knowledge and will be useful to farmers, students, and others interested in the distribution, habits, and economic relations of our wild-animal life.

Respectfully,

E. W. NELSON,
Chief of Bureau.

Hon. W. M. JARDINE,
Secretary of Agriculture.

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A BIOLOGICAL SURVEY OF NORTH DAKOTA

By Vernon Bailey

INTRODUCTION

In the preliminary survey of the wild life of North America information has been gathered on the birds and mammals of the country at large, and provisional maps of the life zones of the continent and subdivisions of it have been published. Much of the general information gathered on birds and mammals has been given in bulletins, circulars, and annual reports. The present publication is prepared in accordance with the general plan of providing for definite subdivisions more detailed information on the natural life zones and on the distribution and habits of the native species of birds and mammals. Part I discusses the life zones of North Dakota and Part II the mammals of the State. The publication of the report on the birds will be arranged for separately.

The field work on which this report is largely based has been carried on in North Dakota by the Biological Survey at intervals from the year following its first organization as the Division of Economic Ornithology and Mammalogy in 1886. In 1912 a definite plan of cooperation for covering the State comprehensively by field work and for gathering the specimens and notes necessary for a better understanding of the animal life was entered into between the Biological Survey and organizations in North Dakota, including the State university, the agricultural experiment station, the agricultural and geological survey, and other State educational institutions. Under this plan field work was carried on each season during the subsequent four years.[1] In addition to the Biological Survey material, the collections of specimens at the agricultural college at Fargo and of those at the biological laboratory at Devils Lake, with the many field notes and reports gathered in connection with these, have been freely drawn upon in the preparation of this report.

The Flora of North Dakota, by Herbert F. Bergman (1918), published in the Sixth Biennial Report of the North Dakota Soil and Geological Survey, has been of great assistance in the preparation of the life-zone report and the map. Also, free use has been had of

[1] The field work of the Biological Survey was carried on with the assistance of H. E. Anthony, Alfred Eastgate, Stanley G. Jewett, Remington Kellogg, J. Alden Loring, Edward A. Preble, H. H. Sheldon, and H. V. Williams. In 1893 A. K. Fisher made a trip across the State and collected specimens and important mammal notes. The field work of the agricultural college was done by W. B. Bell, assisted by U. S. Ebner, H. V. Williams, and other students at the college. At the State university the work was begun by M. A. Brannon, with the assistance of Alfred Eastgate, and later continued by R. T. Young.

a manuscript report on the Geographical Distribution of North Dakota Plants, by O. A. Stevens, of the agricultural college.

Important material was obtained from notes and records from the private collections of Morris J. Kernall, of the normal school, at Valley City; of Alfred Eastgate, of the fish and game commission, at Devils Lake; of H. V. Williams, taxidermist, at Grafton; of O. J. and M. C. H. Murie, of Moorhead, Minn.; and of other local naturalists. Much valuable information has also been gathered from ranchers and other residents of the State, and especially from early settlers familiar with conditions during pioneer days.

Of published reports consulted, there may be mentioned the following: The journal of Alexander Henry, the Younger (1897), in charge of the Northwest Company's trading posts in the Red River Valley from 1800 to 1808, edited by Elliott Coues and published in 1897; Lewis and Clark's (1893) journals of their trip up the Missouri River through North Dakota, in 1803 and 1804, edited by Doctor Coues in 1893; Maximilian's (Wied, 1839–1841) journal and notes made during his trip up the Missouri River through North Dakota in 1833, his wintering at the Mandan villages, and his return journey in 1834; John James Audubon's journals of his trip up the Missouri River to Fort Buford in 1843, edited in 1897 by his granddaughter, Miss Maria Audubon, and Doctor Coues; and also Audubon and Bachman's Quadrupeds of North America, in which many of Audubon's North Dakota notes were first published in 1851.

Elliott Coues, naturalist of the Northern Boundary Survey, in crossing the northern part of the State in 1873, collected many specimens and has included his records in various monographs and publications. J. A. Allen (1875, pp. 33–44), as naturalist of the North Pacific Railroad Expedition of 1873, traveled from Fort Rice, on the Missouri, west to the Yellowstone River in Montana and returned by nearly the same route, and published a list of the mammals observed. Col. Theodore Roosevelt (1900, 1919), from his cattle ranch in the Little Missouri Badlands (1884 to 1886), gave a full and delightful account of the game and natural history of the region in his "Hunting Trips of a Ranchman," "Hunting Trips on the Prairie," and "Hunting the Grisly." Ernest Thompson Seton, in his "Mammals of Manitoba" (1886), and later in his "Life-histories of Northern Animals" (1909), has included many important notes from the State. All these publications have been consulted.

In C. Hart Merriam's Report of the Ornithologist for 1887, there is a summary of Bailey's (1888) field notes of the year, taken on a trip from Fargo to Pembina, Devils Lake, the Turtle Mountains, and Fort Buford. In 1914 a brief preliminary report on the Mammals of North Dakota, by the writer (1914), collaborating with W. B. Bell, then of the agricultural college, and Melvin A. Brannon, of the State university, was published as Circular No. 3 of the North Dakota Agricultural Experiment Station. This was largely in the nature of an appeal for additional information on the mammals of the State.

PART I.—PHYSIOGRAPHY AND LIFE ZONES OF NORTH DAKOTA

CHANGING CONDITIONS

North Dakota, like other great prairie States, has rapidly changed in character from a country of native grassland and abundant wild life to one of rich grainfields unsuited to wild life and from which much of it is being banished. With the ever-increasing diversity of crops and livestock and with more intensive methods of agriculture, the new conditions are being advanced, and some of the most desirable native species of both animals and plants are disappearing, while many of the undesirable are holding their own or increasing in numbers. These conditions are accompanied by many problems of animal protection and control, the wise solution of which depends largely upon our knowledge of the species in the past and present, and especially of their habits, distribution, and environment.

GENERAL PHYSIOGRAPHIC FEATURES

The surface of the State, while generally classed as prairie or plains, varies from vast level stretches and rolling hills to buttes, badlands, and mountains.

Glacial Remains

In the Red River Valley, formerly occupied by the waters of Lake Agassiz, the prairie is comparatively level and often stretches away beyond the horizon without a ripple on its surface (Pl. 2). Over much of the State, however, the prairie is irregular, hilly, and undulating, forming what in the common phrase of the country is called "rolling prairie." This hilly configuration is due to the enormous deposits of glacial drift made during the advance and recession of the great ice sheets, which at different times covered a large part of the State. The ridges, hills, hollows, and lake basins formed by the ice sheets where they dumped their moraines of soil and bowlders in scattered heaps and long ridges, have been subjected to the rounding and leveling influence of the elements until the surface often suggests the billowy swells of midocean. Great numbers of marshes, sloughs, and lakes occupy the basins scooped out by the ice and often are left without possible drainage. The extensive inland lakes thus formed have disappeared in some cases and have left level areas of rich alluvial bottoms.

The later ice sheets stopped before reaching the Missouri River, piling up great terminal and lateral moraines along the northern and eastern margin of the river valley, still marked by the series of buttes and ridges known as the Coteau de Missouri, but one of the earlier sheets pushed across and unloaded its bowlders and débris

well up the valleys to the west. This sheet was evidently of no great duration, for the course of the river was not materially changed. Over most of the country west of the river there is little trace of ice action, and the water-carved buttes of the Badlands stand high and sharp, with their flat tops dating back far beyond the glacial period.

While the great Missouri River flowing through the State defied this early continental ice sheet, resuming its course when this receded, and not being reached by the later ones, the streams east of it were greatly modified, and some were wiped out of existence by ice action. Those flowing northward were first blocked by the ice and forced to overflow to the south. Then, after deep channels had been cut and the sheet had receded, some returned to their old northward courses and drew back old tributaries, while others cut new channels in other directions or were blocked and filled until only chains of lakes remained.

Lowered Water Levels

The country east of the Missouri River is generally well watered, but the greater part of the surface water is standing in numerous lakes and sloughs rather than flowing in the limited drainage system. Many of the smaller sloughs and marshes have been drained and converted into rich agricultural land and many have dried up in recent years. Since the cultivation of the soil a great shrinkage of the lakes and streams has taken place. Where formerly the water ran quickly from the firm prairie turf into the streams and hollows, both the rain and snow water are now absorbed by the mellow surface of the plowed land. This absorption distributes a greater quantity of water through the soil, and at the same time the more extensive evaporation surface increases the humidity of the climate. A striking illustration of the decrease in the water levels is shown at Devils Lake, which at the time of the early settlement of the region in 1887, had a steamboat landing close to the town of the same name. In 1920 the water had receded about 2 miles from the town, and since 1879 the level has fallen approximately 18 feet. Many of the smaller lakes have disappeared, and the smaller streams are shrinking. The disappearance of the prehistoric glacial lakes, Agassiz (now the Red River Valley), Souris (now the Mouse River Valley), and Sargent (now the general district of the county of the same name), was due not to a decrease in humidity nor to absorption of rainfall, but to the opening of a direct drainage into Hudson Bay after the recession of the last ice sheet.

Drainage Systems

The present drainage of North Dakota lies mainly in four well-defined systems (see map, Plate 1): (1) In the southwest, the Missouri River, with its main western tributaries, the Yellowstone, Little Missouri, Heart, and Cannonball, pouring its waters eventually into the Mississippi and the Gulf of Mexico; (2) in the southeast, the Dakota, or James, River, which joins the Missouri in Nebraska; (3) in the east, the Red River of the North with its main western tributaries, the Sheyenne and Pembina, flowing northward into Lake Winnipeg and eventually reaching the waters of Hudson

FIG. 1.—SHORT GRASS PRAIRIE OF WESTERN NORTH DAKOTA, SHOWING GRAINFIELDS AND PRAIRIE GRASS TO THE FAR HORIZON

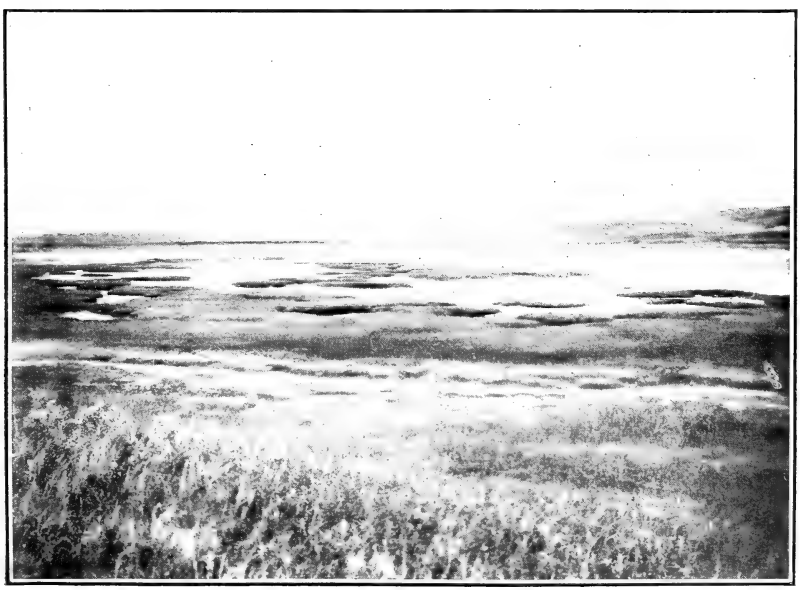

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FIG. 2.—PRAIRIE SLOUGH AND GLACIAL RIDGE OF CENTRAL NORTH DAKOTA, CHOICE BREEDING GROUNDS OF NATIVE WATERFOWL AND HOME OF THE MUSKRAT

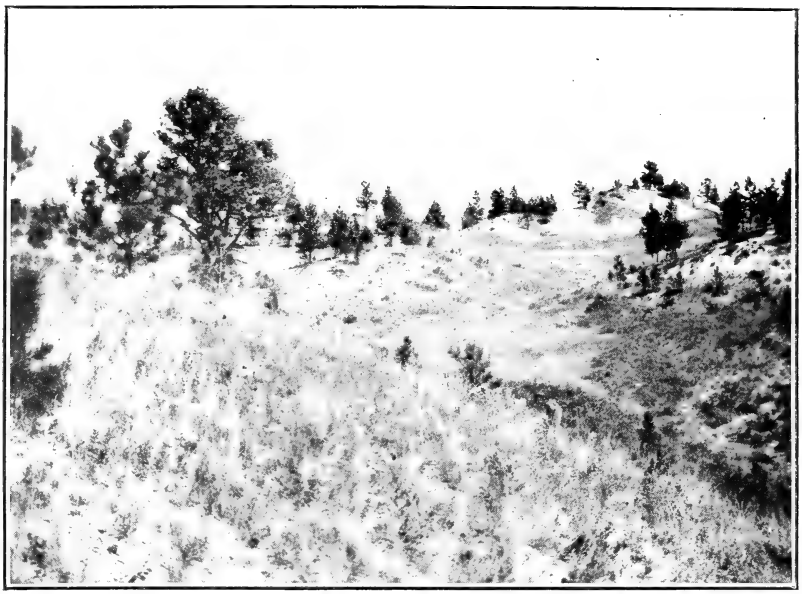

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FIG. 1.—YELLOW PINES ON BUTTES SOUTH OF MEDORA

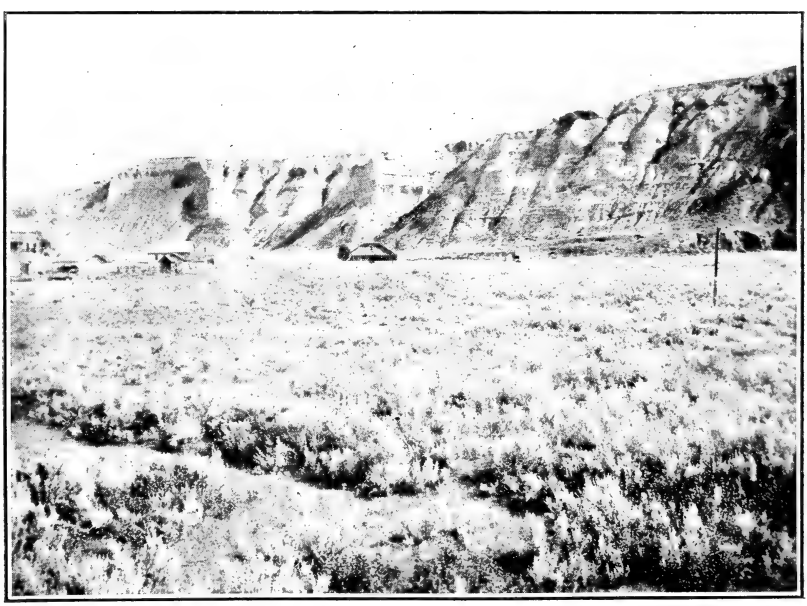

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FIG. 2.—BADLANDS AND SAGEBRUSH AT MEDORA

Bay; and (4) in the north, the Mouse or Souris River, with its chief tributary, the Riviere des Lacs, making a deep loop into the State and then turning north and east to join the Assiniboine in Manitoba.

Elevations and the Badlands

The variation of altitude within the State is comparatively slight and gradual, ranging from 753 feet above sea level on the Red River at Pembina, in the northeastern corner, to 3,463 feet on Black Butte, in the southwestern corner. The Turtle Mountains, midway of the northern boundary, are merely high moraine-covered hills, the greatest altitude being about 2,500 feet, while the highest point of the Pembina Hills, to the east, is given as 1,660 feet. West of the Missouri River, with a high-water mark near Bismarck of 1,646 feet, the country rises to a prairie level at Dickinson of 2,411 feet; at Sentinel Butte, 2,711; at Beach, 2,759; and at Summit, between the last two localities, 2,830 feet, while numerous buttes over the surface of the prairie rise only a few hundred feet higher. The Killdeer Mountains, a group of rounded hills with timber and brush in the gulches, lying in the bend of the Little Missouri northeast of Medora, are but a part of the Badlands plateau, rising about 700 feet above the surrounding prairie.

The great stretches of prairie west of the Missouri River show their age in the flat-topped ridges and wide sloping valleys of a lakeless and deep and well-worn drainage system. The greater part of this area is composed of level prairie or gentle slopes well suited to agriculture, but there are great numbers of sharp or flat-topped buttes or groups of buttes rising above the general surface, numerous deep ravines cutting through to lower levels, and brush or tree fringed streams tracing the bottoms of the valleys (Pl. 3). For a long time the region was considered too arid for uses other than stock raising, but with the improved farming methods of recent years demonstrating its value for grain and other crops, it has rapidly filled up with enterprising farms and towns. Most of the area is good farmland, but there are some parts so rough and steep that they can never be cultivated, and these will long remain in a primitive condition. These are the "Badlands" (Pl. 3).

The Badlands of the Missouri Valley and westward are not only a striking feature of the landscape, but they are of interest to the student of wild life, as they have had a marked influence on the distribution of species. They are most conspicuous and picturesque along the Little Missouri River Valley, but also occur in marked form along the banks and bluffs of the Missouri above the mouth of the Little Missouri, and especially from Little Knife River westward.

The presence of the Badlands is due to the reduced rainfall in this western part of the State, together with peculiar geological formations, soft rock, beds of lignite coal, the bright-colored scoria, and mineral-laden beds of clay with generally a dry, baked surface, which quickly sheds the little rain that falls. In texture as well as in form the land is in striking contrast with the glacier-plowed rolling prairies east of the river. Underneath the surface soil the older strata are generally impervious to water.

In form, the Badlands are characterized by flat-topped or rounded buttes, abrupt walls, benches, terraces, and bottomland flats. In their most typical and picturesque form they are found along the steep slopes of the stream valleys, where their bare walls are carved and eroded into grotesque and striking shapes, suggesting ancient ruins. In many places the Badlands banks are too steep to be climbed even by mountain sheep, except on well-known and well-worn trails leading from shelf to shelf. When wet the alkaline slopes are as slippery as a piece of wet soap, and are then of necessity avoided by man and beast.

The steep slopes are generally devoid of vegetation, but the benches and flat tops are usually covered with the finest grasses, and many of the gulches are filled with dense tangles of brush and scrubby timber. The colors in the Badlands are in places as brilliant as those of the Painted Desert of Arizona, ranging from broad black bands of lignite coal, through the grays, browns, and yellows of various clay formations, and the bright brick-red and pink beds of scoria, to the brown or gray or chalky white of sandstone and limestone cliffs. Usually from the top of the cliffs and walls the level prairie stretches away to the far and treeless horizon.

Geologically the Badlands are ready-made cross sections of the earth's surface. For untold ages their strata were deposited in deep or shallow waters, along shores and estuaries, or in marshes and forests, layer after layer, each of which embedded and preserved in some form the plant and animal life of its time. Great logs and stumps of petrified trees crop out in places along the banks or lie scattered over the flats below, while fossil bones, teeth, and shells of ancient types of animal life are often found in abundance. Even at the present day the cliffs, caves, and gulches, and the sheltered valleys, warm nooks, and corners of these Badlands harbor many species of native animals that otherwise would not be found within the borders of the State.

Probably no area in North Dakota is better suited for game refuges and parks than the Killdeer Mountains. The need is not so great for the present as for 20, 50, and 100 years hence. The mountains stand on the edge of the Badlands like a cool, green, rugged island in the midst of a great prairie region of rich soil, good farms, good roads, and a good beginning toward a future teeming population. On pleasant Sundays 50 to 100 automobile parties even now visit the mountains for picnics in the cool shade, for drafts of pure, cold water, the sight of strange flowers, plants, trees, birds, and mammals, rugged climbs, and a glorious view over wide country. With greater attractions of native animals, well-selected picnic and camping grounds, and trails to the points of interest, the visitors would to-day number thousands instead of hundreds, and in a few years hard-working farm people and tired city people from all over the State would find an easily available health and pleasure ground.

The Turtle Mountains represent another type of country with a strong bearing on the distribution of animal life. Although merely a group of high, rough, glaciated hills, alternating with hollows and lakes, they stand up from the surrounding prairie dark and timbered in inviting contrast with the boundless open expanse. Their charm is not so much in height or roughness as in the oasis of forest and the

beautiful forest-bordered lakes which they offer in the midst of a great prairie region (Pl. 4). This timber body is practically isolated except for a scattered and broken connection eastward along the streams and hills to the strip of timber along the Red River. Fortunately much of the land is rough, steep, and stony, and so covered with scrub timber that it is not likely to be cleared off in the near future. Its chief value is for game refuges and for fishing and recreation grounds.

Prairie

The one striking feature of the country is the original boundless grassland prairie, which at the present time is largely under cultivation in almost equally boundless fields and crops. Over much of the State the uncultivated areas are coming to be so restricted that game birds have difficulty in finding suitable nesting places outside of the fields, while some of the mammals are equally shut out and others have taken up quarters within the cultivated areas, where they cause serious damage to crops.

Forest

The native forest of North Dakota may be placed in three groups—the Minnesota type, the Missouri-River type, and the Rocky-Mountain type.

The eastern or Minnesota type borders the streams in the Red River Valley, covers the Pembina Hills and Turtle Mountains, and skirts the snowdrift borders of the larger lakes, such as Devils Lake, Stump Lake, and the Sweetwater Lakes. (Pl. 5.) This consists mainly of a moderate growth of deciduous trees, such as American elm, red elm, white ash, boxelder, bur oak, ironwood, basswood, aspen, balsam poplar, and cottonwood, and such shrubs as hazel, alder, serviceberry, chokeberry, pin cherry, cornel, and rose.

The Missouri-River type is found along the Missouri and Little Missouri River bottoms and consists largely of the broad-leaved cottonwood, many willows, and scattered boxelder, elm, ash, buffaloberry, shrubby dogwoods, and flowering currants. (Pl. 6.)

A trace of the third type of forest is found in the Badlands and over the higher buttes along the Little Missouri River, where in places the Rocky Mountain yellow pine and Rocky Mountain juniper grow in considerable abundance and the western birch and shrubby cinquefoil come into the Killdeer Mountains.

Though more or less mixed, these three groups indicate types of climate and soil conditions that to some extent govern the distribution of the animal life. The forest growth is very restricted, covering only a small part of the surface of the State, lying mainly in narrow strips along the banks of streams, on the edges of lakes, in the gulches and on the steep slopes of the mountains and bluffs, where deep snowdrifts lie late into the spring. It is of great importance, however, not only for the use of the present inhabitants, but for the influence it has had on animal life, in the shelter, protection, and food afforded, without which many of the species would have been excluded from the State.

In its restricted range along the immediate stream courses and in gulches and valley bottoms, the native forest is often hidden, and at a distance is less conspicuous than the planted groves scattered over the prairie. At the present time the artificially planted plots far exceed the native forests of the State both in abundance and in value. These, too, are beginning to show a marked influence on the distribution of species, attracting to the vicinity of homes many birds and mammals that otherwise would be absent. Thus physiography, forest and plant distribution, soil, and climate all bear a vital relation to the problems involved in a study of the animal life of the State.

LIFE ZONES OF NORTH DAKOTA

In a comparatively level prairie country there are no striking contrasts in the distribution areas, and the life zones blend almost insensibly into each other. The greater part of North Dakota lies in the Transition Zone, which, in crossing the continent as a broad band between the warm Upper Austral (Sonoran) and the cold Boreal Zones, spreads to its greatest width over the northern prairies of the Dakotas, Montana, and Saskatchewan. (See Plate 1.) It so nearly covers North Dakota that many of its species are found scattered over the limited areas of both the Canadian Zone of the Turtle Mountains on the north and the narrow tongues of Upper Austral Zone thrusting into parts of the Missouri River Valley from the south and west. These restricted areas of the Austral and Canadian Zones, however, are sufficiently marked to be of importance in giving to the State a wider range of crop, timber, and animal adaptations, and an interesting diversity of living conditions. For the best development of a State, it is necessary that every climatic and physiographic advantage be fully understood.

Upper Austral Zone

The Upper Austral Zone, the Upper Sonoran, or semiarid subdivision of which penetrates only into the warmest corners of the State, is in no part sufficiently extensive to be marked by entirely characteristic mammals, birds, or plants. In its narrow strips along the Missouri Valley below Bismarck, down the Missouri and Yellowstone Valleys to Williston, along the Little Missouri Valley above the Killdeer Mountains, and on many dry, warm slopes between these areas, it is strongly characterized. So near the edge of a zone, however, the slight inclination of a slope to the north reduces the heat received from the sun's rays sufficiently to change the flora and fauna in part or wholly to that of the colder, higher zone, while a steep slope facing the direct rays of the sun will attract many species of the warmer, lower zone above their normal limits. Hence, in a rough and broken country on the border of the two zones, conditions are so complicated and often confusing that the areas can be mapped in only a very general way.

In a study of the zones in this region the slope exposure and the heat-absorbing qualities of the surface (surface cover) are found more important than actual altitude, since the gradual increase in base level westward does not tend to lower the zones and nowhere is the altitude above base level sufficient to reduce noticeably the general temperature except by slope exposure.

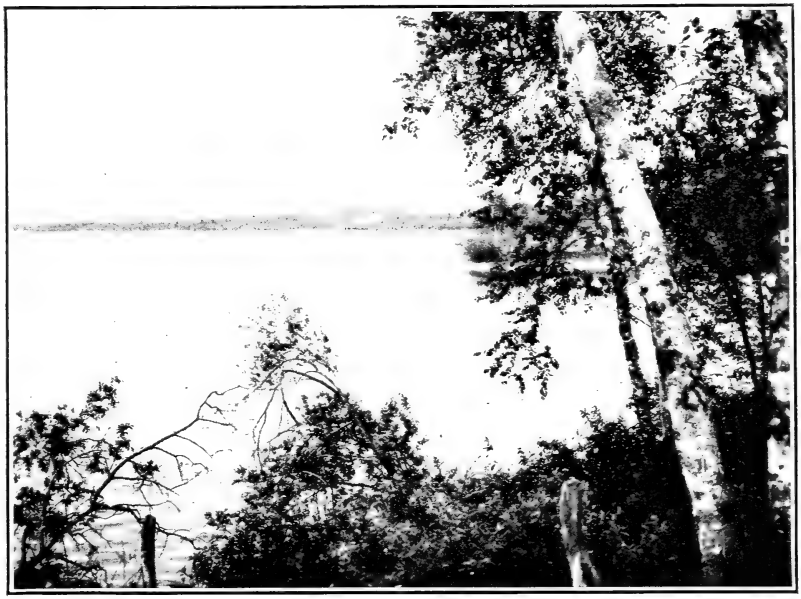

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FIG. 1.—A TYPICAL LAKE OF THE TURTLE MOUNTAINS

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FIG. 2.—TYPICAL ASPEN FOREST OF THE TURTLE MOUNTAINS

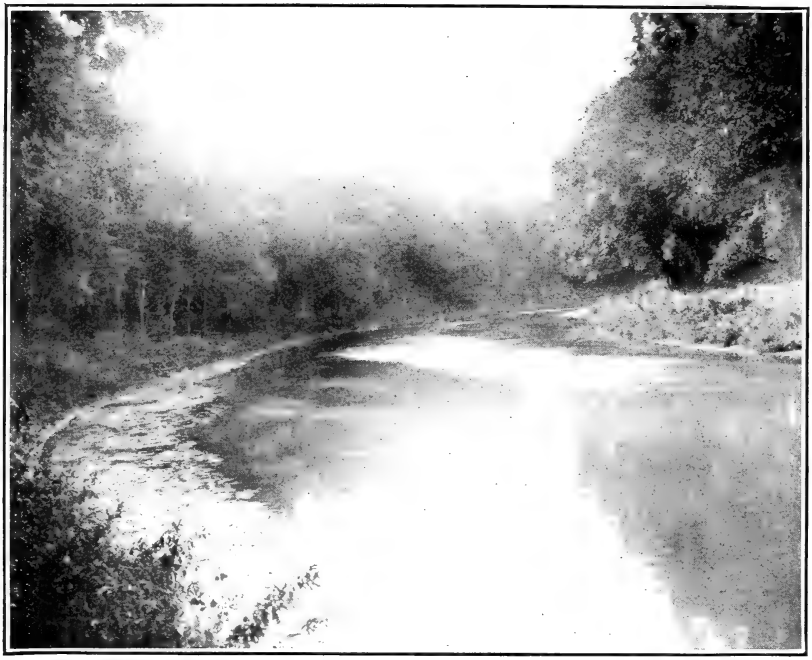


FIG. 1.—RED RIVER WITH ITS FORESTED SHORES, NEAR FARGO

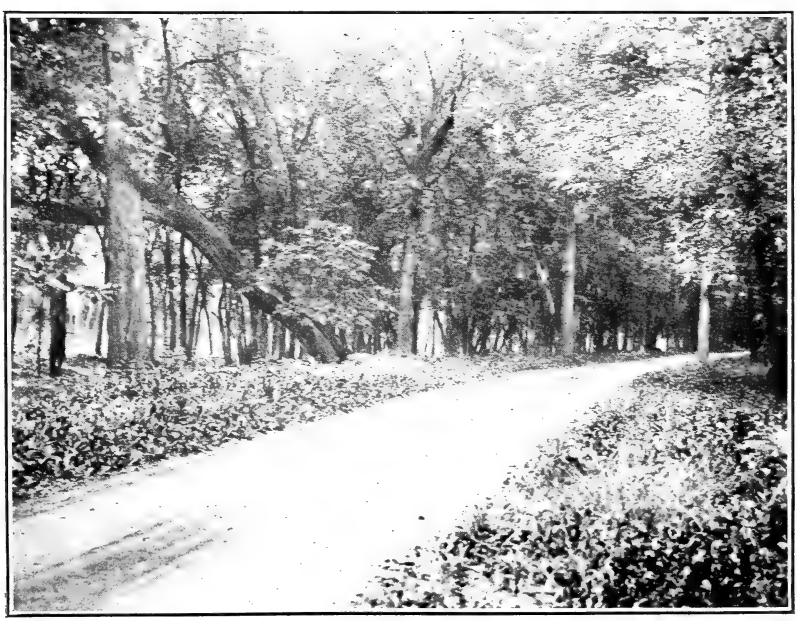
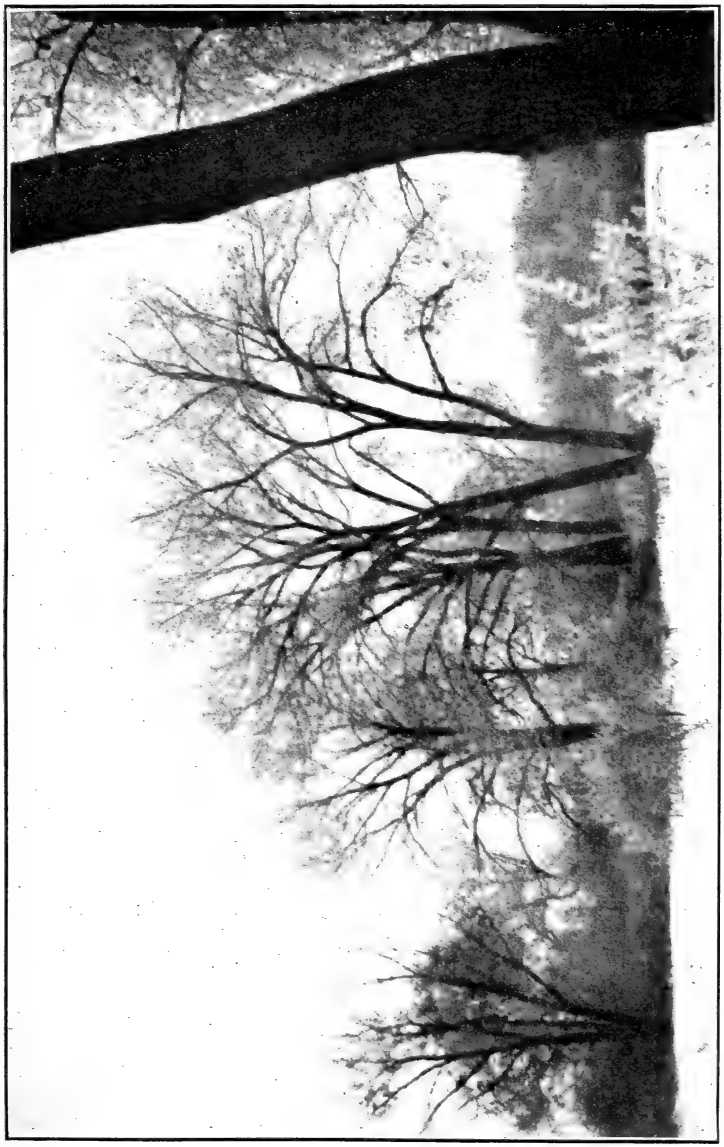


FIG. 2.—TYPE OF FOREST ALONG THE RED RIVER, NEAR FARGO



COTTONWOOD TIMBER ALONG THE MISSOURI RIVER BOTTOMS NEAR MANDAN IN EARLY WINTER AFTER THE LEAVES HAVE FALLEN

Some of the very highest parts of the State, in the extreme southwestern corner, lie mainly within the Upper Austral Zone. The Little Missouri Valley above and below Medora (2,270 feet above sea level, and almost as high as the tops of the Turtle Mountains) is the nearest to pure Upper Austral and zonally the lowest point in the State. The aridity, causing scanty soil cover and thus allowing the greatest absorption of heat by the soil, adds to the purity of the zone here, as also may the warm western winds.

Along the Missouri River Valley from Bismarck to Williston many Austral species have a continuous range, but seem generally to be secondary to the Transition Zone or neutral species. The broad-leaved cottonwood and the long-tailed chat have a practically continuous range along the river valley, but other species, such as the little chipmunk and dwarf lupine, seem to drop out of sections of it.

Farther east local traces of Upper Austral Zone species may be found on the warm slopes of the sand dunes near Hankinson, and in the Dakota and Maple River Valleys at Ludden and Ellendale. These are mere traces overlapping from the zone farther south in the Dakota River Valley. The zone is indicated at Hankinson by the harvest mouse, little dusky pocket mouse, and sand cherry, and at Oakes and Ludden by at least the harvest mouse.

Following are characteristic species of the Upper Austral Zone in North Dakota:

Characteristic Mammals—Upper Austral Zone

Badlands mountain sheep (*Ovis canadensis auduboni*).
Badlands chipmunk (*Eutamias pallidus pallidus.*)
Pale thirteen-lined ground squirrel (*Citellus tridecemlineatus pallidus.*).
Black-tailed prairie dog (*Cynomys ludovicianus ludovicianus*).
Osgood white-footed mouse (*Peromyscus maniculatus osgoodi*).
Badlands white-footed mouse (*Peromyscus leucopus aridulus*).
Pale bushy-tailed wood rat (*Neotoma cinerea rupicola*).
Prairie harvest mouse (*Reithrodontomys megalotis dychei*).
Western upland mouse (*Microtus ochrogaster haydenii*).
Maximilian pocket mouse (*Perognathus fasciatus fasciatus*).
Dusky pocket mouse (*Perognathus flavescens perniger*).
Kansas pocket mouse (*Perognathus hispidus paradoxus*).
Richardson kangaroo rat (*Perodipus montanus richardsoni*).
Sagebrush pocket gopher (*Thomomys talpoides bullatus*).
Black Hills cottontail (*Sylvilagus nuttalli grangeri*).
Black-footed ferret (*Mustela nigripes*).
Merriam shrew (*Sorex merriami*).

Characteristic Breeding Birds—Upper Austral Zone

Western mourning dove (*Zenaidura macroura marginella*).
Burrowing owl (*Speotyto cunicularia hypugaea*).
Poor-will (*Phalaenoptilus nuttallii nuttallii*).
Say phoebe (*Sayornis sayus*).
Bullock oriole (*Icterus bullockii bullockii*).
Lark sparrow (*Chondestes grammacus grammacus*).
Western lark sparrow (*Chondestes grammacus strigatus*).
Indigo bunting (*Passerina cyanea*) (also Transition).
Lazuli bunting (*Passerina amoena*).
Dickcissel (*Spiza americana*).
Long-tailed chat (*Icteria virens longicauda*).
Rock wren (*Salpinctes obsoletus obsoletus*).
Long-tailed chickadee (*Penthestes atricapillus septentrionalis*).

CHARACTERISTIC PLANTS—UPPER AUSTRAL ZONE

Broad-leaved cottonwood (*Populus deltoides*).[2]
Sand cherry (*Prunus pumila*).
Flowering currant (*Ribes aureum*).
Skunk bush (*Rhus trilobata*).
Gray shadscale (*Atriplex canescens*).
Low shadscale (*Atriplex confertifolia*).
Nuttall shadscale (*Atriplex nuttallii*).
Greasewood (*Sarcobatus vermiculatus*).
Winterfat (*Eurotia lanata*).
Gray sagebrush (*Artemisia cana*).
Rabbitbrush (*Chrysothamnus graveolens*).
Tipsin (*Psoralea esculenta*).
Prairie-clover (*Psoralea tenuiflora* and *Psoralea lanceolata*).
Dalea (*Parosela enneandra*).
Dwarf lupine (*Lupinus pusillus*).
Painted milk-vetch (*Astragalus pictus*).
Slender milk-vetch (*Astragalus gracilis*).
Bird's-foot trefoil (*Hosackia americana*).
Winged abronia (*Tripterocalyx micranthus*).
Snow-on-the-mountain (*Euphorbia marginata*).
Mentzelia (*Mentzelia decapetala*).
Bee plant (*Cleome serrulata*).
Spiny solanum; buffalo-bur (*Solanum rostratum*).
Indian plantain (*Plantago purshii*).
Large-flowered beardtongue (*Pentstemon grandiflorus*).
Prickly-pear cactus (*Opuntia polyacantha*).
Slender cactus (*Opuntia fragilis*).
Spanish bayonet (*Yucca glauca*).
Low evening primrose (*Pachylophus caespitosus*).
Sand verbena (*Abronia micrantha*).
Wild sunflower (*Helianthus annuus*).
Dropseed grass (*Oryzopsis micrantha* and *Oryzopsis cuspidata*).
Grama grass (*Bouteloua gracilis*).
False buffalo grass (*Munroa squarrosa*).

CROP ADAPTATIONS OF THE UPPER AUSTRAL ZONE

The variation in climate in North Dakota is so slight and gradual, and the greater part of the State lies so fully within the Transition Zone, that the raising of a comparatively limited variety of crops has been customary over most of the State. The great success of the small grains has encouraged their production to the exclusion of many others that might be cultivated in certain sections with equal success. The early explorers found the Indians raising an abundance of corn (Will and Hyde, 1917), squashes, beans, and native tobacco on the fertile bottoms along the Missouri River, where also the comparatively mild climate rendered living conditions comfortable for these poorly equipped and half-housed people. Many of these long-tested and thoroughly acclimated varieties of vegetables have been adopted into general cultivation and have helped to increase the crop resources of the State; varieties from other parts of the Upper Austral Zone have also been found to thrive in these mild valleys.

Although no attempt is made in the present report to indicate the particular kinds and varieties of crops adapted to the different life zones and their subdivisions in the State, it is evident from the distribution of native species and the climatic areas which they dominate that certain crops will thrive in one part of the State and not in others. Only by careful study of local conditions and by careful testing of different varieties of seeds can safe recommendations be made and the best results obtained from diversified agriculture. With the increasing necessity of bringing the producing quality of

[2] This upper Missouri form is so different in characters and growth from the Carolina cottonwood that the necessity of calling it *deltoides* is regrettable.

the land to the highest standard, and the more intelligent study being given to farm problems, the value of a reliable map of the life zones and subdivisions of these zones is apparent.

The intrusion of narrow areas of a southern zone into a northern one, as pointed out by Doctor Merriam (1898, p. 15) many years ago, adds a distinct advantage in marketing the crops by saving long transportation and thus increasing their value. The possibility of raising southern crops and fruits within an area of unusually rich grain production is self-evident. Although not always the richest in soil and natural resources, the warmest sections of the State, with their climatic advantages, should, if wisely used, be of special value.

Transition Zone

The Transition Zone covers the whole of North Dakota with the exception of the Turtle Mountains and various cold slopes and gulches in other elevated areas, where Canadian Zone conditions prevail, and the warmer Upper Austral valleys of the Missouri and Little Missouri Rivers. Its range of climate shows no marked variation over the State, except for a slight decrease in temperature northward and a gradual decrease in rainfall westward. The annual rainfall, as given in the Climatology Report of the Weather Bureau (U. S. Dept. Agr., 1919) for 1918, a nearly typical year, varies from 25 inches in the eastern to 15 inches in the western part of the State. The westward decrease is so gradual that no sharp line can be drawn between the humid eastern and semiarid western subdivisions of the zone. Doctor Merriam (1898, map) places the dividing line a little east of the one-hundredth meridian.[3] The change from humid to semiarid is noticeably marked by the shortening of the prairie grasses and the appearance of western drought-resistant species.

The humid Transition Zone covers practically all of the State west to and including the Dakota (James) and Mouse (Souris) River Valleys. It is generally characterized by a heavy growth of prairie grasses, by strips of timber along the streams, and by thickets of brush in protected locations.

The semiarid Transition Zone covers most of the western half of the State, including the high country on both sides of the Missouri River Valley and much of the Badlands region. It is generally characterized by short-grass plains and a limited mixture of Rocky Mountain species of mammals, birds, and plants.

The following lists contain the chief characteristic animals and plants of the Transition Zone in North Dakota:

Characteristic Mammals—Transition Zone

(a) Both Eastern and Western Divisions

Richardson ground squirrel (*Citellus richardsoni richardsoni*).	Prairie jumping mouse (*Zapus hudsonius campestris*).
Loring red-backed mouse (*Evotomys gapperi loringi*).	White-tailed jack rabbit (*Lepus townsendii campanius*).

[3] See also Fourth Provisional Zone Map of North America, by the Biological Survey, 1910 (included in A. O. U. Check-List of Birds).

Yellow-red fox (*Vulpes fulva regalis*).
Long-tailed weasel (*Mustela longicauda*).
Bonaparte weasel (*Mustela cicognanii cicognanii*).
Minnesota mink (*Lutreola vison letifera*).
Northern skunk (*Mephitis hudsonica hudsonica*).
Hayden shrew (*Sorex cinereus haydeni*).
Large brown bat (*Eptesicus fuscus fuscus*).

(b) Eastern (Humid) Division

Minnesota gray squirrel (*Sciurus carolinensis hypophaeus*).
Gray chipmunk (*Tamias striatus griseus*).
Thirteen-lined ground squirrel (*Citellus tridecemlineatus tridecemlineatus*).
Gray ground squirrel (*Citellus franklinii*).
Rufescent woodchuck (*Marmota monax rufescens*).
Northern white-footed mouse (*Peromyscus leucopus noveboracensis*).
Baird white-footed mouse (*Peromyscus maniculatus bairdii*).
Eastern meadow mouse (*Microtus pennsylvanicus pennsylvanicus*).
Little upland mouse (*Microtus minor minor*).
Mississippi Valley pocket gopher (*Geomys bursarius*).
Dakota pocket gopher (*Thomomys talpoides rufescens*).
Nebraska cottontail (*Sylvilagus floridanus similis*).
Brush wolf (coyote) (*Canis latrans latrans*).
Short-tailed shrew (*Blarina brevicauda brevicauda*).
Little brown bat (*Myotis lucifugus lucifugus*).
Say bat (*Myotis subulatus subulatus*).

(c) Western (Semiarid) Division

Pale mouse (*Microtus pallidus*).
Drummond meadow mouse (*Microtus pennsylvanicus drummondi*).
Northern bobcat (*Lynx uinta*).
Kit fox, swift (*Vulpes velox hebes*).
Plains coyote (*Canis latrans nebracensis*).
Yellowstone bat (*Myotis lucifugus carissima*).

CHARACTERISTIC BREEDING BIRDS—TRANSITION ZONE

(a) Both Eastern and Western Divisions

Franklin gull (*Chroicocephalus pipixcan*).
Forster tern (*Sterna forsteri*).
Canvasback duck (*Aristonetta valisineria*).
Redhead (*Nyroca americana*).
Ring-necked duck (*Perissonetta collaris*).
Wilson phalarope (*Steganopus tricolor*).
Marbled godwit (*Limosa fedoa*).
Upland plover (*Bartramia longicauda*).
Ferruginous rough-leg (*Buteo ferrugineus*).
Bobolink (*Dolichonyx oryzivorus*).
Chestnut-collared longspur (*Calcarius ornatus*).
Baird sparrow (*Centronyx bairdii*).
Nelson sparrow (*Ammospiza caudacuta nelsoni*).

(b) Eastern (Humid) Division

Woodcock (*Rubicola minor*).
Broad-winged hawk (*Buteo platypterus platypterus*).
Yellow-bellied woodpecker (*Sphyrapicus varius varius*).
Yellow-shafted flicker (*Colaptes auratus luteus*).
Whip-poor-will (*Setochalcis vocifera vocifera*).
Blue jay (*Cyanocitta cristata bromia*).
Baltimore oriole (*Icterus galbula*).
Vesper sparrow (*Pooecetes gramineus gramineus*).
Swamp sparrow (*Melospiza georgiana*).
Chewink, towhee (*Pipilo erythrophthalmus erythrophthalmus*).
Rose-breasted grosbeak (*Hedymeles ludovicianus*).

(c) Western (Arid) Division

Avocet (*Recurvirostra americana*).
Sage grouse (*Centrocercus urophasianus*).
Red-shafted flicker (*Colaptes cafer collaris*).
Magpie (*Pica pica hudsonia*).
Arctic towhee (*Pipilo maculatus arcticus*).
Black-headed grosbeak (*Hedymeles melanocephalus papago*).
McCown longspur (*Rhynchophanes mccownii*).
Western vesper sparrow (*Pooecetes gramineus confinis*).
Sprague pipit (*Anthus spragueii*).

CHARACTERISTIC PLANTS—TRANSITION ZONE

(a) Eastern (Humid) Division

Bur oak (*Quercus macrocarpa*).
Basswood (*Tilia americana*).
Ironwood (*Ostrya virginiana*).
White ash (*Fraxinus pennsylvanica*).
White elm (*Ulmus americana*).
Red elm (*Ulmus fulva*).
Hackberry (*Celtis occidentalis*).
Red maple (*Acer rubrum*).
Sugar maple (*Acer saccharum*).
Hawthorn (*Crataegus chrysocarpa* and *Crataegus succulenta*).
Wild plum (*Prunus americana*).
Hazel (*Corylus americana*).
Alder (*Alnus incana*).
Missouri willow (*Salix missouriensis*).
Cornel (*Cornus femina*).
Black haw; nanny-berry (*Viburnum lentago*).
Sumac (*Rhus glabra*).
Honeysuckle (*Lonicera dioica glaucescens*).
Red raspberry (*Rubus strigosus*).
Prairie rose (*Rosa pratincola*).
Pale rose (*Rosa blanda*).
Bittersweet (*Celastrus scandens*).
Black currant (*Ribes americanum*).
Smooth gooseberry (*Ribes gracile*).
Prickly ash (*Xanthoxylum americanum*).

(b) Western (Semiarid) Division

Yellow pine (*Pinus scopulorum*).
Rocky Mountain juniper (*Juniperus scopulorum*).
Creeping juniper (*Juniperus horizontalis*).
Western birch (*Betula fontinalis*).
Silver-leaf (*Elaeagnus argentea*).
Buffaloberry (*Lepargyrea argentea*).
Sagebrush (*Artemisia tridentata*).
Silver sage (*Artemisia frigida*).
Yellow willow (*Salix lutea*).
Green ash (*Fraxinus lanceolata*).
Shrubby cinquefoil (*Potentilla fruticosa*).
Bearberry (*Arctostaphylos uva-ursi*).
False lupine (*Thermopsis rhombifolia*)

Bergman (1918, p. 162) has made essentially this same division under *mesophytic* and *xerophytic* prairie, well characterizing each by its grasses and "more abundant secondary species" as follows:

(a) Mesophytic, or Andropogon, Prairie (Eastern)

Forked beardgrass; Big blue-stem (*Andropogon furcatus*).
Broom beardgrass; Little blue-stem (*Andropogon scoparius*).
Indian grass (*Sorghastrum nutans*).
Porcupine grass (*Stipa spartea*).
Sedge (*Carex festucacea*).
Yarrow (*Achillea lanulosa*).
Gray false indigo; Lead-plant (*Amorpha canescens*).
Cylindric wind-flower (*Anemone cylindrica*).
Cut-leaved wormwood (*Artemisia caudata*).
Harebell (*Campanula rotundifolia*).
White-flowered avens (*Drymocallis arguta*).
Closed gentian (*Gentiana puberula*).
Maximilian sunflower (*Helianthus maximilianus*).
Alum root (*Heuchera hispida*).
Blazing star (*Lacinaria pychnostachya* and *Lacinaria scariosa*).
Lobelia (*Lobelia spicata*).
Evening primrose (*Meriolix serrulata*).
Slender beardtongue (*Pentstemon gracilis*).
Ground cherry (*Physalis lanceolata*).
Black-eyed susan (*Rudbeckia hirta*).
Spiderwort (*Tradescantia bracteata*).
Ironweed (*Vernonia fascicularis*).

(*b*) *Xerophytic, or Bouteloua, Prairie* (*Western Short-grass*)

Grama grass (*Bouteloua oligostachya*).
Buffalo grass (*Bulbilis dactyloides*).
Loco plant (*Aragallus lambertii*).
Silver sage (*Artemisia frigida*).
Buffalo pea (*Astragalus crassicarpus*).
Brown-eyed susan (*Brauneria angustifolia*).
Indian paintbrush (*Castilleja sessiliflora*).
Golden aster (*Chrysopsis villosa*).
Treacle mustard (*Erysimum asperum*).
Prairie marigold (*Gaillardia lanceolata*).
Scarlet gaura (*Gaura coccinea*).
Yellow flax (*Linum rigidum*).
Narrow-leaved puccoon (*Lithospermum linearifolium*).
Skeleton plant (*Lygodesmia juncea*).
Orange-red false mallow (*Malvastrum coccineum*).
Yellow Indian paintbrush (*Orthocarpus luteus*).
Pale beardtongue (*Pentstemon albidus*).
Silver clover (*Psoralea argophylla*).
Groundsel, paintbrush (*Senecio plattensis*).
Yellow violet (*Viola nuttallii*).

Crop Adaptations of the Transition Zone

The crop adaptations of the Transition Zone and its subdivisions make it the most important in the State because of the extent of the zone and the enormous quantity of its products. Every slight advantage in variety of grain or other crop under different climatic conditions should be utilized so far as these conditions prevail. Different crops and varieties are being constantly tested and the more resourceful farmers are quick to adopt any that offer even a slight advantage in quality, yield, or price.

Canadian Zone

The Canadian Zone, which sweeps across the continent mainly north of the United States and is generally characterized by forests of spruce, fir, hemlock, aspen, and birch, is only lightly represented in a few restricted areas in North Dakota. Its largest area lies within the Turtle Mountains, where Canadian-Zone species dominate the flora and fauna, although by no means unmixed with Transition species. Other districts with still less representation of the zone are the Pembina Hills, the Killdeer Mountains, and numerous cold slopes and cold gulches in the high bluffs and buttes along the western side of the Mouse River Valley. On many steep northeast slopes, on high buttes, and in the Badlands, where in winter drifting snows fill shaded gulches to such a depth as to remain until late in spring or to the beginning of summer, a trace of Canadian Zone species may be found.

The aspen (Pl. 4, fig. 2) is one of the most widely distributed and abundant of the Canadian Zone trees, and from its habit of reproduction from myriads of widely blown, cotton-tufted seeds, it not only fills its zone, but lodges and grows wherever climatic conditions are possible for it. For this reason it is often found in spots far from its regular range, where even such local conditions as late snowbanks, cold springs, cold underground waters, or well-shaded slopes reduce the summer temperature. Thus, the aspens, with a few other Boreal plants and animals, often form little islands far out in the Transition Zone, in places even to its lower edge, that carry Boreal species whose presence is very confusing unless the conditions are thoroughly understood and the existence of the zone recognized.

Cold slopes and gulches facing the north or northeast and missing much of the heat from the sun's rays are also important factors in carrying local traces of zones far below their real borders. Often cold gulches contain springs or streams of cold water in addition to the snow which accumulates in winter and which helps to keep their summer temperature low. In the Turtle Mountains the cold slopes and gulches are practically pure Canadian Zone, as are mainly the moist bottomlands and all but the more open slopes facing the south. Although the temperature in these hills may be no lower in winter than that of the surrounding prairies, the more important growing temperature of summer is noticeably cooler than that of the open prairies where the sun's rays are more readily absorbed by the ground and returned to the surface layer of air.

The Turtle Mountains at their highest rise less than a thousand feet above the prairie base level, and the actual altitude of the highest hills is only approximately 2,500 feet. Although their elevation is not such as to lower perceptibly the general temperature, it is sufficient to attract an unusually heavy precipitation. This, in the form of rain and snow, produces not only a cooling effect on the surface, but a heavy growth of vegetation, largely arboreal and shrubby, the only extensive openings in which are lakes and marshes. The timber is largely aspen mingled with balsam poplar, white birch, and a few oaks, elms, and boxelders. The forests have been frequently swept away by fires, which fact undoubtedly accounts for the complete absence of conifers. Even the tamarack, which would find ideal conditions in the marshes, is not known to occur in this region. The preponderance of aspens also indicates frequent fires, as these trees, more than any other in this region, quickly reforest burned areas. Owing to the fact that heavy winter snows remain late in spring on the cold slopes, and to the difficulty of clearing the brush and timber-covered soil, the settlement of the hills has lagged behind that of other parts of the State.

Though much modified, the Canadian Zone area is here of special importance and interest in carrying a comparatively well-forested area in the midst of an extensive treeless region. The forest is happily associated with numerous beautiful lakes, originally well stocked with fish. The whole region was once famous for its game and fur-bearing animals, and at present it affords a delightful resort for fishing and camping, and is steadily growing in importance as a summer recreation ground.

Characteristic Mammals—Canadian Zone

The principal Canadian Zone mammals of the Turtle Mountains and Pembina Hills at the present time are the red squirrel (*Sciurus hudsonicus*), northern chipmunk (*Eutamias borealis*), varying hare (*Lepus americanus*), Canada lynx (*Lynx canadensis*), Richardson shrew (*Sorex richardsoni*), and silver-haired bat (*Lasionycteris noctivagans*). Formerly there occurred also the caribou, moose, marten, fisher, and wolverene.

Characteristic Breeding Birds—Canadian Zone

The typical Canadian Zone birds of this region are not strongly represented, but the white-throated sparrow (*Zonotrichia albicollis*) is a common summer songster in the Turtle Mountains, and the slate-colored junco (*Junco hyemalis*) occurs and probably breeds.

Characteristic Plants—Canadian Zone

The number of species of Canadian Zone plants in North Dakota is not great, but the forest is dominated by a few of them, as the aspen (poplar), balsam poplar, and white birch. The following characterize the zone in the State:

Aspen poplar (*Populus tremuloides*).
Balsam poplar (*Populus balsamifera*).
White birch (*Betula papyrifera*).
Shrubby birch (*Betula pumila glandulifera*).
Pin cherry (*Prunus pennsylvanica*).
Autumn willow (*Salix serissima*).
High-bush cranberry (*Viburnum opulus americana*).
Beaked hazel (*Corylus rostrata*).
Rabbitberry (*Lepargyrea canadensis*).
Bunchberry (*Cornus canadensis*).
Canadian serviceberry (*Amelanchier canadensis oblongifolia*).
Red currant (*Ribes triste*).
Winter-lettuce (*Pyrola asarifolia*).
Miterwort (*Mitella nuda*).

The Killdeer Mountains, lying just south of the Little Missouri River, about 30 miles directly west of its junction with the Missouri, are another group of high hills of a different type, but with only a slight trace of Canadian Zone in their cold gulches. They are about 900 feet higher than the surrounding prairie, with the main ridge about 12 miles long and from 2 to 3 miles wide. Their slopes are steep and rocky in places and at the southern end form limestone cliffs 100 feet high. The top of the ridge is a level, grassy plateau, but there are many deep gulches with springs and small streams of cold water. All the deep gulches and about half the area of the mountains are covered with a growth of deciduous trees and shrubs. The principal trees are oak, aspen, ash, elm, boxelder, white birch, and western birch; the shrubs are mainly willow, serviceberry, chokecherry, red cherry, pin cherry, plum, rose, gooseberry, wild currant, raspberry, thorn apple, cornel, beaked hazel, buffaloberry, rabbitberry, and shrubby juniper. Of these plants the aspen, white birch, pin cherry, beaked hazel, rabbitberry, and shrubby juniper are mainly Canadian Zone species. This element, however, is not sufficiently pronounced to warrant mapping the Killdeer Mountains as Canadian Zone.

Similar but even less strongly marked elements of Canadian Zone may be found in the deep gulches west of the Mouse River, and on some of the high ridges and cold slopes over the northwestern part of the State.

Crop Adaptations of the Canadian Zone

Although pure Canadian Zone is of comparatively limited agricultural value, it has other advantages, as forest, fur, and game production. Its representation in North Dakota is so limited and so mixed with Transition-Zone conditions that most of the hardy crops of the Transition Zone thrive in it except on pronounced northerly slopes or cold bottomlands. The clearing of the land gives a slight advantage to the lower zone conditions, especially on open areas and southerly slopes. The main area of the Canadian Zone lies in the Turtle Mountains, but even the more limited spots in the Pembina Hills, the Killdeer Mountains, in the gulches, and on the cold slopes of other elevated areas may prove of special value for timber and fur production.

PART II.—THE MAMMALS OF NORTH DAKOTA

INTRODUCTION

Present and Former Abundance

In the economy of the area now known as North Dakota the mammalian fauna has played an important part, not only since the separate State was created in 1889, and when it was a Territory with South Dakota in 1868, or a part of Nebraska in 1854, or of the Louisiana Territory in 1804, but still earlier, before the Louisiana Purchase added it to the United States. The fur-bearing animals first attracted white men to take up shifting residence within what are now the borders of North Dakota, where abundance of game insured their support and lured them on to new fields of profit and adventure. The rich soil and the luxuriant vegetation of the region originally supported vast numbers of the most important large game animals of the country, and these naturally attracted many predatory species. The rivers, streams, and lakes teemed with beavers and muskrats, and the limited forest areas supported many other valuable fur-bearing animals.

The region was exceptionally rich in the number of individuals, if not in the species, of large game. Of the abundance of small animals before the settlement of the region, there is little record, but probably in most cases there has been comparatively slight change. Many of the larger species have entirely disappeared, or have become very scarce or local in their distribution, owing to the change from a limited Indian population with crude weapons to the occupation of the country by hunters, trappers, and traders, and later by a well-armed, well-equipped, energetic, and sport-loving people. Before any thought of game protection or conservation influenced the destructive methods of the early settlers, much of the game had disappeared. Only in comparatively recent years have wise and effective laws been enacted for the protection of the game that remains, and there are not enough protected areas to insure the maintenance of this remnant. Some of the vanished species are being reintroduced in areas of little value for other purposes, and it is hoped that still others that are no longer found within the State may thus be preserved for the interest of future generations.

In many cases the disappearance of the game before the settlement of the country was necessary and can be regretted only on the ground that the methods employed were wasteful and the rate of depletion was unnecessarily rapid. With better control the buffalo, elk, deer, antelope, and mountain sheep would have lasted much longer, and could have been of value to great numbers of people for several generations, instead of being largely squandered by a few skin hunters. It is futile to waste time in regrets over what can no

longer be helped, but future loss to the State can be prevented by a fuller knowledge of the species which should be preserved and those which can well be spared.

Useful and Harmful Species

At the present time the mammals of the State may be divided into two groups, the useful and the harmful. The clearly useful species may be grouped under game animals, fur-bearing animals, certain rodent destroyers, and insectivorous animals. The harmful species may be classed broadly as predatory animals and rodent pests. Each of these groups has an important place in the economy of the State, but without a thorough knowledge of the abundance, distribution, and habits of each it is impossible to employ intelligently successful methods of protection, propagation, control, or destruction of a species or a group of species. To supply the needed information, the present report has been prepared, the information being based on facts gathered in field work of the Biological Survey, supplemented by data from all available reliable sources.

Indian Names of Mammals

The Indian names given for many of the mammals have been collected for the sake of perpetuating those longest in use for the species, and in the hope that in cases where other names are not available or well established, some may be generally adopted. Names of many of the conspicuous species from several different tribes are found in the reports of Maximilian and other ethnologists, but most of those used have been contributed by Melvin R. Gilmore, formerly curator of the State Historical Society, at Bismarck, now of the Museum of the American Indian, New York City, who has obtained them directly from the Indians through his own knowledge of their language or by showing skins of the species with which they are familiar. Many of the Mandan names have been supplied by George F. Will, of Bismarck, in cooperation with Doctor Gilmore.

The following phonetic key is used except in names from Maximilian, where the German spelling is retained:

a, as *a* in father.
e, as *e* in they.
i, as *i* in marine.
o, as *o* in go.
u, as *u* in rule.

c, as *ch* in chin (*k* and *s* are used for the ordinary sounds of *c*).
ch, as guttural *ch* in German ich, ach.
zh, as *z* in azure.
ⁿ (elevated) nasalizes the preceding vowel.

Measurements and Weights

In most cases the usual three measurements are given: *Total length*—from tip of nose to tip of tail vertebrae in a straight line; *length of tail*—from base at right angle with back to tip of skin at end of tail; and *hind foot*—from point of heel to tip of longest claw. Most of the measurements are, as originally taken, in millimeters.[1] Weights are given, when available, in grams for the smaller and in pounds for the larger animals.

[1] For the convenience of those not familiar with the metric scale it may be stated that 25 millimeters make approximately 1 inch, and 304.8 millimeters are equivalent to 1 foot.

Class MAMMALIA: Vertebrate Animals That Nurse Their Young

Order ARTIODACTYLA: Hoofed Animals—Cattle, Sheep, Goats, Antelope, and Deer

Family BOVIDAE: Cattle, Sheep, and Goats

Bison bison bison (Linnaeus)

American Bison; American Buffalo

Te of the Omahas (Gilmore); *Pte* of the Dakotas (Gilmore) and Mandans (Will); *Mité* of the Hidatas (Matthews); *Tanaha* of the Arikaras (Gilmore).

[*Bos*] *bison* Linnaeus, Syst. Nat., ed. 10, t. 1, p. 72, 1758.

Type locality.—Indefinite.

General characters.—The American buffalo, or bison, is so well known as a feature of all western description and travel and from picture, statue, and the currency and coin of the Republic, as well as from the examples still preserved in public and private parks, that it needs no detailed description. A large buffalo bull described by Audubon (1897, p. 111), killed by one of the party at Fort Union (now Buford), in 1843, measured from tip of nose to root of tail, 131 inches; tail vertebrae, 15½ inches; hair on end of tail, 11 inches. When cut into pieces it weighed 1,777 pounds—it was not fat, and would have weighed 2,000 pounds if it had been in better condition. In his detailed description of the buffalo, Audubon (1851–1854, vol. 2, p. 44, 1851) says that very large bulls generally weigh about 2,000 pounds and cows about 1,200 pounds. These approximate weights are in accord with some recent records.

Early abundance.—Until the beginning of the past century, buffalo ranged over all of North Dakota in vast herds. Although no approximate estimate of their numbers is possible, the abundance of the animals is attested by vivid statements of early explorers. Alexander Henry (the younger) (1897, pp. 84, 162, 167, 208–209) recorded them in immense numbers along the Red River Valley in September, 1800, and on January 1, 1801, near the junction of the Park and Red Rivers, as in great abundance, the Plains entirely covered, the animals moving in a body from north to south; and on January 14 of the same year, he says:

> At daybreak I was awakened by the bellowing of buffaloes. . . . On my right the Plains were black, and appeared as if in motion, . . . and on my left, to the utmost extent of the reach below us, the river was covered with buffalo moving northward. . . . I dressed and climbed my oak for a better view. I had seen almost incredible numbers of buffalo in the fall, but nothing in comparison to what I now beheld. The ground was covered at every point of the compass, as far as the eye could reach, and every animal was in motion.

In January, 1803, on a trip from Park River, N. Dak., to Riding Mountain, Manitoba, he says "we never marched a day without passing herds of buffaloes;" and men who "have lately been up as far as Goose River, tell me the buffalo continue in abundance

from this place to that river and as far as the eye could reach southward."

On October 19, 1804, Lewis and Clark (1893, pp. 172, 174, 175, 276, 278, 282, 286) counted 52 herds from a single point on the Missouri River, 11 miles above Fort Rice; the next day they saw great numbers on the flats just below where Bismarck now stands, and the following day a little farther up the river found the Plains covered with herds. As they journeyed toward the Mandan villages, where they spent the winter, herds of buffalo were frequently seen, although during the winter the Indians had to make many hunting trips to bring back a meat supply. Again in the following April, as the expedition proceeded up the river, numerous buffalo herds were encountered, and great numbers of carcasses of drowned animals were seen floating in the current or stranded along the shores. On the broad flats at the mouths of the Little Missouri, the Muddy, and the Yellowstone, buffalo were reported in "vast herds" and immense quantities. In 1811 between the Arikaree and Mandan villages Brackenridge (1816, pp. 133–134) says, "I discovered in every direction immense herds of buffaloe . . . in this [small] valley there appeared to be several thousand . . . armies of buffaloe all in motion as far as the eye could distinguish in every direction."

In 1833, Maximilian (Wied, 1839–1841, Bd. 2, p. 84, 1841) found buffalo abundant throughout the North Dakota section of his trip up the Missouri River, except near the larger Indian settlements, where persistent hunting kept them at times at considerable distances. During the migrations, however, as the great herds swept back and forth from summer to winter range, they came close to the villages. While wintering at Fort Clark, Maximilian says the herds did not appear in the immediate vicinity except when the weather was very severe, because they were too much disturbed by the numerous Indians in the neighborhood. The hunters of the fort were often obliged to ride 20 miles before finding them. In the cold snowstorms, so prevalent during the winter, the animals took refuge in the forests on the banks, where great numbers were killed and where it was almost impossible to drive them out of the woods. Their bones and skulls, scattered all over the ground, prove the immense destruction of these harmless animals.

At Fort Union on the upper Missouri, Audubon (1851–1854, vol. 2, p. 47, 1851) in 1843, gave a good idea of the immense numbers of bison on the wild prairies at that time in an account of a trip by Mr. Kipp, one of the principals of the American Fur Company, from Travers Bay on Lake Winnipeg to the Mandan Nation on the Missouri River. In August, "in a cart heavily laden, he [Kipp] passed through herds of buffalo for six days in succession. At another time he saw the great prairie near Fort Clark on the Missouri River, almost blackened by these animals, which covered the plain to the hills that bounded the view in all directions." On his return trip down the Missouri in August, Audubon (1897, pp. 154–155) also saw great numbers of buffalo and said the roaring of the bulls was like the long continuous roll of a hundred drums, and could be heard for miles; while the animals were seen all over the prairies and river bars and many were swimming in the river.

In 1845 Father De Smet, (1905, p. 657) on crossing the Missouri River west of Fort Union, said: "the whole space between the Missouri and the Yellowstone was covered [with buffalo] as far as the eye could reach . . . During a whole week we heard their bellowings like the noise of distant thunder, or like the murmurs of the ocean waves beating against the shore."

In "A story of 53," of the fur-trading days at Walhalla, Charles Cavileer states that 10,000 to 12,000 buffalo robes, worth $1.25 to $2.50 each, were brought in to that post each year.

In the spring of 1862, on the Missouri River, A. H. Wilcox (1907, p. 46) writes:

> At two different times our steamboat was obliged to stop, and tie up alongside the shore to avoid the immense herds of buffalo that were floating down the river. The first drove we encountered was near where Bismarck in North Dakota is now located. The river was nearly half a mile wide and was filled nearly its entire width with live buffaloes, and they were at least half an hour in passing. We encountered the other drove a little above the mouth of the Yellowstone and it must have contained at least 20,000 animals.

L. C. Ives, of Veblen, S. Dak., told the writer that his company of cavalry, the Second Minnesota Volunteers, on their return trip from an Indian expedition up the Yellowstone in 1863, encountered untold thousands of buffalo on the prairies east of the Missouri River.

In July, 1866, R. M. Probsfield (Wilcox, 1907, p. 50) reported a herd on the North Dakota side of the Red River about 18 miles north of Fargo. He says: "There may have been 10,000 or 100,000 of them . . . as we could not see their limit either north or west." The next herd, only 25 in all, was seen in 1867, and another small herd in 1868 in the same vicinity on the east side of the river.

Often the early travelers reported days without seeing buffalo, or only scattered bunches or occasional individuals, from which to draw their meat supply. The great numbers seen at certain times and places were usually the migrating bands that swept back and forth from north to south or east to west, according to season or the abundance or scarcity of food and water. But, while migratory in habits, the buffalo did not entirely leave the State at any time of year, nor apparently any considerable part of it, as the fall and spring herds swept in a general way north and south, those from farther north and farther south coming in to replace those that drifted beyond its borders and to fatten on the rich summer grasses or to paw through the winter snow for the still abundant supply of well-cured prairie grass underneath. The country was well stocked but not overstocked. The buffalo had reached a fair equilibrium between natural increase and annual loss, loss from wolves, bears, and native hunters, and from quicksand, water, rotten ice, blizzards, and prairie fires.[2]

Natural checks on abundance.—At his winter quarters on the Park River, where it joins the Red River, Alexander Henry (1897, pp. 174, 175, 177, 253, 254) writes in his journal, on March 31, 1801: "Rain broke up the ice . . . It continued to drift, . . . bearing

[2] For full and interesting accounts of the buffalo, see Allen, J. A. (1876), The American bisons, living and extinct; Hornaday, W. T. (1889), The extermination of the American bison; Seton, Ernest Thompson (1909), vol. 1, pp. 247–303, Life-histories of northern animals.

great numbers of dead buffalo from above, which must have been drowned in attempting to cross while the ice was weak." On April 1, he says: "The river is clear of ice, but drowned buffalo continue to drift by entire herds . . . It is really astonishing what vast numbers have perished; they formed one continuous line in the current for two days and nights. One of my men found a herd that had fallen through the ice in Park River and all been drowned; they were sticking in the ice, which had not yet moved in that part." On April 18 he records "drowned buffalo still drifting down the river, but not in such vast numbers as before"; and on May 1, "The stench from the vast numbers of drowned buffalo along the river was intolerable . . . Two hunters arrived in a skin canoe from Grandes Fourches with 30 beaver and 7 bear skins. They tell me the number of buffalo lying along the beach and on the banks above, passes all imagination; they form one continuous line, and emit a horrid stench. I am informed that every spring it is about the same." Similar accounts of buffalo in the Missouri River are found in journals of the early explorers.

In the Hair Hills, at the source of Salt River, on November 25, 1803, Henry saw the effects of fire on the buffalo and writes:

> Plains burned in every direction and blind buffalo seen every moment wandering about. The poor beasts have all the hair singed off; even the skin in many places is shriveled up and terribly burned, and their eyes are swollen and closed fast. . . . In one spot we found a whole herd lying dead. The fire having passed only yesterday these animals were still good and fresh, and many of them exceedingly fat. . . . At sunset we arrived at the Indian camp, having made an extraordinary day's ride, and seen an incredible number of dead and dying, blind, lame, singed, and roasted buffalo. The fire raged all night toward the S. W.

Extermination by man.—Although natural losses among the buffalo herds were at times great, they were local and irregular. With the advent of the white trappers and traders with powder and ball, and later of the skin hunters with better rifles, the long-established equilibrium was destroyed, and as settlements crept in the buffalo were crowded back or killed for local supply of meat and robes, and the great herds were followed and exterminated for their skins by gangs of men employed for the purpose. Old hunters have told of shooting 75 to 100 buffalo a day, from which their skinners would remove the hides and pin them to the ground to be dried and later hauled by teams to the nearest river or railway point for transportation. In the seventies the principal cargo of boats coming down the river from Fort Benton to Bismarck consisted of buffalo hides, more than 60,000 having been shipped down by one firm. Big wages were paid and big profits realized.

The first record of the buffalo receding before the settlement of the area now included within the State of North Dakota was in 1821, by Alexander Ross (1856, pp. 57, 100, 255, 257, 267), who reported them as becoming scarce in the vicinity of Pembina, and in 1826 as apparently not found without going 150 or 200 miles beyond Pembina. In 1840, he says the Pembino hunters went 250 miles in the direction of the Sheyenne River for buffalo, and in 1840 he prophesied that the end of the buffalo was fast approaching. Thenceforth the history of the buffalo becomes the history of their slaughter and rapid disappearance. On July 4, 1840, Ross records

a buffalo hunt organized and carried to the vicinity of the Sheyenne River, west of Fargo. The herds were located and on the evening of the first day's hunt 1,375 tongues were brought into camp and more than 2,000 buffalo were estimated killed by the 400 mounted hunters.

In September, 1861, Charles E. Patton and party, traveling west from the Red River Valley, saw the first buffalo and killed seven, about one day east of Devils Lake. A few days later 15 more were seen and 2 killed, a half day west of Sullys Hill. One day farther west herds of 15 and 20 were seen and the main great herd was near.

At Devils Lake, in 1916, Frank Palmer said that in 1866, on a trip in Minnesota and North Dakota, the first buffalo in any abundance were encountered on the James River near the southern border of the State. In 1868 when he came to Devils Lake they were getting scarce near the fort and the Indians were in the habit of making trips to procure their meat supply. In 1869 and 1870 they were getting scarce all around the lake and hunting for hides had begun on a commercial basis. (Hornaday, 1889, pp. 507–508.) Near Valley City the last buffalo was killed in 1874.[3]

A surveying party in charge of George G. Beardsley in 1874 encountered a herd of buffaloes numbering about 300 near the Hawk's Nest Buttes, not far from where Carrington now stands. The next year these were all killed (Wilcox, 1907, pp. 51, 53).

In 1876 the Northern Pacific Railway reached Bismarck and diverted most of the cargoes of buffalo hides from the Missouri at that point, but only incomplete records were kept of the shipments. In 1881 more than 75,000 hides were shipped out from there, but these were mainly of animals killed in Montana (Hornaday, 1889, pp. 507–508).

Mr. Holes, who settled at Fargo in 1871, told the writer that the nearest buffalo then were found on the prairies south of Devils Lake. J. A. Allen (1875, pp. 39–40) says the last buffalo killed near Fort Rice was in 1869, when three were killed from a herd of 10 old bulls which had strayed far eastward from the main herds. In 1915, Remington Kellogg was told that the last buffalo seen in the Goose River country was killed in March, 1878.

Some of the old settlers reported in 1916 that the last buffalo was killed near Cannon Ball in the seventies. In June, 1882, the last great buffalo hunt of North Dakota took place on the headwaters of the Cannonball River, where 600 Indian hunters, well mounted and well armed, killed in a two-days' hunt 5,000 animals, as vividly described by Major McLaughlin (1910, pp. 97–116), who took part in the hunt.

The Fargo Record reports an old bull killed near Sykeston, in Wells County, in 1881, and E. E. Booth, of Minot, tells of one seen near Sawyer, in the same county in 1883, which was chased by horsemen but not caught. He says the animals were still common in the Dickinson country in 1882. Near Stump Lake the writer was told that the last buffalo ever seen in that region was a lone wanderer seen and chased, but not killed, in the winter of 1881–82.

In 1913, at Fort Clark, Stanley G. Jewett learned from old hunters that the last buffalo in that region was killed by Joe Taylor during

[3] Report by John Hailand to Morris J. Kernall in 1913.

the fall of 1884. At Medora he was informed that the last killed was in the neighboring hills in 1884; and at Sentinel Butte, Lewis F. Crawford told him that, so far as he knew, the last one killed in the State was in the country south of Dickinson in 1884.

There may be later records for the State, but even those of 1884 were of scattered individuals missed in the big hunts that had swept the main herds out of existence.

Present-day remains.—To-day a buffalo robe or coat is rarely seen and the few remaining are greatly prized. A few mounted heads are still preserved in museums and public places.

In 1887 when the writer first visited North Dakota, heaps of bones, mainly of buffalo, were commonly found at the stations along the Northern Pacific and Great Northern Railways. Great piles of bones were often seen near the sidetrack, waiting until enough more were brought in to load one or more freight cars for shipment to fertilizer plants. Almost perfect buffalo skulls and horns were found in these bone piles but unfortunately the importance of saving series of skulls for future study was not then appreciated.

Buffalo bones have now almost disappeared from the surface of the prairies, but they are still abundant under ground and under water. The marshy and springy places around the edges of lakes or along the river valleys fairly bristle with them. The shores and beaches of Devils Lake, Stump Lake, and the Sweetwater Lakes are strewn with such characteristic bones as the skulls, vertebrae with the long dorsal processes which supported the hump, and pieces of the rough black horns always distinguishable at a glance from those of cattle. Even the islands in the middle of Devils Lake are thickly strewn with buffalo bones, the unrecorded history of which is well understood by reading the accounts of Alexander Henry, Lewis and Clark, and others, of the thousands of buffalo carcasses found in spring floating down the rivers when the ice was melting and breaking up.

Every lake and river in North Dakota seems to have trapped the buffalo during their abundance, while marshes, bogs, and spring holes drew heavily upon their numbers. The spring and fall migrations were in large part responsible for these fatal results, as rivers and lakes must necessarily be crossed or the migrating herds be checked or change their courses. For ages to come, well-preserved skeletons will be found embedded in the mud and silt, and still more perfect specimens in the oozy bogs of cold and mineral-impregnated water so common in the State.

The old buffalo trails have not all disappeared. In many places they are still deep and well preserved in the tough prairie sod or on steep sidehills and Badlands buttes, where not disturbed by the plow or by the less hardy domestic stock.

Buffalo wallows, little prairie basins that caught the rain and were used for mud baths by molting bulls with itching hides, are still found in great numbers not only on level areas but on hilltops and along the crests of ridges. Rubbing stones, great granite bowlders high enough to reach the itching sides of the buffalo, still stand on the prairie or on morainal ridges where they have been rubbed and polished until their sides are smooth and glossy, and

the earth around them has been trampled and blown away, leaving them like inverted cups standing in deep saucers of earth.

The survivors.—Of living buffalo, there are many in private and public parks, and a small national herd is maintained in the Sullys Hill Park, on the south side of Devils Lake. These are hardy and bid fair to keep the species permanently within the borders of the State as a reminder of the romantic days when tribes of wild Indians and herds of wild bison roamed at will over the great prairies and sought the shade and shelter of the groves on the margins of streams and lakes.

Ovis canadensis auduboni Merriam

Audubon Mountain Sheep

Bighorn of the Badlands; *Ansa-chta* of the Mandans (Will); *Heki^{n}skagi;* (*Heki^{n}shkagi*) of the Dakotas (Gilmore); *Azichtia* of the Hidatsas (Matthews); *Arikusa* of the Arikaras (Gilmore).

Ovis canadensis auduboni Merriam, Proc. Biol. Soc. Wash., vol. 14, p. 31, 1901.

Type locality.—"Upper Missouri," probably the Badlands between the Cheyenne and White Rivers, S. Dak. Type specimen supposed to have been collected by F. V. Hayden in 1855. [See original description.]

General characters.—Fully as large or larger than *Ovis canadensis*, molars and jaws much heavier. Audubon (1851–1854, vol. 2, p. 165, 1851) gives the color of July specimens as light grayish brown, rump and underparts, grayish white; and the weight of a male as 344 pounds, and of a female as 240 pounds.

Distribution, habitat, and habits.—Lewis and Clark in 1805, Maximilian in 1833, and Audubon in 1843, in their trips up the Missouri River, found mountain sheep on the Badlands bluffs between the points where the Little Knife and White Earth Rivers join the Missouri from the north, below the mouth of Muddy River, and near the junction of the Yellowstone with the Missouri. Maximilian reported them as abundant in the "Black Hills," where the Indians went to hunt them, and on his map includes under this name the Killdeer Mountains and Badlands along the Little Missouri River. At Fort Clark he (Wied 1839–1841, Bd. 2, p. 85, 1841) said they were not found within 50 miles, which may have been either north or west, but was probably both. Apparently the original range of the bighorn in North Dakota included all of the very rough Badlands country along and west of the Missouri River. Howard Eaton in the seventies, and Theodore Roosevelt in the eighties, killed mountain sheep in the Badlands along the Little Missouri, but they were then no longer abundant; and at the present time there is probably not a live wild mountain sheep in the State, nor one of this subspecies in existence.

The history of the bighorn in North Dakota is in a small way like that of the buffalo—a record of extermination. In 1804, Lewis and Clark (1893, pp. 150, 214, 284) reported bighorns in the Badlands west of the Missouri River. At the Mandan villages they saw sheep horns among the Indians, and near the mouth of the Yellowstone one of their men met several of the bighorn animals, but they were too shy to be obtained.

In 1833, Maximilian, Prince of Wied (1839–1841, Bd. 1, p. 423, 1839; Bd. 2, pp. 85, 309, 315, 1841), on his way up the Missouri to Fort Clark and Fort Union and thence west to Fort McKenzie and back to Fort Clark, where he spent the winter of 1833–34 among the Mandan Indians, first saw mountain sheep above the mouth of the Little Knife River. Later he found them below the mouth of the Muddy River and near the mouth of the Yellowstone, while among the Mandans and Minnetarees he found beautiful shirts made of bighorn leather. The Minnetarees, he said, went to the Black Hills and other mountainous tracts to hunt, and killed a hundred or more sheep in a season. Among the Mandans and some of the other tribes he found the horns in use as bowls or ladles.

Audubon (1897, pp. 24, 28, 40) saw his first bighorns in 1843 on the summit of a hill above the mouth of the Little Knife River, quite probably the same butte on which Maximilian had seen them 10 years before, and he was told by the captain of the steamer that they had been seen there on his previous trip up the river. He saw others 6 miles below the mouth of the Muddy River, and near the mouth of the Yellowstone he saw a mixed band of 22, including rams, ewes, and one lamb (June 12). Many others were seen by members of his party, but it was with great difficulty that his hunters obtained enough sheep for his drawings and for a few specimens to be brought back. The sheep were very shy and kept on the highest and roughest parts of the Badlands buttes. He says, "I am told that the Rocky Mountain rams lost most of their young during the hard frosts of the early spring; for, like those of the common sheep, the lambs are born as early as the 1st of March, and hence their comparative scarcity." This explanation suggests some more recent theories to account for the scarcity of game, but with wolves and coyotes as abundant as they were at that time, the wonder is that any lambs could escape to grow up, even on the very rough slopes that afforded the only protection to the adults.

In 1860, J. G. Cooper (1869, p. 296) reported mountain sheep along the rocky bluffs bordering the Missouri River "above the Great Bend," but this record is indefinite, as most of his notes refer to the part of his trip from Fort Buford west to Fort Stanton, Mont.

A. McG. Beede, who has had long acquaintance with the Indians and is familiar with their language, hunting lore, and traditions, says that there never were any mountain sheep near the Missouri at Cannon Ball, but that formerly the Indians went farther west to hunt them.

Howard Eaton stated that in October, 1879, he killed two mountain sheep on Bullion Butte, a high plateau about 20 miles south of Medora. He also captured a live ewe on or near the butte and sent it to the Philadelphia Zoological Gardens, and he had killed many more in the Badlands of the Little Missouri.

In the early eighties Theodore Roosevelt (1900b, pp. 73–105) hunted mountain sheep in the Badlands along the Little Missouri, and, although much hard hunting was required for the few mountain sheep seen and the one fine ram killed, he has given us the best account of the habits and haunts of this species to be found in literature.

In 1913, Stanley G. Jewett, while in the Killdeer Mountains, was told by Mike Caskelly, of Oakdale, N. Dak., that three mountain sheep were found in the Killdeer Mountains in 1888. For several days they were seen feeding on the ridge above his ranch, where the present town of Oakdale now stands. Two of these were killed by Caskelly's brother. In 1915, Remington Kellogg saw a mounted mountain sheep head at the home of Charles W. Hoffman, principal of the Indian School at Shell Village. It was one of the three killed by an Indian (Birdsbill) in 1898 from a bunch of five in the Badlands of the Little Missouri just outside the reservation. Later a photograph was obtained of this head. On Magpie Creek, a branch of the Little Missouri, west of the Killdeer Mountains, Jewett saw an old weathered horn that had been picked up a few years previously, and ranchmen told him that mountain sheep had formerly ranged over the rough hills along Magpie Creek. The last one known there was an old ram killed about 1905, the head of which was in the possession of a ranchman near Quinion. So far as known this is the last record for the State, although there are somewhat later reports of the species from the Badlands of South Dakota.

In the destructive and constructive periods of the West, as it passed from savage to civilized life, the bighorn of this open and accessible area contributed its all. Besides its most savory of wild meats, its magnificent head and horns offered a highly prized trophy not often obtained in the low country or where hunting on horseback was possible. Whether for sport or profit there was always a high price on the head of the bighorn, and this spells the doom of any species.

Family ANTILOCAPRIDAE: Pronghorned Antelope

Antilocapra americana americana (Ord)

Pronghorned Antelope; American Antelope; Pronghorn

(Pl. 7)

Koka of the Mandans (Will); *Tatókana* of the Dakotas (Beede); *Uchi* of the Hidatsas (Matthews); *Chka* of the Arikaras (Gilmore).

Antilope americana Ord. Guthrie's Geog., 2d Amer. ed., vol. 2, pp. 292, 308, 1815. (Reprint by S. N. Rhoads, 1894).
Antilocapra americana Ord, Journ. Phys. [Paris], vol. 87, p. 149, 1818.

Type locality.—Plains and highlands of the Missouri River.

General characters.—Size of a small deer, very slender, graceful, and swift. The striking characters are the flat-pronged and hooked horns, which are shed and renewed each year, the mere stump of a tail, the great white rump patch that is spread in a wide rosette or closed down at will, and the strongly contrasted buff and black and white markings. It is neither a true antelope nor a goat, but belongs to a family of one-pronged deciduous-horned animals including one species and several geographic races peculiar to North America.

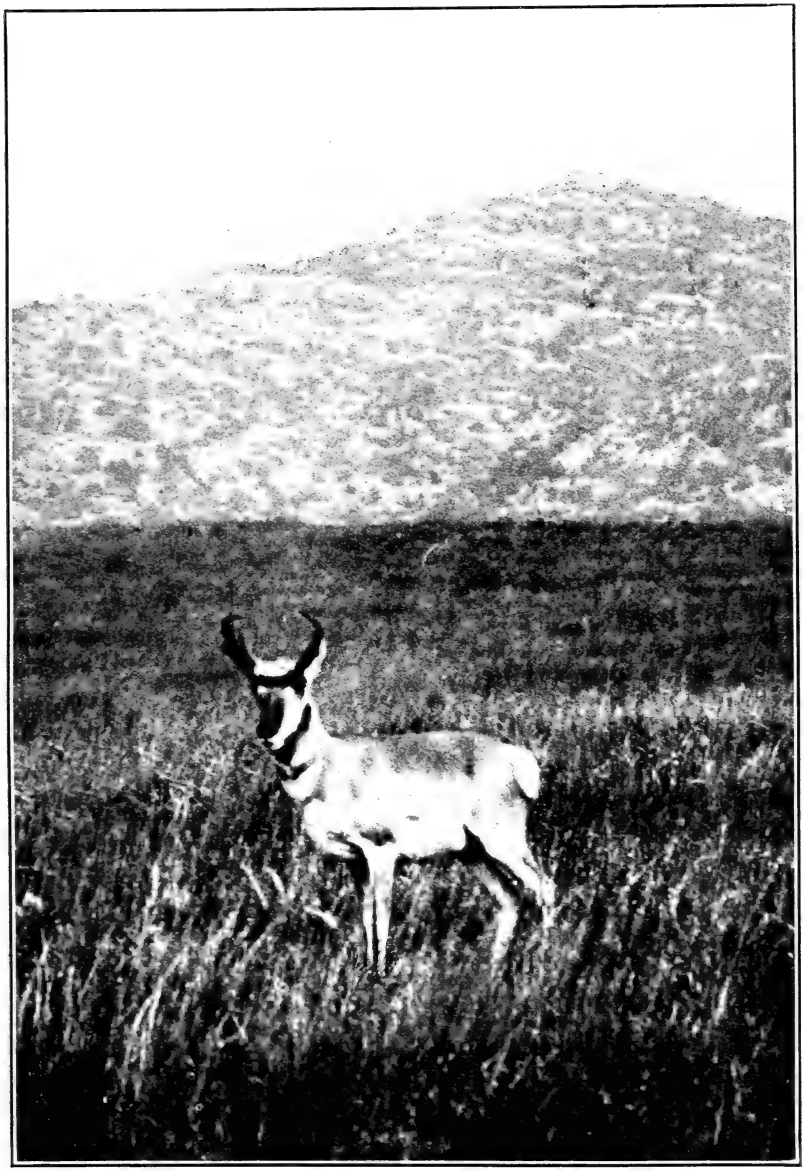
Distribution.—Antelope originally ranged over nearly all of the open country of North Dakota. It is doubtful that they ever penetrated the timbered area of the Turtle Mountains to any extent,

and they seem to have been always absent or scarce in the immediate valley of the Red River. On his numerous trips up and down the Red River Valley from 1800 to 1806, Alexander Henry (1897, p. 191) never mentioned them except for one brought him by an Indian at Pembina, November 15, 1801. At Fargo, James Holes, one of the early settlers, said in 1912 that as long ago as 1871 there had been no antelope nearer than the western part of Cass County, where they were abundant until at least 1879. In 1887 at Pembina, the writer heard that they were still found in the Pembina Hills, 34 miles west of the Red River, and all along the valley they were reported west of the low, flat bottom of old Lake Agassiz. Perhaps their range was established before the lake disappeared, but more probably the tall grass and rich waxy soil kept them away from the valley bottom.

Early abundance.—In 1804, Lewis and Clark (1893, pp. 170, 174, 190, 211) reported great numbers of "goats" (antelope) along the Missouri River. On October 16, 9 miles below the mouth of Cannonball River, they recorded great numbers on the banks and in the river, where they were driven by the Indians and killed with sticks and guns. Again, great numbers were seen on the wide flats just below Bismarck and about their camp above Mandan, where 100 were caught at one time in a pen by the Indians. The explorers were told that the antelope were then on their fall migration west to the "Black Mountains" to spend the winter, but would return to the plains east of the Missouri in spring; and as the party continued up the river the following April, after wintering at the Mandan villages, they met the returning antelope in great numbers.

In August, 1806, Alexander Henry (1897, p. 410) reported numerous herds of "cabbrie" (antelope) on his way from Mouse River to Fort Union. In 1833, Maximilian (Wied, 1839–1841, Bd. 2, p. 84, 1841; 1843, p. 246) says the "cabri" or antelope (*Antilocapra* Ord), lived the whole year in the immediate vicinity of Fort Clark. In the summer great numbers congregated, going in the winter toward the mountains, where they found protection from the snow, and returning in April, when large bands of them were seen about the Missouri. Their migrations were by no means checked by the Missouri River, as bands were frequently seen swimming across, and the great prairies east and north of the river were a favorite summer range, as the Badlands of the Little Missouri, the Powder, and the Cheyenne Rivers (South Dakota) were a favorite winter resort for the antelope of that region.

In 1873 from Fort Abraham Lincoln west to the Little Missouri J. A. Allen (1875, p. 40) found antelope the most abundant game animal, almost constantly in sight and attracting much attention for their grace and beauty. On his return trip a few months later a fatal epizootic had raged among the pronghorns over nearly the whole area between the Yellowstone and Missouri Rivers, destroying apparently three-fourths to nine-tenths of the animals. For the whole length of the Heart River, considerably over 100 miles, along the line of march, he says, their carcasses were thickly scattered and included both sexes and all ages, fawns often lying within a few yards of their dams. There were 10 dead seen to every live antelope, but the disease had apparently not extended beyond the Yellowstone or Missouri Rivers.



B2778M

BUCK ANTELOPE (ANTILOCAPRA AMERICANA AMERICANA)

From photograph by H. W. Henshaw, Wichita Game Preserve, Okla.

Decrease in abundance.—In later years the disappearance of the antelope over the State has been not so much in advance of settlement as in the case of the buffalo, but has been coincident with the early filling up of each section of their range by settlers. Frank Palmer, of Devils Lake, told the writer that antelope were numerous in that part of the State up to 1872 and common to 1876, while a few remained into the eighties. Mr. Holes, of Fargo, reports "lots" of antelope seen in the western part of Cass County in 1879. In 1877 a herd estimated at 3,000 was seen by J. S. Weiser between Valley City and Jamestown. From 1878 to 1880 they were common about Valley City, according to John Hailand, and as many as 200 were seen in a bunch. In 1882 a "whole herd" of antelope was seen on Judge Green's farm, southwest of Valley City, by D. W. Clark, and in 1892, ex-Governor Frank White saw eight antelope near Valley City. In 1887 the animals were reported as still common in the Mouse River country, a few were still found in the Pembina Hills and country east of the Turtle Mountains, and a bunch of 14 had wintered near Devils Lake. In 1891 and 1892 Elmer T. Judd killed several near Canby, but they were the last he knew of in that section of the State. At Stump Lake the writer was told in 1912 that antelope were abundant over the prairies during the eighties and that the last few individuals had disappeared in 1909 or 1910. A few were reported on the prairies west of the Turtle Mountains in 1909, but the latest record available at Crosby, in the northwestern corner of the State, was of three seen in 1906, although they had been numerous there until about 1903.

In 1915, Remington Kellogg was told of one recently seen near Lostwood Lake in the northern part of Mountrail County, but it is doubtful if there are at present any remaining east or north of the Missouri River.

West of the river, the more arid prairies have been used as stock range and only in recent years have filled up with grain farms and close settlement, to which fact, and to the fact that the areas of rough Badlands country are unsuited to farming, the antelope owe their present though scant existence in the State. In the early eighties Roosevelt (1900c, pp. 72, 77–80, 97–98, 119–120) found them still abundant in places. On one trip with the round-up between the Little Missouri and the Yellowstone, he wrote: "Antelope were very plentiful, running like race-horses across the level, or uttering their queer, barking grunt as they stood at gaze, the white hairs on their rumps all on end, their neck bands of broken brown and white vivid in the sunlight." Being detailed to get antelope meat for the round-up camp, he says: "There was no lack of the game I was after, for from every rise of ground I could see antelope scattered across the prairie, singly, in couples, or in bands." They were wild and in open country, but he managed to bring in three to the camp that night. One December in the eighties, making a trip of about 20 miles from his ranch to where a band of antelope were wintering, he found a herd of several hundred and killed an old buck and a yearling to take back for meat. The others ran around him, but would not leave the flat for the broken country and deep snowdrifts beyond. He says: "Their evident and extreme reluctance to venture into the broken country roundabout made me

readily understand the tales I had heard of game butchers killing over a hundred individuals at a time out of a herd so situated." Again, he says: "Several times I killed and brought in prong bucks, rising before dawn, and riding off on a good horse for our all-day's hunt on the rolling prairie country 12 or 15 miles away" [from his ranch].

In 1893, A. K. Fisher reported antelope as still common within 25 miles of Medora, where J. L. Foley had killed 13 on one trip the previous fall. In 1909 the farmers reported a bunch of 20 that had been seen a little west of Fort Clark a couple of years before.

In 1913, Charles Converse said there were still a few antelope about Schafer and Alexander; and Stanley G. Jewett reported a few still on the rolling prairie around the Killdeer Mountains, where the settlers told him it was not uncommon to see them anywhere in the open country north and west from Oakdale to the Little Missouri. At the Q-Bar ranch, on Magpie Creek, he was told of five antelope often seen on the hills to the east of the ranch house, but no others were known in that vicinity. At Medora, he learned that there were still a few on the plains about 30 miles south of there, where a doe and a fawn had recently been seen by a ranchman, and where four others were reported by a local surveyor. At Sentinel Butte, Mr. Crawford told him of a band of 17, which he had seen a few miles south of town two years previously, and of one that was frequently seen on the hills north of town during the summer of 1912. In August, 1913, there were about 30 antelope ranging on the Dakota National Forest, some 25 miles south of Medora, and a few on the big flats south of Bullion Butte. In 1915, H. H. Sheldon reported about 30 still in and around the national forest, and a few seen on Deep Creek, south of it, but said that they were being frequently killed and were apparently on the decrease. In August and September of 1915 Remington Kellogg reported a buck seen several times in Dunn County, west of Elbowoods, and a few near Goodall in McKenzie County. In 1916 the writer was told that there were still a few antelope in the section about Cannon Ball, and that two had been seen only a few miles west of the town within a few days. The great numbers formerly occupying that region had entirely disappeared.

A recent report on antelope by E. W. Nelson (1925) gives their present numbers in the State as follows:

> Antelope have almost disappeared from North Dakota. The remaining herds now number only five and aggregate about 225 animals. Their future appears to be extremely doubtful unless a game preserve can be established wherein they may be safeguarded.
>
> The distribution of the herds [in 1924] is approximately as follows:
>
> 1. In September, 1924, 60 antelope were reported as ranging from northwestern Dunn County into the adjacent part of McKenzie County.
>
> 2. A band of 9 was reported in September, 1924, in southwestern McKenzie County.
>
> 3. About 75 are reported in adjacent parts of central Golden Valley and Billings Counties. This is the largest band reported in the State. William McCarthy, who owns 11,000 acres of rough, rolling land in the heart of the Badlands along the Missouri River, which affords a natural range for game, writes that when he came into possession of the range in 1910 there were about 15 antelope there. Much hunted, they sought and were given every protection in his pastures, where they found running springs and flowing wells with an abundance of grass, and as a result have become very tame.

4. Bands numbering 55 were reported in September, 1924, in the Badlands of the Little Missouri River in Slope County.

5. In September, 1924, a band of 26 was reported from southwestern Bowman County.

Protection for the remnant.—The few antelope still inhabiting the roughest and least-settled parts of the Badlands would doubtless, if taken in time, form the nucleus of a herd that might rescue the species from being wiped out of the State, if not out of existence. If rough land of little value except for forest production and grazing were properly fenced so that the antelope would not stray to unprotected areas, and if coyotes were trapped to a harmless minimum and sheep scab kept out, it would seem that antelope should increase as rapidly as any herd of sheep. There are often, if not usually, two young at a birth, and these rough Badlands buttes and gulches afford the shelter and protection needed from storms and the most severe winter weather. Native plants furnish ample food in short grass for summer and in choice buds and tips of bushes for winter. Away from their native haunts no animals are more difficult to raise and keep in good health; at home no domestic animals are so hard and able to care for themselves under all conditions of weather and climate. Some of the Badlands areas that have been the wonder and admiration of geologists and travelers since the days of the early exploring expeditions could well be used as a preserve to save the antelope. Mule deer, elk, and bison could be added to the preserve thus created, but it is probably too late to rescue the Audubon mountain sheep for the purpose, although they have only recently vanished from the terraces and crests of these brilliantly colored buttes.

Family CERVIDAE: Moose, Elk, Caribou, and Deer

Alces americanus americanus Jardine

Moose

(Pl. 8)

Orignal, of the early French voyageurs; *Moose* [or *Muswa*] of the Crees and Ojibways (Seton); *Wesucharut* of the Arikaras (Gilmore); *Ta* of the Dakotas (Gilmore); *Pachúptaptach* of the Mandans (Will).

Alces americanus Jardine, Nat. Libr. Mamm., vol. 3, p. 125, 1835.

Type locality.—Eastern North America.

General characters.—The largest of the deer family, with throat pendant, or bell, long legs, short tail, and the dark colors of the deep forest habitat; the bulls with broadly palmate, deciduous horns. Measurements of a large bull by Seton (1909, vol. 1, pp. 145–146), total length, 9 feet, 6½ inches; tail, 2½ inches; hind foot, 31¼ inches; height at shoulders, 6 feet. Weight of very large bulls, 1,300 and 1,400 pounds.

Distribution and habitat.—Their long legs and wide-spreading hoofs enable moose to wade and swim and pass rapidly through marshes, swamps, and lakes, as well as through dense forests, but these animals avoid the open country as completely as antelope do the timber. From the great forests on the north and east, the moose in the early days entered North Dakota in the Turtle Mountains

and along the timbered fringes of the Red River Valley. In 1800, Alexander Henry (1897, pp. 90, 118) stated in his journal that they frequented the mouth of Park River. He also said that the Pembina Hills made a famous country for moose and elk. In 1887, when the writer was at Bottineau, moose were still reported from the Turtle Mountains, and in 1912, records were obtained of some killed there in 1888, 1899, and 1906. The country is ideal for them and the extensive area combines dense forest, thickets, and a network of marshes and lakes, where the tule borders half hide the floating pads and golden globes of the cowlily, forming a perfect moose paradise. It is not improbable that an occasional pair may still stray into these mountains, and if given sufficient protection these might remain to restock their old range. The mounted head to be seen in the agricultural college at Fargo is from a moose killed in 1898 by G. N. Brown at Rock Lake, just east of the Turtle Mountains. At Walhalla the writer learned of one killed near there in 1889.

In 1915, Remington Kellogg learned of a moose killed 3 miles south of Grafton, in 1900, and another on the Red River, 3 miles east of Grafton, in 1908. H. V. Williams reported one killed near Glasston in 1905, and another at Drayton, on the Red River, in 1906.

W. B. Bell reported the capture of a cow moose in Sargent County in the fall of 1913. It was kept captive at the Ellendale Industrial School for a time, but later was sent to a public park in Minnesota. A bull and cow and two calves near Mayville, in Traill County, were also reported to Doctor Bell the same year, but the report was not fully verified.

At the Fort Totten Indian School in 1916, Mr. Zibeau, the agent, said that the old Indians say there used to be moose in the timber around Devils Lake, but the report was not confirmed by the oldest white settlers in that region. The woods on the Sullys Hill Park are well adapted to moose, and it is hoped that sometime they may be added to the attractions of this historic park.

Few of our large game animals respond more satisfactorily to protection than do moose, as is demonstrated by their abundance and increase in such well-protected areas as in Maine and New Brunswick and in the Yellowstone and Glacier National Parks. They have few natural enemies that they can not overcome; they are too conspicuous to be much temptation to poachers; and, like the other deer, they often raise two young in a season. Although one of the most difficult of our native animals to keep in captivity, owing to their peculiar habits of feeding largely on the twigs of shrubs and small trees and from lake bottoms, they are extremely hardy in their natural environment in any sufficiently cold climate.

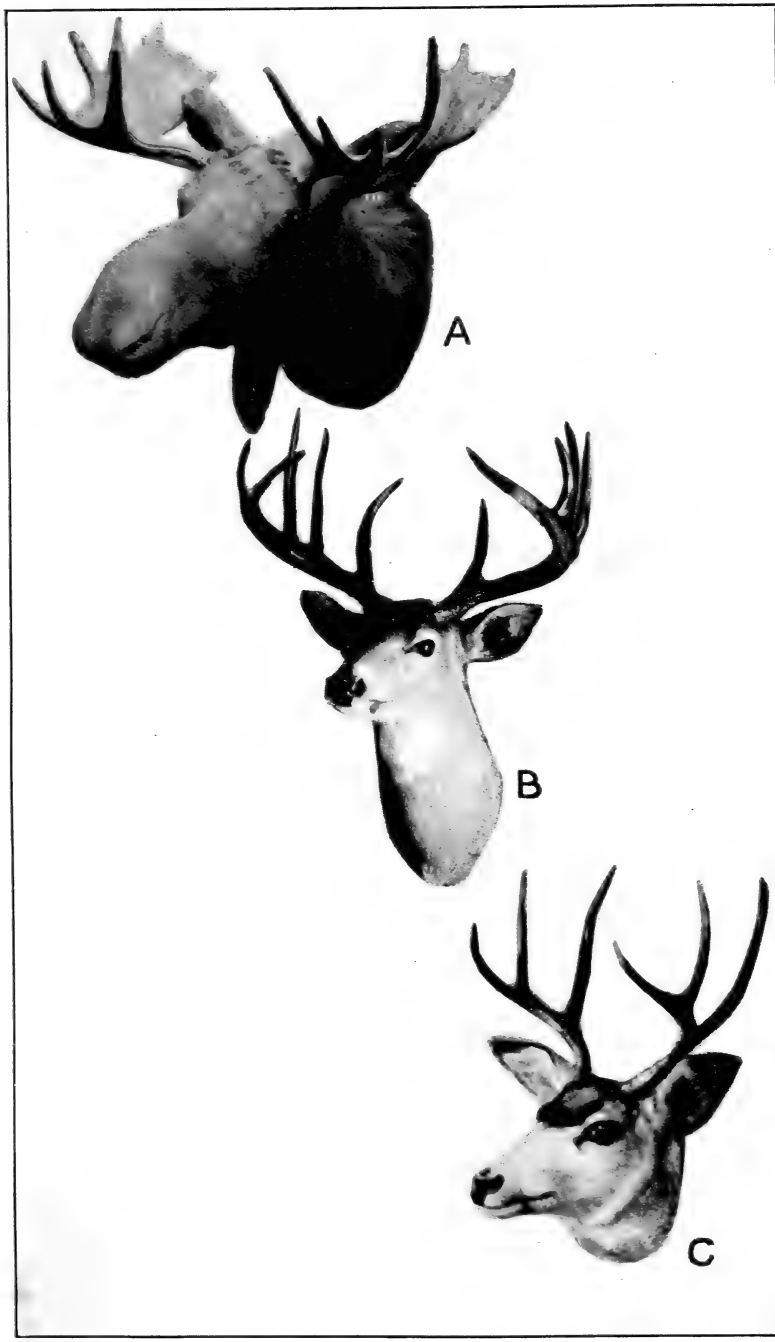
Rangifer caribou caribou (Gmelin)

Woodland Caribou

[*Cervus tarandus*] *caribou* Gmlein, Syst. Nat., 13th ed., vol. 1, p. 177, 1788.

Type locality.—Eastern Canada.

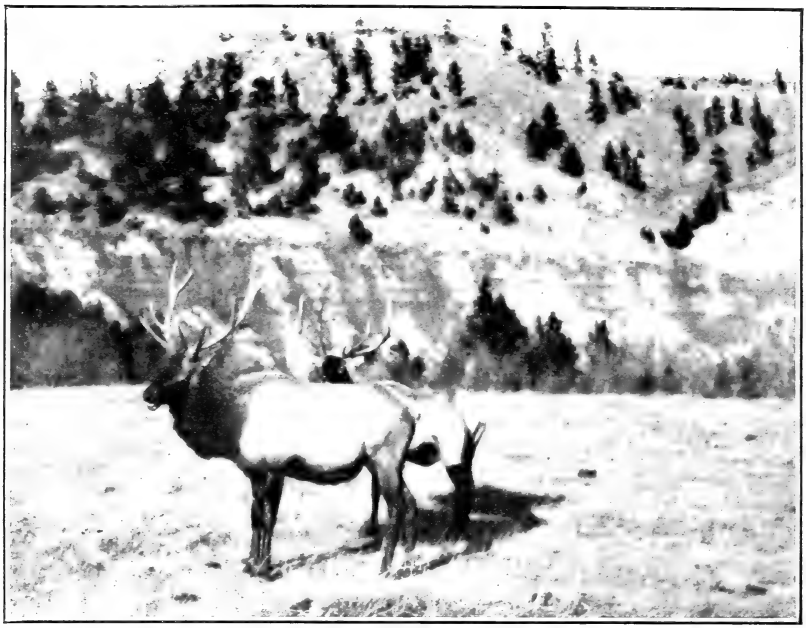
General characters.—In size between a large deer and small elk; horns large, with more or less flattened prongs and forks of beams, often with broad, flattened brow prongs in the male; females usually with small horns; feet, large; tail, short; color, dark smoky-gray, with more or less white on neck, feet, and underparts.



B1910M, B1911M

HEADS OF BIG-GAME ANIMALS

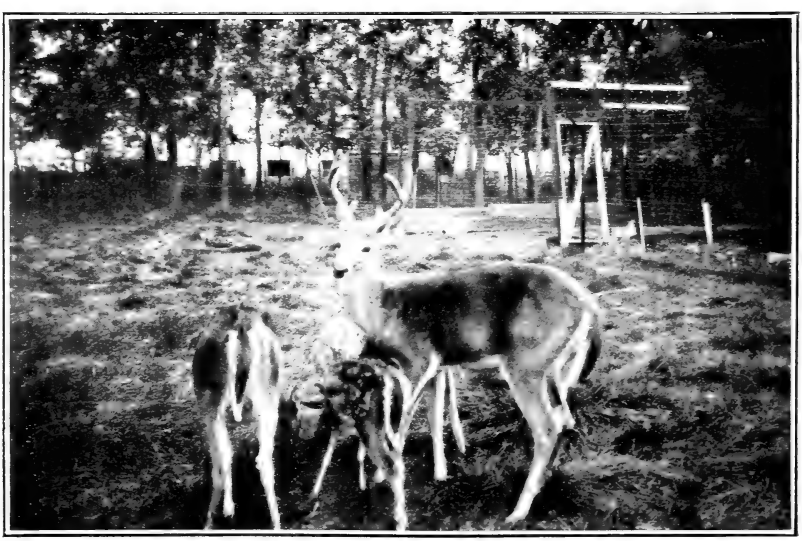
(A) Moose (*Alces americana americana*), from Rock Lake, east of the Turtle Mountains; (B) northern white-tailed deer (*Odocoileus virginianus borealis*), from Riding Mountains, Manitoba; (C) mule deer (*Odocoileus hemionus hemionus*), from Pembina Hills



B17624

FIG. 1.—TWO BULL ELK (CERVUS CANADENSIS CANADENSIS)

Photographed on game preserve, Niobrara, Nebr.



B15577

FIG. 2.—PLAINS WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS MACROURUS)

Family group of buck, doe, and two fawns from Missouri Valley below Williston

Distribution and habitat.—The eastern woodland caribou or closely related forms range through the Canadian Zone from the Gulf of St. Lawrence to the Rocky Mountains of western Canada, the lower edge of their recent range passing through northern Minnesota and central Manitoba. Their regular range is, therefore, at no great distance to the east and north of the corner of North Dakota, but apparently there are no records of their occurrence within the State since white men have known the region. It would not be strange, however, if at times during their former abundance, bands of this more or less wandering species should have strayed into the Red River Valley and the Turtle Mountain region. That this has been the case is shown by some fragments of old horns picked up in the Turtle Mountains and on exhibit at the museum of the fish hatchery near St. Johns. The writer has not seen these horns, but Mr. Eastgate writes that they are unmistakably those of caribou. If they came from the marshes or springy bogs of that region, they may have been there for many years, possibly centuries; but if from the surface of the ground, they could probably not have lasted more than 50 years at the most, and it is doubtful if they would have remained that length of time unless especially well protected.

Cervus canadensis canadensis Erxleben

American Elk; Wapiti

(Pl. 9, fig. 1)

Wapiti of the Shawnees (Handbook Amer. Indians); *Wah* of the Arikaras (Gilmore); *Ompa* of the Mandans (Maximilian), *O^{n}pa* (Will); *A^{n}pa^n* of the Omahas (Gilmore); *Upa^n* of the Dakotas (Gilmore); *Madoka* of the Hidatsas (Matthews).

[*Cervus elaphus*] *canadensis* Erxleben, Syst. Regni Anim., p. 305, 1777.

Type locality.—Eastern Canada.

General characters.—Next to the moose the largest of our deer, adult bulls being estimated to weigh from 700 to 1,000 pounds; adult cows, 500 to 600 pounds. Bulls with long, heavy, rounded, deciduous horns, each with normally six points in adults; cows hornless; tail short. General colors, dark brown with light-brown sides and a conspicuous white or buffy patch on the rump.

Distribution, habitat, and habits.—Originally elk ranged over all of what is now North Dakota, and were equally at home in the timber and over the open prairie. On his trip up the Red River in 1800, Alexander Henry (1897, pp. 83–85, 108) found them abundant and wrote in his journal of September 5: "Large herds were seen at every turn of the river and the bulls were bugling all through the woods. The rutting season was at its height." During the next six years he frequently mentioned them, and next to the buffalo they seem to have been the main source of meat supply for him and his parties of trappers in the Red River Valley and adjacent country.

In 1804–5, Lewis and Clark (1893, pp. 172, 174, 237, 250) recorded elk along the Missouri River all the way through North Dakota. On October 19, 1804, they reported three herds seen from a point 11

miles above the site of Fort Rice, and the next day great numbers on the wide river bottoms below where Bismarck now stands. At Fort Clark, where they wintered with the Mandans, elk meat was an important part of their winter provisions. On one hunting trip below the fort, February 21, 1805, they killed 14 elk, and on another trip on April 2, 21. Many herds were noted on the way up the river to Fort Union and beyond in the following April, and the Missouri River Valley seems to have been the great winter resort of the elk of the prairie region at that time.

In 1833, Maximilian (Wied, 1839–1841, Bd. 2, pp. 18, 47, 84, 1841) also found elk herds abundant along the river on his trip to Fort Union and westward and on his return trip to Fort Clark, where he wintered. On September 23 and October 31 he records the loud bugling (flöten) of the bulls from the timber along the river bottoms, and the spirited drawings by his artist, Karl Bodmer, show the elk herds in their prime. Maximilian said that the elk might be shot during the winter about 18 miles from Fort Clark, but that they did not approach nearer because of the Indians. Their skins were of great value in the manufacture of Indian moccasins.

Audubon (1897, p. 20, 157) (Audubon and Bachman, 1851, vol. 2, p. 88) found elk as abundant along the Missouri River in 1843 as had his predecessors. On June 9 he says: "We saw three elk swimming across it [the Little Missouri] and the number of this fine species of deer that are about us now is almost inconceivable." Many were killed during his stay in the country about Fort Union and on his return trip down the river they were seen and killed along the shores, while on August 26 the bulls were heard bugling, or "whistling," as he calls it. He says they were not confined to the wooded water courses, but roamed over the prairies in large herds.

L. C. Ives, of Veblen, S. Dak., told the writer of seeing thousands of elk along the Lower Yellowstone River in 1864 while on an expedition against the Indians. At Devils Lake, Frank Palmer reported that in the sixties, when he first came there, elk were common all over the State, and especially along the timbered areas of the Sheyenne River, and around Devils Lake, where they remained common up to 1879 and 1880. But as the country filled up with settlers, they rapidly disappeared.

In 1887, on the writer's first visit to North Dakota, he was told by an old hunter at Larimore of two elk killed near there in 1881 or 1882, and at Devils Lake there were said to be still a few. The last elk of which a record was obtainable in the Turtle Mountains was killed that year and a few were still found in the timbered areas along the Missouri and Yellowstone Rivers.

In the early eighties Colonel Roosevelt (1900c, p. 188; 1900b, pp. 155–156) says: "I have occasionally killed elk in the neighborhood of my ranch on the Little Missouri. They were very plentiful along this river until 1881, but the last of the big bands were slaughtered or scattered about that time." Later he says: "They have now vanished completely, except that one or two may still lurk in some of the most remote and broken places where there are deep, wooded ravines. Formerly the elk were plentiful all over the plains, coming down into them in great bands during the fall months and traversing their entire extent. . . . In the old days running

elk on horseback was a highly esteemed form of plains sport." He (Roosevelt, 1900c, p. 184) says: "Sometimes, but rarely, fighting wapiti get their antlers interlocked and perish miserably; my own ranch, the Elkhorn, was named from finding on the spot where the ranch house now stands two splendid pairs of elk antlers thus interlocked."

In 1915, Remington Kellogg was told of six elk killed in 1883 near Elkton, in Cavalier County. At Towner he was told by Mr. Lymburner that in 1884 elk horns were very plentiful in that section and that as late as the nineties the Sioux Indians had elk meat for sale that had been procured somewhere farther west. Near Plaza, in Mountrail County, he was told that a Mr. Hart had killed an elk in the summer of 1913, but no one could tell where it had come from. At Goodall, in McKenzie County, and near Elbowoods, in McLean County, in 1915, Kellogg found a few old antlers, as he did also on the river flats west of Sather, in Burleigh County.

On the flats east of Fort Clark in 1909, the writer found fairly well preserved pieces of old antlers, and in 1916 a few very old fragments near the mouth of Cannonball River, although the last elk there were said to have been killed 36 years before. At Stump Lake, in 1912, the writer also found a few fragments of old antlers, but could get no record of elk living there since 1881. The same year at the Sweetwater Lakes and in the Turtle Mountains he found a few old pieces, and in 1909, photographed a fairly well preserved pair of antlers at Mr. O'Neil's farm near Metigoshe Lake in the western part of the Turtle Mountains.

To what extent the elk were migratory in this open country will never be fully known, but their great abundance along the river valleys in fall, winter, and spring would indicate that these valleys were their wintering grounds. With a dense cover of timber and undergrowth and an endless supply of choice browse, they certainly afforded ideal conditions for elk winter range, just as the high windswept prairies gave equally ideal summer conditions. The shed horns of the elk are found mainly along the valleys or in the timbered areas around the lakes. According to Lewis and Clark (1893, p. 170), Big Beaver Creek in Emmons County was called by the Indians, "Warreconne," meaning where the elk shed their horns; Maximilian (Wied., 1839–1841, Bd. 1, p. 477, 1839) also speaks of the great numbers of shed horns along the river valley, and in his account of the region figures a pyramid of horns that had been piled up by passing bands of Indians as a landmark. As the horns are shed mainly during March and April, they are usually left on the winter grounds, but a few are carried back to the summer ranges and widely scattered.

Next to the buffalo, the elk at the height of their abundance were the easiest to hunt and hence the most rapidly killed of the large game, but when much hunted they become very wild, and it is probable that besides the vast numbers killed in the State, many were driven out of its borders.

With the possible exception of mountain sheep, elk meat is the most delicious of all our large game and a half year or year's supply of jerked elk meat has carried many an early pioneer's family safely over the period of "hard times" coincident with the settle-

ment of wild land. In the open country the disappearance of elk before settlement was inevitable and in their going the advancement of civilization has been well served. Only the needless waste caused by skin and tooth hunters need be regretted. Among the Indians elk skins provided most of the moccasins, but were little used for other clothing. Later, together with the buffalo skins, they found a ready market and, like many of the noblest of our game animals, the elk were sacrificed by the white skin-hunters.

Elk teeth were prized by the Indian women, to whom their use as ornaments was restricted. The wealth and rank of the women were often indicated by the number of elk teeth worn in necklaces and attached to various parts of their clothing. Even in recent times some of these treasured teeth have been worn by the older women and were so coveted that a price of a dollar each was put upon them. More recently, however, white men have adopted elk teeth as emblems or ornaments and, outbidding the squaws of savage tribes in their price for a useless bauble, have caused the wanton destruction of thousands of these superb animals. The braves and chiefs of these savage tribes, adopting the claws of the grizzly bear, scorned elk teeth as feminine adornments.

Economic considerations.—In domestication elk have proved more hardy and prolific than other stock and almost as easily handled under well-fenced range. If in the future the production of elk meat proves as profitable an industry as it promises, there will be found ideal conditions for elk pastures in many parts of western North Dakota, where rough and steep slopes lie close to brushy bottomlands, and winter browse and summer grass can be inclosed in single or adjoining areas. The severe winter weather which means suffering and loss to domestic stock without shelter is a joy to these native born and bred deer if a suitable and adequate food supply be available. Along many of the stream valleys with Badlands borders, which now lie idle or are of little use for stock, elk would find an abundance of their favorite food and choice living conditions. The time seems ripe for adding this industry to the many resources of the State.

Odocoileus virginianus macrourus[4] (Rafinesque)

Plains White-tailed Deer

(Pl. 9, fig. 2)

Tachtsha of the Dakotas (Gilmore); *Tsita-taki* of the Hidatsas (Matthews); *Mahmanaku* of the Mandans (Maximilian); *Ta-paht* of the Arikaras (Gilmore).

Corvus [sic] *macrourus* Rafinesque, Amer. Mo. Mag., vol. 1, p. 436, 1817.

Type locality.—Plains of the Kansas River.

General characters.—Similar to the eastern Virginia deer but slightly larger and paler in coloration. Horns with a single beam and upright prongs;

[4] In the Red River Valley, the Pembina Hills, and the Turtle Mountains, it is quite probable that the large northern deer of northern Minnesota, generally referred to *Odocoileus virginianus borealis* Miller, will be found to enter North Dakota, but until the group is more fully worked up the writer is referring all the white-tailed deer of the State to the Plains form, *macrourus*.

ears, small; tail, long, bushy, pure white below and gray on upper surface; no light rump patch. Metatarsal glands, small and low down on the hind legs. General color in summer, light-yellowish or reddish-brown; in winter, light gray with dark markings on face and ears; throat and underparts, always white. Fawns, spotted with white.

Distribution and habitat.—Unlike the mule deer in habits, the white-tails are secretive and depend largely upon cover for protection. While originally well distributed over North Dakota, they have always been locally restricted to the timber and brush areas along the stream valleys, about the lakes, or in the rough and hilly parts where the gulches are well filled with timber and a tangle of undergrowth.

Little mention was made of the deer of this region by the early explorers, as most of their attention was taken up by the other more abundant and conspicuous forms of game. Alexander Henry rarely mentions them in the Red River country, and their principal use seems to have been to provide skins for clothing. Along the Missouri River bottoms, however, they were so numerous in the timber and lake regions that their numbers were often commented upon by Lewis and Clark (1893, pp. 174, 233, 237) on their expedition up the river in 1804–5. On October 20, 1804, on the great flats just below the present site of Bismarck, great numbers of deer were reported. At Fort Mandan and old Fort Clark, these deer furnished an important part of the winter's food supply of the expedition as it wintered among the Indians. On one trip a hunting party brought in 40 deer, 16 elk, and 3 buffalo. On another trip a few miles down the river, February 21, 1805, Lewis returned with 3,000 pounds of meat, having killed 36 deer, 14 elk, and a wolf. Many deer were mentioned at other localities along the river on the way to Fort Union (Buford).

In 1833 while wintering among the Mandan Indians, Maximilian (Wied, 1839–1841, Bd. 2, p. 84, 1841) reported the white-tail as found in the nearest woods not a mile from the fort, while all other game was kept at a much greater distance by the Indians, who were constantly hunting for meat.

The disappearance of these deer from the greater part of North Dakota was coincident with the settlement of the country. While they were quickly destroyed, however, or driven from the small areas of cover, the more extensive areas are still preserving them in some degree of abundance locally. At Fort Sisseton, just below the southeastern corner of the State, Doctor McChesney (1878, p. 203), reported them as very common 10 years before, but said that none had been seen in that vicinity for several years. At Valley City Morris J. Kernall was told by several of the early settlers that white-tailed deer as well as mule deer were common there from 1878 up to 1885 or 1886, and one was reported by Frank White as killed in 1893. At Ellendale, in the possession of Fred S. Graham, Sheldon found a mounted head of a deer killed in the hills 12 miles northwest of Forbes in 1886.

In 1887, on the writer's first trip to the North Dakota region, he found no trace of white-tails in the Red River Valley, which was then well occupied by settlers, but they were still abundant along the Missouri River bottoms and were reported in the Pembina Hills and

Turtle Mountains. At Devils Lake, Frank Palmer reported that white-tailed deer were more numerous about there than the mule deer from 1868 to the early eighties. At Stump Lake they were said to have been common in the early days, and in 1912 Mr. Hovey said that four or five had wintered in a little grove on his place near Tolna, a few years before. In Benson County, Remington Kellogg learned of two that were killed at Bald Creek in 1912, but none had been known in that region for so long that these were supposed to have been driven from Minnesota by forest fires. In 1912, the writer was told that there were still a few deer in the Turtle Mountains, probably an overflow, however, from the well-stocked game preserve just across the line in Manitoba. The same year Eastgate reported two that had been killed on the North Dakota side not far from the borders of this preserve. He said that the ground under the ash trees in this preserve, from which the deer had been eating the seeds, looked like a goat pasture.

At Fargo, in the grounds of the agricultural college, in June, 1912, there was kept an interesting group of eight beautiful does, all raised from one pair of deer brought from the northwestern part of the State. They were captured when fawns on the Missouri River flats, about 20 miles south of Williston. The buck from this herd had died the previous year and was preserved in the college museum, but another was obtained later and the breeding of this little herd has continued. The mounted buck was in the long winter gray coat, but the does were in the full yellowish-red summer coats. When the herd was seen again, on August 27, 1914, there were three pairs of twin fawns in beautiful spotted coats. All were in the summer red coats and the horns of the fine young buck then with the herd were in the velvet. Altogether it would be hard to find a more beautiful group of animals.

In 1913, careful inquiry was made for deer in the region about Crosby, in the northwestern corner of the State, but only two were heard of, seen during a heavy snowstorm at a farmhouse north of town 3 years before. At a livery stable, however, there was the mounted head of a buck which had been killed 6 or 8 miles north of there 10 years previously. At Williston, there were still a goodly number of white-tails in the densely timbered and brushy bottoms of the Missouri River, where, owing to several years of protection from hunting, they were apparently on the increase. Formerly hunters had been coming in in great numbers during the open season and by hiring men with dogs and horses to drive the deer out of the bottoms had killed them off to the verge of extinction; with such systematic hunting the last deer could easily have been destroyed in this their best and almost their last stronghold in the State.

In the same year, Stanley G. Jewett found a few deer in the thickets along the river bottoms near Fort Clark, where fresh tracks were often seen. He found none in the immediate vicinity of Mandan, but some were still seen in the bottoms a few miles above. At Medora, they were reported as rare, but along the Little Missouri River below that point they were fairly common in the brushy draws and in the side gulches. South of Medora, along the northern edge of the North Dakota National Forest they were fairly common in the thickets and draws of the Badlands

breaks. In the horse pasture of Forest Ranger Follice, there were a half dozen that kept in the dense thickets along the banks of the river and in the gulches. When the hunting season opens, Mr. Follice said, they quickly leave his pasture and scatter out over the country, but usually after it ends all return to their former haunts. If a little more of this brushy area had been included in the national forest, an ideal game preserve for the white-tail, as well as for the mule deer and antelope, could have been established.

In 1915, Sheldon found white-tailed deer comparatively common on the brushy flats near the mouth of the Cannonball River and also on the flats of the Missouri bottoms. Tracks were abundant and a number of deer were seen from August 12 to September 9. The following year the writer found them there in considerable numbers, judging by their fresh tracks and trails among the thickets of the river bottoms. The law protecting them was then apparently well observed and they were comparatively tame and unsuspicious.

In 1915, at Towner, Remington Kellogg was told of a large doe that was killed seven years before by Clyde Coss from a bunch of three does and a buck in the forest along the Mouse River. At Grinnell, in the southeastern corner of Williams County, he was told that one buck was still left in the forest along the Missouri River. In a boat trip down the Missouri from Williston to Bismarck, during September, 1915, he found the deer more or less common all along the river bottoms. At Goodall, he reported a few in a patch of woods on a point of the river, where they were slowly increasing since the law protecting them had gone into effect. Above Shell Village a few tracks were seen, and above Elbowoods there were thought to be a dozen deer in the vicinity. At Big Bend, he was told that 125 deer had been seen and counted in the spring when the ice was breaking up. At Stanton a buck and doe and fawn were often seen from the settlement in the evening. From Stanton to Washburn and down the river to Bismarck, deer tracks were seen near almost every patch of timber along the river.

In September, 1919, O. J. Murie told of a deer recently killed near the Red River, 15 or 20 miles north of Fargo, and at Grafton H. V. Williams told of two that had been seen during the month about 5 miles north of town. At Walhalla it was reported that a few white-tails were still in the Pembina Hills near there, but that enough were killed each year by irresponsible residents to prevent any increase, even during the five-year period of protection accorded them by State laws. These hills, like the Turtle Mountains with their extensive area of timbered, brushy, rough, and sparsely settled country, afford a natural paradise for deer and could well support several thousand without detriment to anyone.

Along the Missouri River, at Buford, Sanish, Mandan, and Cannon Ball in 1919, the deer were holding their own or were slightly on the increase and it was thought would rapidly multiply and restock the timbered bottoms if they could be adequately protected.

Protection.—Reasonable protection would keep white-tailed deer fairly abundant along the Missouri and Little Missouri Rivers, as they are less averse to disturbance by people and domestic stock than any other deer. Theodore Roosevelt (1900a, p. 172), in writing of his ranch life along the Little Missouri in the early eighties, says

that when the cattle were first driven onto the northern plains the white-tailed deer were the least plentiful and the least sought after of all large game and that they had held their own as none of the others had begun to do. In certain localities they were more common than any other kind of game and in many places were more so than all other kinds put together. Ranchmen along the Powder River, for instance, had to content themselves with white-tailed venison, unless they made long trips back into the hills, and the same was becoming true along the Little Missouri. Skin and meat hunters found this deer the most difficult to hunt and the least remunerative to the hunter, and therefore only turned their attention to it when nothing else was left to hunt. In Roosevelt's long and interesting account of the habits and methods of hunting these deer he gives a good picture of their former abundance and rapid disappearance after other more easily obtained game had vanished, and he pays a well-merited tribute to the cunning and sagacity of the animals in protecting themselves, even where the country became well settled.

General habits.—When not harassed the white-tails are active both day and night, feeding mainly during the evening and morning hours. When much disturbed, however, their activities are for the most part nocturnal, while during the daylight hours they keep closely hidden in the dense cover of brush and timber. Once convinced of man's friendly intentions, as in some of the national parks, they become frankly confiding and will feed in the open for hours at a time, lying on the sunny slopes in cold weather and in the shade during the warm seasons, often in plain view of passers-by.

Food.—The food of these deer rarely includes much grass, but is mainly leaves, buds, and seeds of a great variety of shrubs and trees. Where acorns are available in fall the deer hunt over the oak-covered ridges in search of these rich-meated nuts, and often paw away the snow to obtain them from the surface of the ground. A great variety of other seeds and nutlets are eaten, including the pods and beans of many leguminous plants. In early spring, the first blades of green grass form an attractive food for the deer, but in the hunting season the writer has never found a trace of grass in a deer's stomach. The little herd in the fenced inclosure on the campus of the North Dakota Agricultural College left the beautiful dense grass of this half-acre inclosure untouched, but not a weed of any kind could be found within it. Outside the dandelions and other weeds were numerous, and a handful of dandelion leaves pulled up and thrown to the deer would create a frantic rush, each deer endeavoring to get as much of the dainty morsel as possible. As they prefer weeds to grass, a limited number of deer in every cattle pasture would improve the grazing by keeping down weeds and other plants that are of no value for ordinary stock.

Domestication.—Naturally quiet in disposition, these deer take readily to domestication. In favorable situations they can be raised with little trouble and much profit, either in the same inclosures with cattle and horses or in pastures by themselves, where the proper food is available. The usual number of fawns at a birth is two, and the increase is even more rapid than with sheep.[5] In the

[5] For information on raising deer and elk, see U. S. Dept. Agr. Farmers' Bul. 330 (Lantz, 1908).

fall when in prime condition their venison is unexcelled, and in many States the game laws have been modified to allow its being placed on the market under proper regulation.

Odocoileus hemionus hemionus (Rafinesque)

Mule Deer [6]

(Pl. 8)

Tsitashipisa of the Hidatsas (Matthews); *Sinte-sapana* of the Dakotas (Gilmore); *Shunte-psih* of the Mandans (Will); *Ta-katit* of the Arikaras (Gilmore).

Cervus hemionus Rafinesque, Amer. Mo. Mag., vol. 1, p. 436, 1817.
Cariacus virgultus Hallock,[7] Forest and Stream, vol. 52, p. 404, 1899.

Type locality.—Mouth of Big Sioux River, S. Dak.

General characters.—In size considerably larger than the white-tail, with forked antlers in adult bucks, very large ears, small white tail with black tip, and conspicuous white rump patch. The long metatarsal gland high up on the outside of each hind leg is one of the strongest group characters, when compared with the small glands low down on the white-tail's legs.

Distribution and habitat.—Although never in such conspicuous numbers as the elk and the antelope, the mule deer apparently occupied all of North Dakota before the country was settled by whites. They were largely animals of the open country, however, and ranged freely over the prairies, keeping as much as possible on the roughest and highest ground. The Badlands were their favorite haunts; here they were most abundant and here long-range rifles accomplished their most deadly destruction. Of the original thousands there is to-day scarcely a remnant left in the State.

The early explorers paid little attention to deer and rarely mentioned them, as buffalo, elk, and antelope were generally more conspicuous and more easily drawn upon for the meat supply. Alexander Henry (1897, p. 274) states in his journal in March, 1806, that three "fallow" deer were seen and one killed by the Indians near Pembina, but says they were the first he had seen in that quarter.

In 1802, LeRaye (1812, p. 180) saw these deer at the mouth of the Big Sioux River and wrote his description, which later furnished the foundation for Rafinesque's publication of the name *hemionus*. He also reported them as one of the principal game animals of the Big Heart River country, in what is now North Dakota. Lewis and Clark rarely mention them on their way up the Missouri in 1804–5, and Maximilian (Wied, 1839–1841, Bd. 2, p. 84, 1841) in 1833 gives only a few records along the river and distinctly says that they were not to be found within 20 or 30 miles of Fort Clark. Audubon in his journal of 1843 records only a few mule deer among the numerous white-tails seen and was unable to pro-

[6] The name "mule deer" was given to this species by LeRaye in 1802, 15 years before Rafinesque clumsily converted it into the Latin combination *hemionus*, and this earlier name should be used instead of "black-tail," which Lewis and Clark in 1805 occasionally applied to it, but later fixed to the "Columbia black-tail."

[7] There are no specimens from the type region of *hemionus* for comparison, but on general principles of geographic variation it is assumed that *virgultus* from northwestern Minnesota is not sufficiently different for separation. Until the group can be more thoroughly studied, it seems best to refer all the mule deer of North Dakota to *hemionus*.

cure a good buck for a specimen and for drawing, so figures in his Quadrupeds of North America only a doe, taken near Fort Union.

Lieutenant Hayden (1875, p. 94) in 1856, collected specimens of mule deer at White Earth River and Fox Ridge, which are still in the United States National Museum, and reported them as more abundant than the white-tails on the Upper Missouri. In 1873, J. A. Allen (1875, p. 41) reported them as "more or less frequent along all the wooded streams" from Fort Rice westward.

From his Little Missouri ranch experiences of the early eighties, Theodore Roosevelt (1900a, pp. 220–221), in his delightful chapter on the "black-tailed" deer, wrote:

> After the disappearance of the buffalo and the thinning out of the elk, the black-tail was, and in most places it still is, the game most sought after by the hunters; I have myself shot as many of them as of all other kinds of plains game put together. But for this very reason it is fast disappearing; and bids fair to be the next animal, after the buffalo and elk, to vanish from the places that formerly knew it.

At Valley City, in 1913, Morris J. Kernall gathered the following notes from early settlers: J. S. Weiser reported mule deer so common in 1878 that one could not travel 5 miles without seeing them. John Hailand reported them common in 1878 and the last one shot in 1885 or 1886; he says:

> There was so much venison in camp during the first years that visitors' ponies were usually loaded down with it before they returned. There was no sale for venison nor for skins, they were so plentiful. Skins were used for mattresses; they would get damp and deteriorate during summer and a new supply was provided each fall for the winter's sleeping.

In 1887, at Fort Sisseton, just below the southeastern corner of the State, the writer was told that the mule deer had been killed off three or four years before. At Pembina, in the extreme northeast, three mule deer had been killed that year a few miles to the east in the corner of Minnesota, and there were said to be still a few in the Pembina Hills, 34 miles west of Pembina, and still farther west in the Turtle Mountains, and along the Mouse River. A few also were reported in the hills back of Fort Buford.

At Devils Lake in 1916, Frank Palmer, who came there in 1868, told the writer that there were a good many mule deer until the country settled up in the early eighties. At Cannon Ball the old residents and Indians reported them as once common, but said they had disappeared a long time ago.

In 1896 Ernest Thompson Seton (1909, vol. 1, p. 118), in company with Howard Eaton, on a 15-mile ride across the Badlands of the Little Missouri saw only three "black-tail" where ten years before his companion had counted 160 over the same ground. In 1897 or 1898 Elmer T. Judd killed a mule deer in the hills south of Cando, and he still has the mounted head. In 1913 Mr. Allen reported that none had been killed in the vicinity of Mandan for 15 years, but that some heads had been sent him for mounting from Medina 8 or 10 years before.

In 1912, Eastgate reported mule deer as rare in the Turtle Mountains, but he obtained the skull of a young buck for the Biological Survey collection. He said that just across the line in Manitoba they were more common and a number were killed each year. In 1913, Stanley G. Jewett reported them as still fairly common in the Bad-

lands along the Little Missouri, below Medora, especially along Blacktail, Beaver, and Magpie Creeks. He saw mounted heads at the ranches and talked with men who had killed the deer during the preceding winter when they were driven down from the hills by deep snow. In the Killdeer Mountains, however, he found that all had been killed off near the settlements, one man at Oakdale having killed seven in 1911 but none since that time. At Sentinel Butte he saw the mounted heads of several killed near there in 1901, 1910, and 1911, and was told by Lewis F. Crawford that they were then found only in the rougher parts of the Badlands and were becoming very scarce where they were formerly abundant. Later in the same season the writer learned that there were a few mule deer on the Dakota National Forest, south of Medora, and H. H. Sheldon in 1915 reported a few still found there. The same year Remington Kellogg learned of two near the mouth of the Little Missouri, and in 1919 a few were reported west of Sanish. L. F. LePage exhibited a mounted head of about a 4-year-old buck, taken by an Indian in the Pembina Hills about 7 miles west of Walhalla in 1916. It was the largest of a bunch of four mule deer but had not reached its full growth.

At the present time there may be a few mule deer in the most remote corners of the Badlands and an occasional wanderer from the Canadian side of the Turtle Mountains and Pembina Hills but, if not already extinct, this finest of all native species of the smaller deer will soon have vanished from the State. Its disappearance, while greatly to be regretted, is as inevitable as that of the elk and the buffalo. A few in public parks or on private game farms are all we can hope to save in open country, but in the steep and rugged mountain areas farther west, where the game and recreational value of extensive tracts is greater than its agricultural value, a strong effort is being made to preserve mule deer as a permanent part of the wild life of the country.

Order RODENTIA: Gnawing Animals

Family SCIURIDAE: Squirrels, Chipmunks, Prairie Dogs, Ground Squirrels, and Marmots

Glaucomys sabrinus canescens Howell

Pale Flying Squirrel

Glaucomys sabrinus canescens Howell, Proc. Biol. Soc. Washington, vol. 28, p. 111, 1915.

Type locality.—Portage la Prairie, Manitoba.

General characters.—About twice the size of the little southern species.[3] Wide membranes connecting the front and hind legs along each side when spread form a monoplane which enables the animal to soar or glide from tree to tree. Tail, wide and flat; fur, very soft and silky, of a delicate cinnamon-brown color over upper parts, creamy white below. Average measurements of adults: Total length, 297 millimeters; tail, 138; hind foot, 37 or 38.

Distribution and habitat.—The pale flying squirrel, a big northern member of the family, comes into eastern North Dakota along

[3] *Glaucomys volans volans* (Linnaeus). There is still a possibility of finding this little flying squirrel in extreme southeastern North Dakota, as it ranges northward into central Minnesota and could readily extend into the Red River Valley at Wahpeton.

the timber of the Red River Valley and up some of the streams to the west. Specimens have been examined from Pembina, Grafton, Portland, Grand Forks, and Fargo. These squirrels are common throughout the forest areas of the Pembina Hills and probably occur in the Turtle Mountains, although no definite records have been obtained. At Portland, in 1895, J. A. Loring caught one in a meat-baited trap set under a log in an oak grove. At Grafton, in 1915, Remington Kellogg reported several taken during the preceding winter when the timber was being cleared from some bottomland, but he was unable to obtain any specimens. He found one in the collection of H. V. Williams, which was examined later by Howell (1918) for identification while preparing his revision of the flying squirrels. At Manvel, in the eastern part of Grand Forks County, he reported a family of flying squirrels including a nest and six young, found by a farmer, William Brown, the preceding year; the nest was made of bark fibers and placed in the fork of an elm tree, but when Kellogg examined it it was empty. W. B. Bell told the writer of a family of flying squirrels found by a boy in the woods at Fargo, in 1912.

General habits.—Owing to their strictly nocturnal habits flying squirrels are rarely seen although they are much more common than is supposed. In a wide range over the northern timbered country woodchoppers and lumbermen frequently see them leaving the hollow of some falling tree and soaring on widespread membranes to a neighboring trunk, or sometimes, in their confusion, to the ground, from which they quickly seek the nearest tree. Usually their nests are within the hollow cavities of tree trunks, sometimes in hollow limbs, knotholes, or the old nest cavities of woodpeckers. Occasionally nests of moss and bark fibers are built among the branches, much like those of the red squirrel. Where the little animals are common it is not difficult to frighten them out of their nests by pounding on the hollow trees with an ax. A few smart raps on the base of their trees will usually induce them to peer out of their nests, and continuous pounding will often alarm them into making long flights to neighboring trees. Often one will run to the top of its tree to get a good start and, sailing downward until momentum is gained, go coasting off 50 or 75 feet and, curving gracefully upward to check its speed, strike lightly on the trunk of another tree much lower down than where it started. By running up each tree and soaring downward to the next, the squirrels pass rapidly through the woods until some safe retreat is found.

They are soft, silent, owl-like animals and in the daytime seem sleepy and sluggish. At night their presence is mainly shown by their getting into traps set for fur animals and by their tracks on the snow between trees whose span is too great to be bridged by their soaring flight. Little is known, however, of their real habits except that they make interesting and often mischievous pets, are easily tamed, and become playful and affectionate, but insist on sleeping through the day and carrying on most of their activities at night. They are frequently preyed upon by cats and owls, which occasionally leave their tails uneaten to mark the place of a nocturnal meal.

Food.—A great part of the food of flying squirrels consists of nuts and seeds of trees, shrubs, and vines. At Moorhead, in 1908, Murie

watched several of them by moonlight feeding on the seeds of ash trees. He says: "They sailed about from tree to tree, stopping occasionally to eat some seeds. Several times I saw one turn a little in its flight and they turned up a little just before landing on a tree trunk." The woods where they occur are usually well supplied with acorns, basswood, boxelder, ash, elm, hackberry, ironwood, birch, and alder seeds and a great variety of berries, grapes, and other seeds, fruits, and buds that remain all winter and are easily obtained, so that generally these animals do not lay up stores of food. They are more omnivorous than most squirrels and will readily take bread, oatmeal, fruit, or meat used for trap bait, and closely related varieties are often caught in marten or weasel traps baited with meat, fur, or feathers.

Economic status.—Though rarely of sufficient abundance to be of economic importance, flying squirrels are, so far as known, practically harmless. Crops and cultivated fruits are rarely if ever disturbed by them and the tree seeds they consume are doubtless well paid for in the scattering and wider planting of those not eaten. As pets for children few animals are more gentle and attractive.

Sciurus carolinensis hypophaeus Merriam

Minnesota Gray Squirrel; Black Squirrel

Sciurus carolinensis hypophaeus Merriam, Science, vol. 7, p. 351, 1886.

Type locality.—Elk River, Minn.

General characters.—Larger and darker colored than the Carolina gray squirrel, with little or no white on the underparts. Color, generally dark gray, often becoming dusky or black. Tail, large and bushy. Average measurements of adult specimens: Total length, 496 millimeters; tail, 220; hind foot, 67. Weight of adult female, 14 ounces (Murie).

Distribution and habitat.—The large Minnesota gray tree squirrels barely come into the southeastern part of North Dakota along some of the timbered stream valleys, although they are abundant throughout the oak region of Minnesota. At Wahpeton, in 1915, an old resident said that he had killed one there 18 years before, but had never seen one since. Later, some squirrels had been brought from Minnesota and placed in a grove on the Dakota side of the river, but they were not protected and all were killed. At Fargo and Moorhead, O. J. Murie remembers them as long ago as 1906, and thinks they have always been there. Since 1910, they have been increasing and in 1919 were common on both sides of the river, and especially in the extensive and beautiful parks just south and north of Fargo, where an abundance of old hollow trees, oak, basswood, elm, and ash, furnish safe homes and choice food. At Valley City, in 1912, Eastgate reported them as introduced in the city parks and slowly increasing. In Minnesota their northern limit seems to be in the vicinity of Crookston, and it would be strange if they did not occasionally extend into the Red River Valley in the neighborhood of Grand Forks. Records, however, are wanting north of Fargo.

General habits.—Besides being good game animals, these large, handsome squirrels are one of the popular attractions of city parks and protected grounds, where they readily become familiar and, with a little care, very tame. Constant hunting keeps them extremely

shy and secretive in their wild state; but, for rodents, they show a high order of intelligence and quickly learn the protected areas, eagerly responding to friendly advances in the way of food, water, and nest boxes. In their native habitat their food consists very largely of acorns from the numerous species of oaks with which they are associated, but it also includes nuts and seeds of many other plants. For a successful introduction into parks or private grounds they must be supplied with acorns, nuts, or grain.

Their winter homes are usually in the hollow trunks of trees, where in well-protected and warm nests of bark and plant fibers they pass the coldest winter weather in comfort. In summer they build large nests of leaves in the branches of the trees, covering them over to form comfortable, rain-proof houses, with nest cavities in the center, which they enter through half-concealed side doors. In some cases the houses are made large and warm for occupation throughout the winter, but usually a hollow trunk or warm box is preferred for a winter residence.

The interest and delight of children in watching the squirrels, which in parks and private grounds become so tame that they will come to the hand and beg for nuts, gives them a value far greater than that of game and fully repays the effort to provide them with comfortable quarters and to plant such trees as will insure their permanent food supply.

Sciurus hudsonicus hudsonicus Erxleben

Red Squirrel; Chickaree

Ahjiduhmo of the Ojibways (Wilson)

[*Sciurus vulgaris*] *hudsonicus* Erxleben, Syst. Regni Anim., p. 416, 1777.

Type locality.—Hudson Strait.

General characters.—About half the size of the gray squirrel, with full bushy tail and a general reddish or rusty color over the upper parts; a black line along each side in summer borders the white underparts, which in fall is lost in the reddish-gray winter coat. Average measurements: Total length, 340 millimeters; tail, 140; hind foot, 50. Weight, 8½ to 9 ounces (Murie).

Distribution and habitat.—The sprightly little red tree squirrels are generally abundant in the timbered areas along the Red River Valley from Wahpeton to Pembina and along all of the streams which carry lines of timber into the prairie country west of the valley; also in the Pembina Hills and Turtle Mountains as far west as the Mouse River and upper timbered strips of the Sheyenne River near Stump Lake. In 1887 they were common near Fargo, Grand Forks, and Pembina, and in the Turtle Mountains. In 1912, there were said to be a small number in the timber around Lake Elsie, near Hankinson, in the extreme southeastern corner of the State, though they had been mostly killed off there. At Portland, in 1892, J. Alden Loring took a specimen, and reported them as common in the groves along the Goose River. In 1893, A. K. Fisher saw one in the timber along the Sheyenne River near Lisbon. In 1912 Eastgate reported a few along the Sheyenne River 3 miles south of Tolna. At Valley City he reported them as very common all along the river in the timber and occasionally in the larger groves around farm buildings on the prairie close to the river valley,

and at Lisbon, farther down the river, he said they were common in patches of woods sufficiently large to afford them suitable homes; often two or more pairs were found in a single grove, and from his tent in one of these groves he was able to see three occupied nests at one time. At Fargo they were still common in the timber along the Red and Sheyenne Rivers. Kellogg, in 1915, found them in good numbers at Grand Forks, Grafton, and Pembina; near Towner, in the timber along Mouse River, he reported them fairly common and saw many of their nests in the branches of the trees.

General habits.—In June, 1912, while camping near the fish hatchery in the eastern part of the Turtle Mountains, the writer found red squirrels common throughout the timber, as they apparently are throughout the Turtle Mountains and Pembina Hills. At that season, when the females taken for specimens were still nursing young, they were quiet and keeping out of sight as much as possible. Only once was a subdued barking heard. They live mainly in hollow trees, but a few nests of grass and bark fibers were found in the branches of the trees, and in places the squirrels apparently were occupying burrows and hollow spaces in old stumps and logs. As soon as the young are safely out of the nest and able to care for themselves the squirrels become noisy and for the rest of the year their sprightly chatter and scolding is heard throughout the forest.

Their food consists of acorns, nuts, seeds, mushrooms, and occasionally birds' eggs. Their omnivorous tastes are strikingly different from those of the gray squirrel, and for this reason they have incurred the enmity of those who appreciate the value and beauty of birds as well as of squirrels, and also those who have unprotected corncribs or grain bins to which squirrels may gain access. It is often necessary to reduce the numbers of these cheerful little marauders for the protection of birds and crops, but where they are not doing serious damage they are among the brightest and most attractive forms of wild life either in the forest or in parks and private grounds. In winter, although they spend much of the time within their warm nest hollows, they are active even during the coldest weather, visiting their food caches, to which they gain access by endless tunnels in the deep snow. One of the cheeriest sounds of the forest on a bright winter's day is the long *chr-r-r-r-r-r* from the feeding branch of one of these squirrels as he cracks a hazelnut or eats an acorn above the glistening field of snow.

Eutamias minimus borealis (Allen)

Little Northern Chipmunk

(Pl. 10)

Tamias asiaticus borealis Allen, Monogr., North Amer. Rodentia, p. 793, 1877.

Type locality.—Fort Liard, Mackenzie, Canada.

General characters.—Readily distinguished from the larger gray chipmunks, with which often associated, by the series of fine longitudinal light and dark stripes extending over the back from head to tail, by their slender build, long slender tails and pointed ears, and by the generic character of five molars in each upper tooth row. A specimen from the Turtle Mountains measures in total length, 223 millimeters; tail, 106; hind foot, 33. Weight of adult female, 52.6 grams.

Distribution and habitat.—The little northern chipmunks are abundant throughout the forested and brushy areas of the Turtle

Mountains and Pembina Hills, and they have been reported in the forest along the Mouse River near Towner (fig. 1). H. V. Williams, in 1912, reported them abundant in the Pembina Hills throughout the timbered parts, where they lived in underbrush and around brush piles, old stumps, and fallen trees. They were very tame, but when alarmed always sought protection in their ground burrows rather than in the trees.

General habits.—In all parts of the Turtle Mountains the writer found them more or less common and often very tame and unsuspicious, although nervous and quick to take alarm. Their fine, rapid chipper or the slow *chuck—chuck—chuck* notes are usually the first indication of their presence. It is often difficult to locate them by their voices, which are more or less ventriloquial, but by

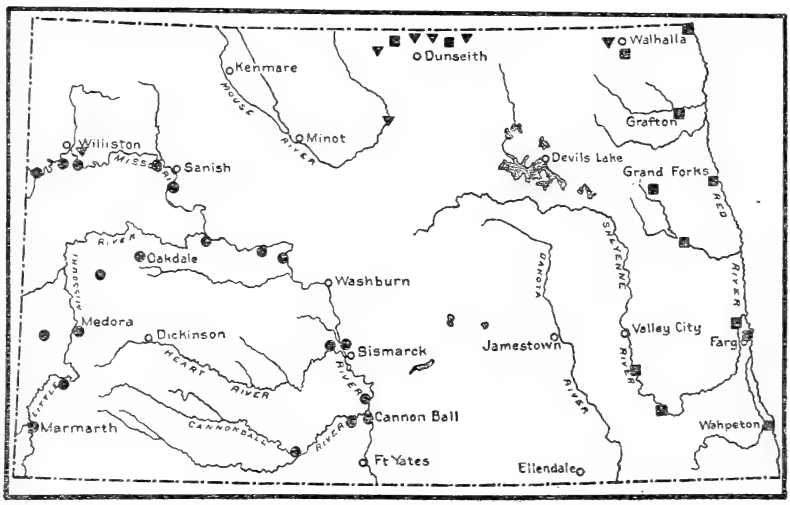
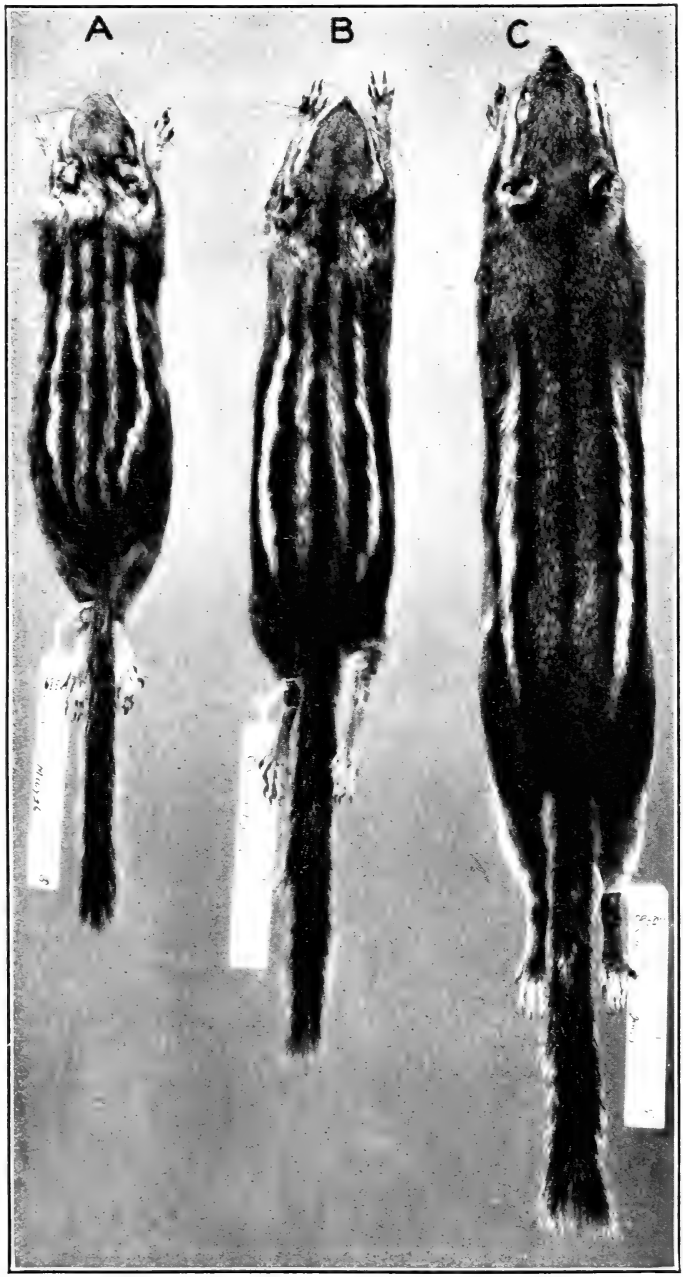


FIG. 1.—Records of three species of chipmunks in North Dakota: Squares, Gray chipmunk; triangles, little northern chipmunk; circles, pale chipmunk

moving cautiously one can usually find a chipmunk perched on the branch of a bush, on a brush heap, or on a stump or log close to its underground home. In a dense thicket careful search is often necessary to locate the voice, but if it does not vanish with a sharp chipper, one may find the little striped gray-coat perched half way up a willow or aspen bush, chirping and waving its tail. To the casual observer its actions may indicate mere curiosity, but its curiosity is far from idle. It involves parental care, mutual protection, watching for enemies, and warning of danger. Although restless sprites, disappearing like a flash and quickly reappearing, at times they will sit quietly for some minutes, calling in a monotonous *churp—churp—churp*, much like the cry of a robin in distress. If an enemy approaches the note often changes to a more rapid *quit–quit–quit*, finer and faster, but suggesting the note of the ruffed grouse when about to take wing. When suddenly frightened they run with a rapid twitter, which at times becomes frantic in their haste to get to cover.



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SKINS OF CHIPMUNKS

(A) Pale chipmunk (*Eutamias minimus pallidus*); (B) little northern chipmunk (*Eutamias minimus borealis*); (C) gray chipmunk (*Tamias striatus griseus*). Slightly more than half natural size

In the Turtle Mountains in August, 1887, northern chipmunks were found feeding extensively on the seeds of chokecherries, the shelled kernels of which were stuffed in their cheek pouches, evidently to be stored for winter food. Acorns and various seeds also were found in their pockets. Their feeding grounds show traces of many seeds and berries that have been eaten. They are said to do some mischief in gardens and along the edges of grainfields, but nowhere were they found a serious pest.

In the Pembina Hills in 1919 up to October, they were busily storing seeds and grain. They were often seen with cheek pouches distended, running for their storehouses in underground cavities, where evidently enough food was being laid up to carry them through the winter, for they showed no signs of becoming fat or preparing for hibernation.

Eutamias minimus pallidus (Allen)

Pale Chipmunk

(Pl. 10)

Sachho of the Arikaras (Gilmore); *Hetkada*^{n} of the Dakotas (Gilmore); *Hinudek* of the Mandans (Gilmore); *Kokokshi* of the Hidatsas (Gilmore).

Tamias quadrivitatus var. *pallidus* Allen, Proc. Boston Soc. Nat. Hist., vol. 16, p. 289, 1874.

Type locality.—Camp Thorne, near Glendive, Mont.

General characters.—Differs from *borealis* mainly in lighter coloration, which goes with the more open and arid habitat; the brown tones are more yellowish, the gray lighter, and the white markings more extensive. Adult specimens average in total length, 206 millimeters; tail, 91; hind foot, 31. A male of the year taken October 15 at Sanish measured 200, 90, and 30 millimeters, respectively, and weighed 38 grams.

Distribution and habitat.—The sagebrush Badlands country along the Missouri River and westward is the home of the little pale chipmunk. (Fig. 1.) Specimens have been taken at Wade and Parkin on the Cannonball River, Palace Buttes, 6 miles north of Cannon Ball, near Sanish, Williston, Buford, Oakdale, Quinion, Medora, Sentinel Buttes, the former Dakota National Forest, and Marmarth. A little below Williston and near Grinnell and Elbowoods a few are found on the north side of the Missouri River, but generally they are restricted to the country south and west of the river. In 1833, Maximilian (Wied, 1839–1841, Bd. 2, p. 49, 1841) wrote of them: "A few miles below the mouth of the Muddy River, these pretty little four-striped squirrels are in great numbers, running along the ground and up the trees with the fruit of rosebushes in their mouths." In 1843, Audubon (1897, p. 27) reported them in the very same place, running over the ground. In 1913, in company with W. B. Bell, the writer crossed the river at this point and was greatly interested to find the chipmunks still there in the brush and timber on both sides of the river. In 1910 H. E. Anthony collected a series at Fort Buford and found them common also on the south side of the river. Near the Sioux Crossing, 6 miles southeast of Buford, he found them abundant along brushy banks and coulées and about ranches where there were woodpiles or old buildings near the banks of ravines on the south side of the river. Some were also found in

the heavy brush, but apparently they are partial to the more open country. In 1915 Remington Kellogg, on his way down the river from Williston to Bismarck, reported them very common near Grinnell, in Williams County, both in the Badlands and in the brush along Beaver Creek, where several were taken. At Goodall, in McKenzie County, they were very common along creeks, rivers, and in the Badlands. Others were seen along the river on the way down to Elbowoods, where they were most abundant on the west side. Near Expansion, in Mercer County, a few were found in the willows, and at Stanton a pair was seen in a buffaloberry bush eating the ripe fruit. They are said to occur at Mandan, and Russell Reid says that he has seen them on the east side of the river at Bismarck. In 1913 Jewett found them in the Badlands and gulches about Medora, near Quinion, and also in the Killdeer Mountains. At Sentinel Butte he collected two specimens among the rocks of the large buttes south of town, and they were found common both along the gulches about the Little Missouri south of Sentinel Butte and on the Dakota National Forest. At Marmarth, in the southwestern corner of the State, they were found common in 1909, over the brushy sides of the Badlands buttes.

General habits.—The little Badlands chipmunks are skilful climbers, but as they generally live in thickets and sagebrush their climbing is mainly through the branches of these dwarf trees and is largely done in search of food or to get high enough above the ground to watch for their enemies. Their real homes are in the ground or in cracks and crevices of cliffs or Badlands banks, to which they dart when alarmed. They are often seen running over the sides of banks and bare walls, from one brush patch to another, or from their dens to the patches of brush and weeds which furnish food and shelter. When alarmed they run with such speed even over the roughest ground that pursuit is useless, and the collector in search of specimens must use much patience and skill to secure them. At other times they are so sure of their safe retreats that they come out boldly to satisfy their curiosity and are easily collected at close range.

Their voice is similar to that of many other species of small chipmunks, but very fine and light. It varies from the slow *chip-chip-chip* as one sits confidently near a safe retreat, to the much more rapid chipper of alarm as it flies for cover. At times this chipper is heard from the top of a bowlder, the point of a clay bank, or from a branch of bullberry or other bush.

These chipmunks eat a great variety of seeds and berries and a little green vegetation. They seem particularly fond of the bullberries, which in fall load the bushes with masses of scarlet fruit. The seeds of these berries are removed and either eaten on the spot or carried away for winter stores. Serviceberries are also a favorite food. The chipmunks eat the outer pulp of the rose haws as well as the hard seeds within and are fond of the flesh and seeds of the little wild currants and purple gooseberries. Their cheek pouches often contain the seeds of various grasses, sedges, and numerous other plants, which are carried away to be eaten at leisure or stored up for winter use. In the Killdeer Mountains Jewett says that acorns and hazelnuts furnish them with a choice supply of food.

Economic status.—In places the Badlands chipmunks become very numerous around the edges of gardens and fields, where they do some mischief to growing crops. Anthony says that at one ranch near Buford they became so troublesome that the owner was forced to shoot them, killing 26 in one afternoon. They are easily trapped or poisoned, however, when it is necessary to thin them out, and by a little care their mischief can be controlled.

Tamias striatus griseus Mearns

Gray Chipmunk

(Pl. 10)

Tamias striatus griseus Mearns, Bul. Amer. Mus. Nat. Hist., vol. 3 (1890–91), p. 231, 1891.

Type locality.—Fort Snelling, Minn.

General characters.—Large and heavily built, with broad stripes on the back; readily distinguished from the two species of small chipmunks by larger size, heavier build, more phlegmatic dispositions, more reddish-brown in the colors of the upper parts, and by the generic character of only four molars in each upper tooth row. Average measurements: Total length, 260 millimeters; tail, 95; hind foot, 37. An adult female weighed 3¾ ounces.

Distribution and habitat.—The grayish race of the large rusty-brown chipmunk is common in the timber all along the Red River Valley from Wahpeton to Pembina, and westward along the timbered valleys as far as Lisbon, Kathryn, Portland, Larimore, Grafton, and throughout the Pembina Hills and Turtle Mountains (fig. 1). Apparently they do not reach the timbered area of the Devils Lake region. They are restricted entirely to timbered and brushy areas, where they live in hollow logs, stumps, trees, and underground burrows.

General habits.—The gray chipmunks climb trees readily, but are more often seen running over the ground, logs, stumps, or fences. Their summer nests are usually placed in hollow logs or trees, but their winter homes and food stores are mainly in burrows underground. These burrows are also used throughout the summer as safe retreats and for storing winter food supplies.

The chipmunks are occupied through the spring and early summer with their family cares, and as soon as the half-grown young are out of the nests in June, the search for food, and a little later the storing of a winter's supply of nuts, seeds, and grain fill the daylight hours. Soon after frosty nights begin late in September, they enter their winter burrows, where they remain buried under the snow until the following March or April. The four to six young are born about the first of May. During the breeding season they are very quiet and shy, keeping as much as possible out of sight, but later a slow *chuck—chuck—chuck* is often heard from the woods and thickets, or a shrill chipper of alarm, as the startled animals rush for the nearest cover or up the trunk of some friendly tree.

Their food includes a great variety of nuts, seeds, grains, berries, and some green vegetation, as well as occasional insects, frogs, and lizards. Acorns and hazelnuts are the favorite winter stores and often are deposited in cavities near the nest chambers, a quart or more in a place. Just when these food stores are used is not well known; they may furnish an occasional meal throughout the winter,

or tide over the drowsy period of entering upon and emerging from hibernation, or carry the chipmunks through the spring, when the ground is still frozen and wet and food scarce, or even through the breeding period. It is improbable that the stores are used up before spring, as hibernation seems to be complete and considerable fat is laid up inside the skins of the animals to carry them through the winter.

Economic status.—In places where they are abundant gray chipmunks sometimes do serious mischief along the edges of fields, digging up the planted corn in spring and harvesting more than their share of the ripe grain later on. Many of the missing hills of corn along the edge of a brush-bordered field are due to the fact that these little squirrels have carried away the seed just when it was sprouting or earlier. Where their mischief becomes serious, it is easily checked by scattering poisoned grain along the fences and under the logs where they run.

Citellus tridecemlineatus tridecemlineatus (Mitchill)

Striped Ground Squirrel; Thirteen-lined Ground Squirrel; Leopard Squirrel

Tashnáheca of the Dakotas; *Tshíshkarani* of the Arikaras; *Naksátshi* of the Hidatsas; *Mashedónikcha* of the Mandans (all, Gilmore).

Sciurus tridecem-lineatus Mitchill, Med. Repos., vol. 21 (n. s., vol 6), p. 248, 1821.

Type locality.—Central Minnesota.

General characters.—Short ears, slender body and tail, seven dark-brown and six narrow buff lines on the back, and buffy underparts. The brown stripes are dotted and these distinguish it from chipmunks and all the other striped squirrels. A rather large specimen from Fargo measures in total length, 300 millimeters; tail, 115; hind foot, 39.

Distribution and habitat.—The striped, or thirteen-lined ground squirrel, with its paler western form, covers the whole of North Dakota, and most of the specimens east of the Missouri River are referable to the typical dark form (fig. 2). Belonging to a widely distributed group, covering most of the prairie and Great Plains region of the United States and southern Canada, they are fortunately never so numerous as some of the other species of ground squirrel. They inhabit both the prairie and brushy areas, but usually are not found in heavy timber or on low, wet ground. Open grassy ridges and dry prairies are their favorite habitat, and here their numerous burrows and striped coats afford the best of protection.

General habits.—They are true ground squirrels, spending all but their working hours below the surface in their well-made dens and burrows.[9] They are strictly diurnal and are partial to warm weather. Early on bright summer mornings they may be seen running over the prairie in search of food or mates or in playful exercise, but in cold or chilly weather they keep mainly within their burrows, where a supply of food is generally stored. In the tall grass, weeds, or brushy patches they keep out of sight for the most

[9] For diagrams and descriptions of burrows and general habits see Johnson, G. E. (1917, p. 261).

part and would rarely be noticed but for their call notes, long bubbling trills, given as signals of alarm or to convey other information among themselves.

Breeding habits.—Breeding activities begin soon after the adults emerge from hibernation in March or early in April, but the actual dates of birth of young are not easily obtained. Females collected in May usually contain embryos showing various degrees of development, but the young do not appear above ground until June or July. They are then nearly half grown and able to run about and take care of themselves under the watchful care of their mothers. When first born the young are very small, naked, and helpless. Doctor Hoy (Kennicott, 1857, pp. 76–77), who observed them in confinement, says that they have no hair on the body before they are 20

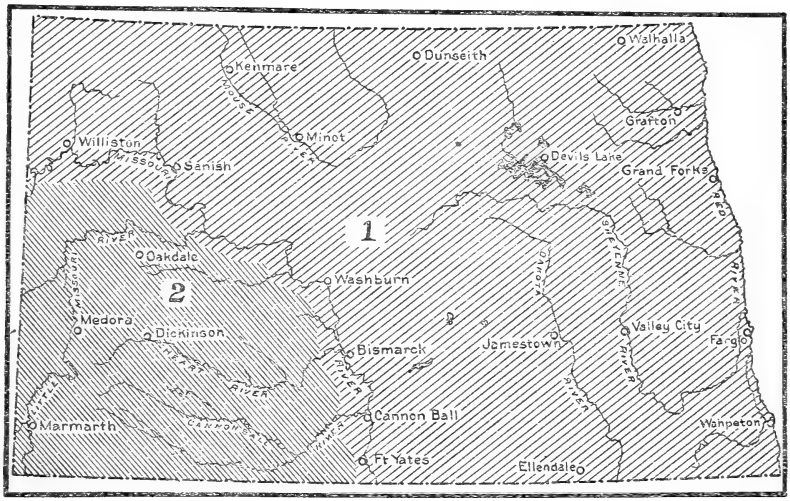


FIG. 2.—Distribution of the thirteen-lined ground squirrel (1), and its pale western form (2), in North Dakota

days old, and that the eyes do not open till the thirtieth day. The number of young in a litter varies widely, but seems to be usually from 7 to 10. A female taken by Sheldon at Fairmount, on May 9, contained 11 embryos, and there are other records of still larger numbers up to 13 (Lee) and 14 (Seton). The full number of mammae in adult females is 12. Apparently but one litter of young is raised in a season, and even for that the time is short for them to mature and lay up sufficient fat and food to carry them through the six months of hibernation.

Food habits.—Although a great part of their food consists of seeds, grain, and nuts, they are omnivorous in habits and take besides berries and some green vegetation, numerous insects, and the flesh of mice, birds, or any small animals which they can capture or find dead. Acorns and hazelnuts are eagerly gathered and stored for winter food, but over most of their range only the smaller seeds and nutlets are obtained, unless grainfields are within reach. Seeds and grain are stored for future use, but much soft food that will

not keep is eaten as it is taken. The examination of the contents of large numbers of stomachs shows a considerable portion of grasshoppers, crickets, caterpillars, beetles, ants, cocoons, insect eggs, and even traces of flesh, hair or small mammals, and feathers of birds; also green foliage, the white pulp of bulbs and tubers and the fruit of solanum, cactus, and strawberries. The contents of the ground squirrel's capacious cheek pouches give a good index to the selection of seeds and grains. The pouches are often distended with wheat, oats, barley, rye, or any of the cultivated grains that are obtainable, but also are found to contain acorns, hazelnuts, seed of sunflower, cactus, bindweed, goosefoot, puccoon, wild peas and beans, and a great variety of grass seeds.

During late summer and fall, all work industriously, laying up their winter stores, quickly filling their cheek pouches and running to the burrows to empty them into the storage cavities near the winter nests. The seeds of native plants are gathered over a considerable area. Sometimes a quart or more is found in a storage chamber, and at the edge of a field where an abundance of grain can be rapidly gathered the winter's stores assume much larger proportions.

Economic status.—In spring the planted seed is dug up and eaten or stored from the time it is sown until long after it has sprouted. Then the green stalks are eaten during the early summer, and as soon as the grain is headed out great numbers of the heads are cut off for the young kernels, from the very beginning of their formation. Thus, before harvest time the edges of the grainfields have become ragged and thin for a considerable distance into the field. Although depredations of these ground squirrels do not compare with those of the more abundant flickertails, their wide distribution over North Dakota and many other States renders them one of the most serious of rodent pests.

But for their natural enemies, which are legion, it would be impossible to raise crops within their territory. They are constantly preyed upon by many species of hawks, and some owls, and by foxes, weasels, skunks, and badgers, so that in spite of their rapid increase their numbers are usually kept somewhat within bounds. However, it is necessary over much of their range to supplement the work of their natural enemies by the systematic use of poison.

Citellus tridecemlineatus pallidus (Allen)

Pale Striped Ground Squirrel; Pale Thirteen-lined Ground Squirrel

Miniwakao of the Cheyennes

[*Spermophilus tridecemlineatus*] var. *pallidus* Allen, Monogr. North Amer. Rodentia, p. 873, 1877.

Type locality.—Plains of Yellowstone River, Mont.

General characters.—A pale western form of the thirteen-lined ground squirrel, slightly smaller, and with paler tones of buff and lighter brown stripes. Average specimens from the type region measure in total length, approximately 255 millimeters; tail, 82; hind foot, 34.

Distribution and habitat.—The striped ground squirrels become gradually paler across the middle part of the State, but not until the semiarid Badlands country is reached west of the Missouri

do the pale forms become clearly recognizable. In the part of the State west and south of the Missouri, they are the only ground squirrels, and here with the prairie dogs they occupy the short-grass plains country in considerable numbers. While sometimes seen in the open, where there is not sufficient grass to conceal them, they are more often found in the better cover of grass and weeds and low bushes. In this region they were originally one of the interesting and harmless forms of native life, but since grain farms have spread over it they have become one of the serious problems with which the farmer has to contend.

General habits.—In habits these squirrels do not differ from their darker relatives to the eastward, except as a change of environment gives them other kinds of food and local conditions which they seem always ready to meet. In many places some protection is sought for their burrows, such as grassy spots or weedy ground. Sometimes a piece of paper or cloth is drawn over the entrance to the burrow, apparently for concealment or protection.

At Parkin, on June 28, 1916, a burrow was found where fresh earth had been lately thrown out and the entrance was securely packed with sand from the inside. As the entrance to this burrow was opened a half-grown young of the species poked its head out of another entrance near by. In the tunnel, about 8 inches below the surface of the ground, was found a large, soft nest in a roomy chamber, with two doors opening out on opposite sides. The nest was made of dry grass, bark fibers, and bits of paper from the railroad track. It was soft and well matted together like a bird's nest, but not covered over. The young had escaped in the branching burrows. Evidently this was their home nest, from which they had not yet begun to make excursions to the world above. The closing of their doors from within was evidently in this case to protect the young from outside enemies.

Economic status.—In many places it has been found necessary to poison these squirrels for the protection of grainfields and garden crops; the methods given for the Richardson ground squirrel, or flickertail, will be found to apply equally well to this species.

Citellus franklinii (Sabine)

Gray Ground Squirrel; Franklin Ground Squirrel

Arctomys franklinii Sabine, Trans. Linn. Soc. London, vol. 13, p. 587, 1822.

Type locality.—Carlton House, Saskatchewan, Canada.

General characters.—Largest of the ground squirrels of this region; sometimes mistaken for the gray tree squirrel, which it approaches in size and slightly resembles, but from which it differs in slender form, very short ears, and much smaller and less bushy tail. Color, dark gray with a brownish wash and a mottled effect in fine, wavy cross lines or scallops over the back. Adults measure in total length 388 millimeters; tail, 136; hind foot, 55.

Distribution and habitat.—Extending over a wide range in the central United States and Canada, from Oklahoma and Illinois to the Athabaska River, the large gray ground squirrels cover approximately the eastern half of North Dakota (fig. 3). Their greatest abundance within the State lies within the Red River Valley and westward to the Dakota River Valley, Devils Lake, and the Mouse River. There is an indefinite record for Burleigh County, near Bismarck,

and another for Turtle Lake in McLean County, but the most westward authentic record is from Kenmare, in the valley of the Riviere des Lacs, where W. B. Bell collected a specimen in 1913. They are particularly animals of open timber and brush land and do not occupy wide stretches of prairie unless there is ample cover for concealment.

General habits.—Although occasionally seen up among the branches of low trees, the Franklin squirrels are strictly ground squirrels, living in burrows generally concealed in brush or weed patches, from which well-worn trails or runways radiate to other burrows or feeding grounds. They are shy and secretive, keeping much under cover of protecting vegetation, as they are too large and dark colored to be inconspicuous in the open. When frightened they rush for their burrows, usually uttering a trill of alarm and warning to other members of the family. Their voice is much like

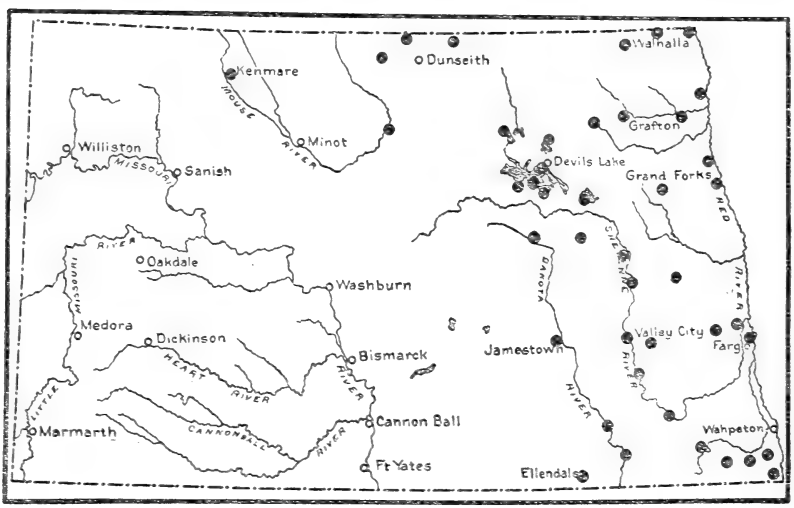


Fig. 3.—Records of the Franklin ground squirrel in North Dakota

that of the thirteen-lined ground squirrel but is as much heavier as they are larger. It is often heard in a long bubbling trill from a weed patch and is almost birdlike in musical quality.

In the timber and brush patches along the Red River Valley, about Stump Lake, Devils Lake, the Sweetwater Lakes, and in the Turtle Mountains, the squirrels are especially numerous and in such situations they are generally the most abundant of the three species of ground squirrel occupying the general region. Throughout the Turtle Mountains they were found along the edges of meadows, fields, and clearings along roadsides, and in all the open places where woods and small brush served for cover. They gathered around camps or dwellings where there were no dogs or guns and even came into the writer's cabin and helped themselves from the grub box. They persisted in getting into traps set for others long after enough of them had been secured for specimens and most of the trails and runways attributed to other animals proved to belong to them.

Their burrows were generally in groups of three or four, or more, not far apart and evidently connected below ground. They were in all sorts of situations, but a sloping bank, brush heap, old log, or stone pile usually provided the protection sought for their dens. A considerable quantity of earth is usually thrown out in front of one of the burrows but others open out with less conspicuous markings. Many old dens and burrows are located through the brush and woods and one seems always to be convenient when danger approaches. Often the animals will stop at the entrances of their burrows and straighten up in the picket-pin attitude, to make sure whether an enemy is pursuing. If approached too closely, they quickly dive into their burrows with a flirt of the tail and a parting chatter, but if all is quiet they soon reappear cautiously to reconnoiter.

Franklin squirrels are easily tamed and make interesting, though rather mischievous, pets. H. V. Williams, at Grafton, had a tame one for which he made a den by burying a box underground. The squirrel carried about a half bushel of grain into this box, and in fall hibernated as usual. When examined in January it was unconscious, but before its awakening time in spring water ran into the box and it was drowned. While collecting specimens at Fish Lake in the Turtle Mountains, Williams fed one around his tent until it became so tame as to take food from his hand and come to the tent regularly at meal times. It finally became so bold that it would enter the tent and search through the baggage for food. After breaking and carrying off a lot of birds' eggs that had been collected for specimens it had to be killed to prevent further trouble.

Hibernation.—With the first freezing weather in fall, usually in September, Franklin squirrels go to their nests deep underground and usually do not reappear until the following April. Before entering upon their hibernation they become very fat and depend upon this concentrated form of nutriment to carry them through the winter rather than upon the ample stores of food laid up in convenient chambers near their nests. Just when these stores are eaten is not well known, but probably before the squirrels have become entirely inactive in fall and again before the outside food supply is available in spring.

Breeding habits.—Their half dozen young are usually born in May or June and by the last of July are half-grown squirrels, out of the burrows, and hunting for their food.

Food habits.—Living largely upon nuts, seeds, and grain, these squirrels show an appetite for a wide range of food. The examination of a large number of stomachs and cheek pouches shows their food to consist not only of a great variety of grains and seeds, but also of berries, green vegetation, roots and bulbs, beetles, caterpillars, grasshoppers, crickets, ants, and eggs and pupae of insects. They also eat young birds, birds' eggs, and young mice, and are said to kill young chickens. When caught in traps or found dead they are even eaten by their own kind. They feed upon grain from the time the seed is planted until the last bundle is removed from the fields. Unlike the smaller ground squirrels, they do not cut the standing grain, but pull down the heads and in this way destroy the grain even more rapidly. In their capacious cheek pouches seeds of

grain are rapidly carried to their winter storehouses. Where a large number of the squirrels gather along the edge of a field they will often harvest considerable of the grain after having fed upon it during every stage of its growth through the summer.

Economic status.—To a great extent the Franklin squirrels occupy the limited areas where the other two ground squirrels of the State, the thirteen-lined and the Richardson, are absent or less numerous. In extensive areas, therefore, they are the dominant species and levy their toll of destruction on the grainfields and gardens that otherwise would be comparatively safe. In some places, however, the three species occupy the same ground and in combined numbers cause enormous losses of crops. Although larger and according to their numbers possibly more destructive to grain than the Richardson squirrels, the Franklin ground squirrels are apparently less numerous in most of their habitat. They are easily poisoned and their abundance may be controlled at comparatively little expense, using the same methods as recommended for the Richardson, or flickertail.

Citellus richardsonii (Sabine)

Richardson Ground Squirrel; Flickertail

Honkóta of the Arikaras; *Pinsa* of the Dakotas; *Shopka-sop* of the Mandans; *Tsipá sopa* of the Hidatsas (all, Gilmore).

Arctomys richardsonii Sabine, Trans. Linn. Soc. London, vol. 13, p. 589, 1882.

Type locality.— Carlton House, Saskatchewan, Canada.

General characters.—A plump little ground squirrel much resembling the prairie dog, but about half the size. Color, rich buffy yellow, darkened over the back with obscure mottling and wavy scallops. Ears, minute; tail, short. Measurements of average adult: Total length, 237 millimeters; tail, 73; hind foot, 45. Ebner gives the usual weight in fall as 16 to 17½ ounces and in spring as 11 to 13 ounces.

Distribution and habitat.—From a wide range over southern Saskatchewan, Alberta, and Montana, Richardson ground squirrels, or flickertails, cover practically all of North Dakota east and north of the Missouri River (fig. 4). They are absent from most of the immediate valley of the Red River and the wooded bottoms and timbered areas generally, being most abundant over the high open prairie of the central part of the State. For some unknown reason they seem to stop at the Missouri River where the prairie dogs begin, although the ranges of the two species overlap slightly in Montana, where no enmity between them is noticeable. The more humid and fertile part of the country was occupied by them long before the great wheatfields spread over their range to supply a new and choice food. Of the three species of ground squirrel in the State, these are by far the most numerous and most destructive.

General habits.—Originally the flickertails had a continuous distribution over the prairies in great numbers. On some favorite slopes they were so numerous as to suggest a colonial tendency, but apparently this only showed a preference for certain kinds of ground yielding an abundant food supply.

In 1887, when much of the prairie was still unbroken, they were living in their primitive manner on such food as the prairie afforded and doing practically no harm except as grainfields and crops en-

croached upon their original range. Their greatest numbers often appeared to be in the areas of the shortest grass and lowest vegetation, possibly because the grasshoppers and other insect life on which they fed to some extent were most easily obtained there. In places the prairie seemed alive with them and they could be seen scampering about together or standing up like picket-pins, while their shrill whistle was heard on all sides. With each call-note their short little tails are flipped up and down, a farewell twinkle being given as they disappear down the burrow, hence the popular name of "flicker-tail." In 1887 they were often seen also in the main streets of Devils Lake and Bottineau, which were then in their early stages of construction, and in 1916, it was most surprising to find them still occupying vacant lots on the edge of the city of Devils Lake. It was a striking illustration of their tenacity in holding to their

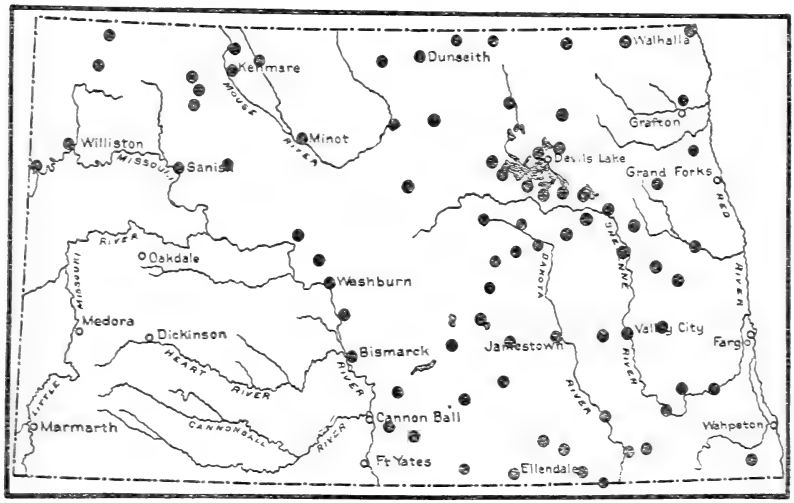


FIG. 4.—Records of the Richardson ground squirrel in North Dakota

original habitat through years of vigorous but sporadic efforts to destroy them.

As soon as the grainfields spread over their range they quickly gathered along the edges to feast on this wonderful new and abundant food. They did not long confine themselves to the edges of the field, however, but went into the middle of large cultivated areas and made their burrows in the plowed ground or in the growing grain.

No reliable estimate of their numbers can be obtained, but a general idea of their abundance may be gained from the statements of Elmer T. Judd, of Cando, in a letter of August 1, 1890, in which he says:

> An old gentleman here killed 1,500 'gophers,' by actual count, before the first of June. From the first of June to the middle of July, he and a cotton broker from St. Louis, who spends the summer here on his farm, calculated that they killed over 2,500 more. One forenoon they killed 135, as shown by the tails they had captured.

These 4,000 animals were killed on and around the outer edges of one section of land.

Breeding habits.—The number of young to a litter is given by Ebner as 6 to 11, with an average of 7 or 8, born in the underground nests mainly in May. By the first of June the young are out of the burrows and find part of their own food while still under the anxious care of their mothers. Small young are occasionally seen much later than the first of June, and apparently the breeding season extends over a considerable period. It has been supposed that flickertails raise two or more litters in a season, but this seems improbable on account of the brief period between their emerging from hibernation in the latter part of March or early April, and entering hibernation in the latter part of August or early in September. This is scant time for even the earliest young to get anywhere near their full growth and lay in sufficient fat to carry them through the winter. By the first of September there are always many individuals that are still small and these are the last to hibernate, presumably because they have not laid up sufficient fat. Even in spring many of those that are seen before the young are born are not nearly full grown and apparently these late young of the previous year are late in breeding. The principal mating season is early in the spring soon after hibernation but sometimes it is as late as the latter part of June. On September 1, 1914, at Bismarck, a few were seen but these were the young of the year, the adults having already gone into their winter dens. At the same time, Silver, who had been studying them at Garrison, for the previous week reported only young of the year caught. At Van Hook on October 16, 1919, the writer saw one out on a warm, sunshiny day after a cold wave, but none had been seen before for some time.

Food habits.—During the summer much green vegetation is eaten by the flickertails—largely the leaves and stems of grain, grass, and a great variety of succulent plants—and apparently it would be possible for these rodents, like the prairie dogs, to subsist entirely upon such vegetation were no grain and seeds available. Late in summer and in fall, when the seeds of the prairie plants and grasses begin to ripen, they constitute the principal food of the squirrels. An important part of the summer food consists also of such insects as grasshoppers, crickets, and caterpillars, though these vary greatly with season and locality. At Crosby, in July, 1913, they were found feeding extensively on the little juicy striped-backed army-worm caterpillars, which swarmed over the roads and fields. Some of the squirrels examined had their stomachs half full and others entirely filled with the caterpillars. Where grasshoppers are abundant they are often fed upon extensively, but wherever grain can be obtained it seems to be the favorite food. One flickertail, shot as it ran out from under a shock of grain, had 269 kernels of oats in its cheek pouches. One recorded by Seton had 162 grains of oats in its pouches and another 240 grains of wheat and nearly a thousand grains of wild buckwheat. Their cheek pouches are so capacious that when well filled they often make the head appear more than double its natural size. The stores gathered are rapidly carried home to be deposited in the burrows and large quantities of food are thus provided for future use. No

stores of grain have been found in the hibernating dens, however, and more study is needed to show when it is used.

Destruction of crops.—The annual loss in grain crops in North Dakota occasioned by these ground squirrels has been estimated at $6,000,000 to $9,000,000 in addition to the annual expenditure of at least $100,000 of public and private funds to combat their depredations. Their tendency is to multiply rapidly in a well-settled and cultivated part of the country because many of their natural enemies are destroyed or kept at a distance, and the food supply is most abundant. As soon as they emerge from hibernation early in spring they begin digging up the seed and eating the young grain that has been sown in the fall, and as soon as the spring sowing starts they dig up the new seed and eat or carry it away. When the grain sprouts they dig both sprout and kernel, and after the kernels are entirely exhausted they feast on the young growing grain until it is headed out, when they begin on the young heads, cutting down the stalks and eating the young seed through all its growing stages. As soon as the grain is ripe they carry it away as rapidly as possible to their storehouses, and this is continued until the last bundle is removed from the fields. Four thousand of these squirrels on or around the edges of a section of land would remove a considerable portion of the crop, and it is not surprising that they are considered the greatest pest of the region. They seem to have no preference between wheat, rye, barley, oats, or flax, but take whatever is nearest their dens.

Natural enemies.—The natural enemies of these ground squirrels are numerous, and but for them the abundance of the animals would be many times greater. Badgers are constantly digging them out and feasting upon them, from early spring until long after they have hibernated or until the ground becomes well frozen and the badgers themselves go into winter quarters. The long-tailed weasels enter their burrows and kill and feed upon them without the least trouble or hindrance and apparently destroy great numbers besides those merely killed for food. At the first appearance of one of these weasels, the squirrels give frantic alarm calls that set the whole prairie community in a panic. They rush to their burrows, but the weasel follows and helps itself to as many as it cares to kill for food or pleasure. This goes on as long as the burrows are open and probably even during the winter, when the weasels can gain access to the dens through the snow, as they are active all winter and sleeping squirrels fill their needs as well as any others. Skunks probably dig out a few, and foxes, coyotes, and bobcats help also to reduce their numbers.

Hawks and some owls prey upon them to a greater or less extent. The ferruginous rough-legged hawk apparently feeds upon them almost exclusively where they occur in its neighborhood and brings them in to feed its hungry broods. The Swainson, marsh, red-tailed, and red-shouldered hawks feed on them extensively, and even the bird-catching sharp-shinned and Cooper hawks may occasionally take one. The little sparrow hawks, which feed mainly upon grasshoppers, probably destroy some of the young ground squirrels, and it is likely that both the short-eared and long-eared owls capture many of them during early evenings or on cloudy days. Gopher

snakes feed upon them to considerable extent, but few data are available in regard to some of the most important species of snakes. The protection of such of their natural enemies as are not otherwise harmful in habits is one of the most important measures for the control of these ground squirrels.

Methods of destruction.—Most efficient methods of controlling these ground squirrels have been carefully worked out by members of the Biological Survey and the North Dakota Agricultural College and Experiment Station. In campaigns against these squirrels, the most economical preparation of poison that has been found to be effective is grain lightly coated with strychnine and starch in the proportions of 1 ounce of strychnine alkaloid to 1 tablespoonful of gloss starch made into a paste with 1 pint of boiling water and stirred into 20 quarts of oats. A teaspoonful of this coated grain placed near each occupied burrow disposes of a large percentage of the squirrels at the first application and the few that remain can be practically cleaned up at the second application. Well-organized and coordinated work over a large area is necessary for satisfactory results, as no matter how thoroughly the squirrels are cleaned out from one or a half dozen farms they will quickly reinfest the whole area from those remaining. This preparation of poisoned grain is equally successful with the other species of ground squirrels and chipmunks where it is necessary to reduce their numbers or clean them out of a section of country.

Ground squirrels as pets.—On a street car from Devils Lake to the Chautauqua Grounds one day the writer saw a boy who had one of these squirrels, which he had caught with a snare earlier in the day. It was about half grown and had become so gentle that he was playing with it and handling it freely, letting it climb up his coat sleeve and carrying it in his pocket or in his cap on his head. It made no attempt either to escape or to bite, but snuggled up to him in a way that suggested the possibility of using these squirrels as pets for children, a vital need that is not well met by any of our domestic animals. Cleaner, neater little pets could not be found. Although quiet in disposition, they have sufficient vivacity to be very attractive. If taken young and well tamed these native squirrels would certainly be far more attractive, interesting, and intelligent than white mice, rats, or guinea pigs, which seem to be the only small mammals available for this important phase of child development. The supply would be endless and easily obtained, and by using only one sex in one part of the country any danger from recolonization would be avoided.

Cynomys ludovicianus ludovicianus (Ord)

Black-tailed Prairie Dog

Pi^{n}spi^{n}sa of the Dakotas; *Achks* of the Arikaras; *Shopka* of the Mandans; *Si^{n}hpa* or *Tsipá* of the Hidatsas (all, Gilmore).

Arctomys ludoviciana Ord, Guthrie's Geogr., 2d Amer. ed., vol. 2, pp. 292, 302, 1815. (Reprint by S. N. Rhoads, 1894.)

Type locality.—Upper Missouri River, where discovered by Lewis and Clark.

General characters.—Prairie dogs might be described as big, husky ground squirrels or little, plump woodchucks, to both of which they are related and

between which they range in size. Although belonging to the squirrel family, they are compactly built for digging and for life on and under the surface of the ground. The ears are minute, the tail short, and the legs short and muscular. The color generally matches well the fresh yellow earth of their burrows, being a yellowish or pinkish cinnamon above and buffy below; the tip of the tail is blackish, and coarse black hairs are scattered over the upper parts; the fur is soft and silky in winter, coarse and harsh in summer. Average measurements: Total length, 388 millimeters; tail, 86; hind foot, 62.[10] Weight, 2 to 3 pounds.

Distribution and habitat.—From a wide range over the Great Plains from western Texas to northern Montana, these prairie dogs extend over that part of North Dakota west of the Missouri River (fig. 5). In this latitude they are all west of the Missouri River, but farther south they occur on both sides. Fortunately they are colonial in habits and have a scattered distribution, so that the

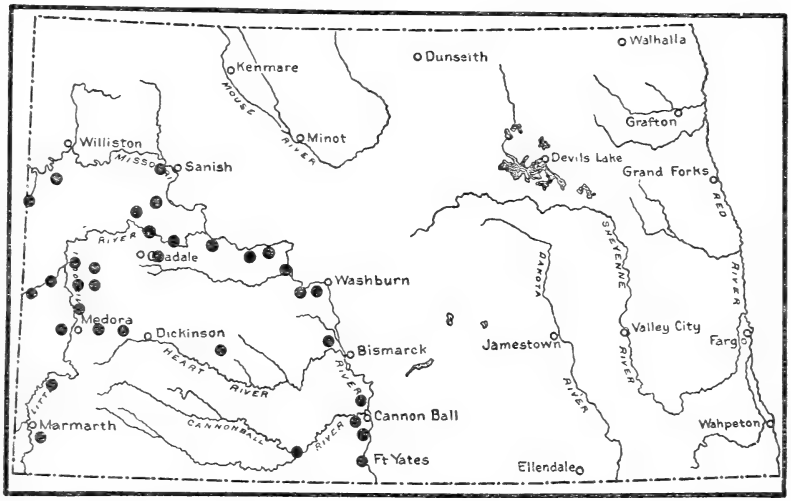


FIG. 5.—Distribution of prairie-dog towns in North Dakota

country is not fully occupied by them, but the colonies, or "dog towns," have been numerous over the part of the State which they occupy. In 1910, Anthony reported a few prairie dogs on the south side of the river not far from Buford, and many 20 miles south of there. In 1909, prairie-dog towns were reliably reported near Mannhaven, just west of the Missouri River, and on the Little Missouri near Marmarth in the southwest corner of the State. In 1913 there was a considerable dog town east of Sentinel Butte. In 1913, Jewett reported a large colony on the flats about a mile west of Fort Clark, where the prairie dogs were doing considerable damage to crops, another colony on a piece of level prairie about 3 miles east of Oakdale, and many others along the Little Missouri River from Quinion to Medora, with exceptionally large colonies at the mouth of Ash Creek and near the head of Magpie Creek. Most of the dog towns he found around Sentinel Butte had been destroyed, but a small colony still existed about 10

[10] Measurements from North American Fauna No. 40 (Hollister, 1916, pp. 16–17).

miles east of there. A considerable dog town was located a couple of miles east of Medora and another along the Northern Pacific Railroad between Hebron and Glen Ullin. Kellogg, in 1915, found near Goodall an uninhabited dog town that had covered about 400 acres. A small colony on the west side of the river opposite Elbowoods was said to be decreasing in population. About a mile north of Mannhaven a colony was found covering about 100 acres. At Stanton there had formerly been a large colony but it had been destroyed by poison. In 1915, Sheldon reported a small prairie-dog town on Deep Creek near the former Dakota National Forest, and other colonies scattered over that general region. At a point about 4 miles northwest of Cannon Ball, he located a town containing about 2,000 prairie dogs and covering an area of approximately 160 acres. Another colony was located near old Fort Rice, covering about 40 acres and containing about 500 animals; still another about 9 miles south of Cannon Ball of approximately 80 acres and about 500 animals. He was told that the Indians had kept them down by shooting them for food. Near Wade, in 1913, Doctor Bell reported them as occurring in scattered colonies.

In 1915, U. S. Ebner, in charge of field operations in the rodent-control work of the Biological Survey in cooperation with the North Dakota Agricultural College and Experiment Station, investigated the prairie-dog situation over a part of the range west of the Missouri River. He reported small prairie-dog towns covering 25 to 250 acres scattered along the Little Missouri River in Billings County, larger colonies of 60 to 640 acres in the northern part of Dunn County, a number of towns of 20 to 160 acres along Big Beaver Creek in the northern part of Golden Valley County, other towns of 25 to 500 acres in the eastern part of McKenzie County, and some large towns running as high as 600 acres on the Berthold Indian Reservation. In most of these prairie-dog towns he estimated 20 to 40 burrows to the acre.

Although these records show only the colonies that have been located, they indicate a very general distribution of prairie dogs over this part of the State, and a careful survey would doubtless show a surprising number of inhabited prairie-dog towns in a region that is rapidly filling up with grainfields.

As a general thing the colonies are located on the open level prairie and often on the best of the grain land. In the Badlands they are usually on the flats and level spaces where the best grass grows, always away from the brushy and barren areas.

General habits.—Prairie dogs are highly social in disposition, almost invariably living in colonies. On rare occasions a new location is chosen where a family or a few prairie dogs have started a colony, but generally there is evidence of their long residence. The old burrows and mounds remain for many years and the sites of ancient prairie-dog towns are marked by little swells of grassy turf scattered over the prairie.

A well-populated prairie-dog town on a bright summer morning is as animated as any busy village could well be. At the first appearance of the sun the animals come out of their burrows and begin their breakfasts of grass and roots, most of them busily digging up grass and little plants for food, nibbling off the grass blades and

plant leaves like rabbits, or sitting up holding them in their hands like squirrels. There are always, however, a few on sentinel duty, usually sitting straight up on the highest mounds, or stretching up occasionally to full height from the grass where they are feeding. Some are always scampering from one point to another, and when the young are out there is much playing and scuffling among them.

A populous town of prairie dogs, all busy and many of them calling back and forth, with a few on sentinel duty, barking in steady little *yap–yap–yap–yaps* at some real or imaginary enemy, makes an interesting picture. If the enemy really approaches, the barking becomes frantic and is taken up by other members along the line, and there is a general scamper for the nearest burrows. If one walks toward them to within rifle range the panic increases and the nearest animals rapidly disappear down the burrows with a farewell twinkle of their tails. The barking passes along farther and farther through the town, usually beyond where the enemy can be seen, every prairie dog taking notice and most of them joining in the alarm. Occasionally one of the guards will stretch up to its utmost height and throwing its head back utter a long *Chu-r-r-r-r-r-r-r-r-r-r*, as if a dozen barks were crowded into one. This seems to be their only note besides the regular *yap–yap*, and a chuckling, scolding *Chu-r-r-r-r-r*, after entering their burrows, as if they were grumbling at having been disturbed.

The burrows are deep and go down at steep angles, sometimes almost straight down, for 2 or 3 feet and then slope off gradually. A pebble dropped into one can be heard rolling and bounding down, often for 5 or 6 feet, and a prairie dog with a string tied to its hind foot will sometimes take down 12 or 15 feet of string before reaching the end of the tunnel. The burrows are simple and almost never lead out to a second opening.

The nest, instead of being at the lowest point, is usually in a chamber well protected from any rain water that may run down the burrow. As a further protection the earth thrown out is carefully placed around the entrance to form a craterlike rim that serves the double purpose of a watch tower and a dike to prevent the entrance of water from heavy rains.

Originally the mound is built of the earth brought out of the burrow, but later fresh earth is scraped up from outside and brought back and added to the sides, and when the ground is moist after a rain the mound is carefully formed and patted and pushed with the end of the nose until externally it has the most approved slopes and internally the correct funnel form. A well-kept mound shows numerous dents and dimples where pushed and poked with the pudgy noses of the prairie dogs. Many old burrows with neglected and broken mounds are used, but the main nest burrows are always kept in good condition. Nest material of dried grass and soft plant fibers is carried into the burrows and the old material is occasionally brought out and scattered about the entrance. The cheek pouches of the prairie dogs are small and little used, and apparently no food is stored.

Breeding.—The 4 to 6 or 8 young are born early in May, but usually do not appear out of the burrows until the first or middle of June. They are then seen in family groups around the entrance to

their homes and always under their mother's watchful eye. At a signal from her they quickly rush to the burrow and disappear. As their experience increases they are left more to their own discretion, but even when half grown if danger appears the mother insists on their all getting down the burrow before she will enter. Small young are often seen later in the year, but in the northern part of their range it is doubtful if more than one litter is raised in a season, the late young probably being the first litter of females of last year's brood.

Hibernation.—In fall the adults become very fat and the young moderately so. They are always ready to hibernate in case of very cold or stormy weather or deep snow, but do not enter their dens to remain unless cold weather comes. In mild seasons they are sometimes active until midwinter and may be seen foraging on warm days when there is no snow. In severe winters, however, they disappear for a long period and evidently pass completely into the state of hibernation. They are out with the first warm days of spring and in March, when a few sagebrush tops were the only visible vegetation, the writer has seen them sitting on top of 2 feet of snow through which they had burrowed to the surface. As soon as the snow is off in spring they find plenty of food in the dry grasses and roots, and their store of fat helps to carry them through the mating season.

Food habits.—The food of the prairie dogs consists principally of grass, including seeds, leaves, stems, and roots, but it includes also a variety of other plants, generally everything that grows over the surface of the ground to a considerable distance around their burrows. The short blades of grasses are not only eaten off to the ground, but the roots also are dug up and the tender bottoms of many species are eagerly eaten. Other little plants are eaten to the ground and those with edible roots or bulbs are dug up and exterminated. Often tall plants, grasses, and weeds that have sprung up in the prairie-dog town are cut down, if not for food, to keep the ground clear and the view unobstructed. An old and well-populated prairie-dog town is often so completely cleared of vegetation that parts of it have to be abandoned, the animals moving on toward the best grass on the margins. In this way parts of the prairie are progressively denuded of vegetation.

The stomachs of prairie dogs are relatively large, as in all grazing animals, and at any time of the day except early morning they are found well filled with finely masticated vegetation, usually showing a good combination of green and white pulp from the foliage, stems, and roots of plants, often with streaks of color from various kinds of flowers and seeds. Many ripening seeds are included in their food, and fields of grain tempt them to extend their colonies into this unusual food supply. When the dog towns are plowed up and seeded to grain the occupants cling to the old burrows with great tenacity, opening them up and if left undisturbed living in the midst of wide grainfields.

Depredations.—An area occupied by a colony of prairie dogs may usually be considered stocked to its carrying capacity and of little or no value for grazing or agricultural purposes. It may also be considered that the area thus occupied is just so much withheld from

other use, and it is only a matter of determining the area of land given over to these animals to know the extent of the loss in grazing. If a well-populated prairie-dog town is plowed and seeded, prairie dogs will be the ones to harvest the grain unless they are first destroyed.

Destruction of prairie dogs.—Fortunately prairie dogs are easily poisoned by the use of oats or other grains coated with strychnine, as described for the Richardson ground squirrel, and a farm suffering severe losses may be reclaimed at comparatively small expense. Full directions for preparing and using the poisons will be furnished by the Biological Survey on request.

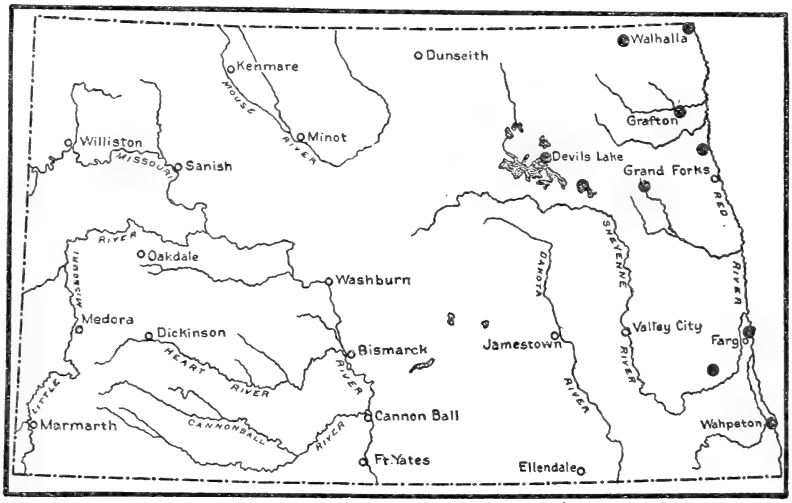


FIG. 6.—Localities where woodchucks are known in North Dakota

Marmota monax rufescens Howell

Rufescent Woodchuck; Groundhog

Marmota monax rufescens Howell, Proc. Biol. Soc. Washington, vol. 27, p. 13, 1914.

Type locality.— Elk River, Minn.

General Characters.—Heavy-bodied animals, with short ears, short legs, and short, bushy tails. Similar in general appearance to the southern and eastern woodchucks, but more reddish brown above and below. Upper parts dark brownish gray, sides and underparts strongly washed with reddish or rusty brown; feet blackish; tail black or dark brown, long-haired and bushy. Average measurements: Total length, 548 millimeters; tail, 143; hind foot, 83.[11] Weight, about 8 to 12 pounds, but individuals have been recorded as heavy as 13½ and 18 pounds. (Anon., 1900; Fellows, 1881.)

Distribution and habitat.—From the Transition Zone of the eastern United States woodchucks extend across Minnesota and into southeastern North Dakota as far as Devils Lake (fig. 6). In revising the group Howell examined specimens from Fargo, Grafton, and Leonard, in North Dakota; and at the biological laboratory in 1913 there were skins collected near Stump Lake and Devils

[11] Measurements from North American Fauna No. 37 (Howell, 1915, p. 26).

Lake. At Wahpeton woodchucks are reported common along the banks of the timbered river bottoms. At Fargo and Grafton they are occasionally found. In 1915, Kellogg collected a half-grown young near Larimore and obtained a specimen at Grafton. While at Manvel, Grand Forks County, he saw their burrows and one young that had been captured. In 1919, Williams reported them becoming more numerous each year at Grafton. Eastgate says they are occasionally found in the forest near the biological laboratory at Devils Lake, but that they are by no means common. Apparently they fill the forested belts along the rivers, extending westward from the Red River Valley and thus reaching the Devils Lake and Stump Lake forested tracts. Although mainly restricted to forested and brushy locations, where no timber is available they will live in the open. Steep banks and sidehills are favorite situations, but in many cases the burrows are found on level ground or under stumps, trees, or stones. Woodchucks are not fastidious as to habitat, the one requisite for their existence seeming to be an ample supply of green food during the summer season.

General habits.—These largest and least squirrel-like of the squirrel family have generally the burrowing habits of the ground squirrels and prairie dogs. They are mainly burrowing and grazing animals, occupying the region of rich plant growth rather than the short-grass prairie, and depending to a great extent on cover and concealment for protection. They are not colonial in habits, except as mother and young remain together during the season, but if undisturbed they often multiply so rapidly as to be seriously destructive to crops and forage.

Their burrows are extensive, and instead of being one simple tunnel, usually open out in two or more directions from the central den. Near Larimore, Kellogg dug out a den where an old female and her half-grown young were living. There were four entrances and three nests in different chambers. The nests were made of dry grass and leaves and one contained some fresh-cut plants, including nettles. The branches of the den were respectively 6, 7, and 9 feet long, but apparently there were other branches not discovered, as the old woodchuck and her young had been seen to enter the burrow, but could not be found. When first seen, one of the young was up in a basswood tree and when alarmed ran down into the burrow. These woodchucks are good climbers and in places where there are no fences or rocks to serve as watch towers, they are often found up in trees where a good view can be had. They also take refuge in trees to escape from dogs and other enemies. A family of seven young is reported from Manvel, by Kellogg, and this seems to be about the average number for the species.

Food habits.—The food of woodchucks consists largely of green vegetation, with which their large stomachs are usually filled. They are particularly fond of clover, alfalfa, or any of the native leguminous plants, but will eat grass and growing grain and vegetables with great relish. In fall, flowers, seeds, and grain furnish a richer food from which more rapidly to accumulate their winter fat. Apparently they do not lay up stores of food, but depend on finding an ample supply until time to hibernate, and in spring live on their store of fat until green vegetation is available. They usually come

out in spring while the ground is still covered with melting snow. Doctor Bell took a specimen at Fargo on April 29, 1906.

Economic status.—The fondness of woodchucks for almost every kind of garden or field crop renders them serious pests wherever they are numerous. Here on the border of their range they may never become troublesome, but they should be watched and their numbers kept down wherever an undue increase is noticeable.

It is unfortunate that the habits of so many of our native animals conflict with the interests of man, as their presence would otherwise add much to the interest of life. A few woodchucks in the meadow and along the fences, where their loud, shrill whistle is occasionally heard and where they are seen sitting up in the grass or on the fence watching for danger, or with flopping tails scampering to their burrows, would add a touch of life and interest to any landscape. Their depredations, however, are too serious to be taken lightly, and it is often necessary to destroy them. Usually they may be shot or trapped, or killed with carbon disulphide placed in their burrows, but they are not easily poisoned, as there is usually an ample supply of their favorite food within reach.

Woodchucks as food.—Woodchucks have some value as food animals; their meat is like that of squirrels, but coarser. Many persons are fond of them, and in the markets they sometimes bring as much as a dollar each. There could be no cleaner or more exemplary animal in food habits and their underground dens are as clean and fresh as the abode of any burrowing animal. When necessary to destroy them their use as food should be encouraged.

Marmota monax canadensis (Erxleben)

Canada Woodchuck; Groundhog

[*Glis*] *canadensis* Erxleben, Syst. Regni Anim., p. 363, 1777.

Type locality.—Quebec, Quebec, Canada.

General characters.—In size somewhat smaller than *rufescens*. Color, strongly rufescent. Average measurements: Total length, 513 millimeters; tail, 108; hind foot, 76.

Distribution and habitat.—From a range extending across Canada from Nova Scotia on the east to Fort Simpson on the Mackenzie, the small northern form of the *monax* group of woodchucks barely enters the extreme northeastern corner of North Dakota. One specimen collected at Pembina in 1887 was identified by Howell as belonging to this form. It was taken on the North Dakota side of the river, but after it had been seen to swim across from the Minnesota side. In 1915, Kellogg reported a few woodchucks at Pembina, but did not obtain any specimens. The river at this point has considerable timber along both sides, and woodchucks are likely to pass back and forth freely, if not during the summer, they certainly would early in spring before the river breaks up. At Walhalla they are fairly common, but by October 1, 1919, they had all denned up for winter. One found in the bank and later mounted was evidently the little dark-colored *canadensis*.

General habits.—The only difference in habits between this form and the more southern *rufescens* may be attributed to climate and environment. With a longer winter, more snow, and a somewhat different set of plants from which to draw their food supply, these

rodents readily adapt themselves to local conditions. In the shorter season they are still able to lay up sufficient fat to carry them through the long, cold winters, and in spring they come out of hibernation even while the snow is still deep. As early as March 18, in northern Minnesota, they sometimes come out on 4 feet of snow, making tracks in the soft, melting surface or on the frozen crust and visiting back and forth from one burrow to another, opened out through snow tunnels. This is the mating season, and, according to Seton (1909, vol. 1, p. 426), the four or five young are born about the end of April. Over this great northern country they are generally harmless, except where locally they come in contact with fields and gardens.

Family MURIDAE: Old World Rats and Mice

Rattus norvegicus (Erxleben)

Brown Rat; House Rat; Wharf Rat

[*Mus*] *norvegicus* Erxleben, Syst. Regni Anim., p. 381, 1777.

Type locality.—Norway, where introduced in 1762.

General characters.—Size, variable; ears, small; nose, long and pointed; tail, long, nearly naked, and minutely scaly; color, dull brownish-gray above, light or whitish below, occasionally bluish black. Measurements of average adults: Total length, 415 millimeters; tail, 192; hind foot, 43; measurements of a large individual, 468, 212, and 44, respectively. Weight of large individuals, about 1 pound.[12]

Distribution and habitat.—The familiar house rats are not native to America, but came over on ships about 1775, and since then have spread over most of this country, except some of the arid interior. They follow railroads and settlements into every part of the country where they can find food and cover, preferring the buildings and habitations of man. It is safe to say that they first entered North Dakota with the early steamboat traffic up the Missouri River.

In 1833, Maximilian (Wied, 1839–1841, Bd. 2, pp. 72, 251, 256–257, 1841) found them a great pest among the grain stores of the Indians at Fort Clark. He says that in the loft of the stores of the fort were 600 to 800 bushels of maize that a great number of Norway rats assiduously labored to reduce. They were so numerous and troublesome that no kind of provision was safe from their voracity, but their favorite food was the maize, among which they created much havoc, and it was calculated that they devoured 5 bushels, or 250 pounds, daily. The rats were brought thither by American ships, but as yet had not reached the Minnetaree villages. The following winter, in the house which had been built for him among the Mandan Indians, Maximilian says: "We were molested during the night by numerous rats and put my little prairie fox in the loft above us, where some maize was kept and here he did excellent service."

In 1887, these large rats were abundant at Fort Buford, which was then the terminus of the Great Northern Railway. The old buildings about the fort were filled with them and they were very destructive. Even in the little adobe hotel they were racing about the room every night until caught in traps. At Grand Forks they were said to have only recently arrived and they were not known

[12] Weights of more than 2 pounds have been recorded.

at Pembina, Devils Lake, or Bottineau. In 1909 they were common at Bismarck and Mandan and were said to be at Devils Lake and Rugby Junction, but at Bottineau none had been found. In 1912 they were abundant and troublesome about Fargo, Hankinson, Valley City, Lisbon, Stump Lake, and Grafton. At this time a dead rat was seen at a ranch near Marstonmoor, Stutsman County; Williams reported them at Walhalla, in Pembina County; and within a few years they had begun to infest the country along the eastern edge of the Turtle Mountains. In 1915 Sheldon found them at Fairmount, where they were a great pest around barns and granaries. He says that the farmers who tried to raise poultry had considerable trouble with them, as they took the little chickens at every opportunity. During his visit at the Hoffman farm, two of the farm hands, while transferring a quantity of hay from one section of the barn to another, killed about 100 rats in a few hours. Most of these were about half-grown, only 1 adult being killed. At Lidgerwood, in Richland County, Sheldon found them less common than at Fairmount. On a trip west across the rest of the southern part of the State, however, he did not find any further trace of them.

In 1915 Kellogg found them at Wahpeton, at Grafton, and a few at Oakes, in Dickey County; at Towner, McKenzie County, he reported them as not very common. In 1913 Jewett reported that no trace of them could be found at Sentinel Butte and old settlers living there had never seen them. At Medora, also, none were found. It is probable that the rats will not find their way to the scattered farms over considerable portions of the western and more arid parts of the State for some years to come, but eventually they will undoubtedly cover practically the whole State.

General habits.—So closely have rats been associated with man and his works and for so long a time, that they have become largely parasitic in habits, seeking the cover and protection of buildings and preying upon the food supplies produced and gathered by man. Their sly, filthy habits, mean appearance, and vicious dispositions have not only won the enmity of mankind, but have done much to instill a dislike for other harmless and more attractive native animals with which their name has become associated. To their destruction of property is added the even more serious menace of conveying disease to man. They are by far the most destructive and dangerous of rodent pests and warfare against them should be relentless.

Breeding habits.—A large female rat was sent to the Biological Survey from Fargo by K. F. Bascom, who reported that it had contained 12 well-developed fetuses. This is not an unusual number of young at a birth, and the rats breed so rapidly that under favorable conditions of food supply and protection the rate of increase is enormous. Litters of young are said to be produced sometimes at intervals of 25 days and the breeding season lasts for a large part of the year (Lantz, 1909, p. 16).

Food habits.—Probably no rodents are more omnivorous than rats. They accept anything of an edible nature from fresh or stale meat to young chickens, eggs, fruit and vegetables, grain, nuts, seeds, and even green vegetation. They revel in garbage of all sorts and will often find an abundance of food in city dumps, manure piles, and in the refuse about stables. In a grain-producing region their fondness

for grain leads to enormous losses, as where an abundant supply is available they merely take the germ and ruin far more than they require for food.

Control measures.—The depredations of these animals are so serious that it is generally found to be good economy to make buildings rat-proof, or as nearly so as possible, by means of concrete, brick, stone, and wire mesh. Where grain and other food can be kept away from them their numbers can easily be controlled, but they are so skilful in burrowing under walls and gnawing through wood that special methods are necessary to exclude them. So adept are they in avoiding traps and poison that a combination of rat-proofing, poison, and traps is often necessary to prevent serious losses from them. The most successful methods of combating them are given in Biological Survey bulletins and circulars, which are available for free distribution.

Mus musculus musculus Linnaeus

House Mouse

[*Mus*] *musculus* Linnaeus, Syst. Nat., ed. 10, t. 1, p. 62, 1758.

Type locality.—Sweden.

General characters.—Size small, with slender, tapering tail, pointed nose, and rather small ears. Color, brownish-gray above, buffy-gray below, usually without any clear white. Measurements of average adults: Total length, 160 millimeters; tail, 81; hind foot, 19. Weight of adult female, 23.5 grams.

Distribution and habitat.—Troublesome little Old-World mice have become well established over almost every part of North Dakota, in fact through most inhabited parts of North America. So thoroughly have they become dependent on the habitations of man that little is known of their origin and distribution. They followed quickly on the heels of the first settlement of the country and generally appeared within a few years after the establishment of a ranch or farm, even at a considerable distance from other habitations. At almost every place over North Dakota where field work has been done by the Biological Survey, these mice have been reported as common or abundant and troublesome about buildings, and in many cases they have been caught in the fields in traps set for native species.

At Fargo, in 1912, these little mice were so numerous along the edges of fields and roads that it was difficult to catch other species until enough trapping had been done to reduce the numbers of the house mice. Near Williston, in 1913, they were abundant at the ranches and very destructive of grain in the bins and sacks. In the bunk house at one of the ranches the mice kept up a racket all night, and in the morning there were little piles of oat shells on the floor where grain had been brought in and eaten. Their musky odor was very evident in the room, leaving no doubt as to the identity of the species, and one was shot as it ran across the floor. At Kenmare, in the northwestern part of the State, they were abundant both in town and in the weedy bottomlands, where many were caught in traps. At Mandan, in 1913, Jewett found them abundant in town and also on rough slopes in the surrounding fields to a distance of 2 miles from town. At Glen Ullin he caught them on the sides of buttes a mile from town, and also in the tall grass along the creek

bottoms. At Sentinel Butte they were found at almost every ranch; also at Fort Clark, and around Oakdale in the Killdeer Mountains. Specimens were also taken at Buford, Bismarck, Cannon Ball, and many other localities over the State.

General habits.—House mice are generally imported in boxes and loads of goods where they have made their nests, and are carried long distances on trains or in wagons. They prefer the protection of buildings, but when they have become numerous overflow into the surrounding fields and country wherever food and cover are to be obtained. They breed and increase with great rapidity and but for their natural enemies would soon overrun the fields and render agriculture unprofitable. Cats are generally used to keep down their increase, but serve as a very limited check. The native owls, hawks, and weasels, however, do much to control their abundance.

In habits the mice are often filthy, running through the dirt of stables and cellars and then over the food in pantries or kitchens, in this way not only destroying food but distributing disease germs.

They are so slender that they can slip through cracks and narrow openings into places supposed to be proof against their entry, and they will also gnaw through a considerable thickness of wood to get at food or grain that is stored. Concrete, plaster, and fine wire mesh are the best protection against their inroads, but in spite of all efforts it is often necessary to resort to poison and trap in order to destroy them. Inverted boxes covering poisoned grain, with small openings through which larger animals can not pass, may be kept in buildings where mice occasionally enter and many may be destroyed in this way. Directions for preparing poisoned bait, as well as for trapping these pests, will be furnished by the Biological Survey, United States Department of Agriculture, on request.

Family CRICETIDAE: White-footed Mice, Harvest Mice, Grasshopper Mice, Wood Rats, and Voles

Peromyscus maniculatus osgoodi Mearns

Osgood White-footed Mouse

(Pl. 11, fig. 1)

Tepa-uti[13] of the Omahas (Gilmore)

Hesperomys leucopus nebrascensis Mearns, Bul. Amer. Mus. Nat. Hist., vol. 2 (1887–1890), pp. 285, 287, 1890 (not of Coues, 1877).

Peromyscus maniculatus osgoodi Mearns, Proc. Biol. Soc. Washington, vol. 24, p. 102, 1911.

Type locality.—Calf Creek, Custer County, Mont.

General characters.—One of the smaller-sized white-footed mice, of rather pale buffy ochraceous color over the upper parts and pure white below; tail sharply bicolor. Immature individuals are more bluish-gray above, only the adults being buffy ochraceous. Average measurements of adults: Total length, 158 millimeters; tail 64; hind foot, 20. Weight of adult male, 20.5 grams.

Distribution and habitat.—The little native white-footed mice are abundant over the western, drier part of North Dakota east to the Missouri River Valley, thence grading insensibly into the darker eastern form *bairdi*. The area of intergradation is mainly east of the river, including such localities as Kenmare, Minot, Napoleon, and Linton. In the Missouri Valley the mice seem to be typical

[13] Mice that live in the buffalo skulls, most likely this species.

of this western form. They are abundant in almost every locality and situation over the areas they inhabit. At Fort Buford, in 1887, they were found abundant, and again in 1913 about equally abundant over the prairies and Badlands buttes, in marshes, and in wooded bottoms. In 1910 Anthony reported them there as numerous in the brush, among the rocks, and on the hills and prairies. At Fort Clark, Jewett caught them in traps set over a wide range of country, but most commonly among rocky buttes and around wheatfields. Along the Little Missouri River from Medora to Quinion he caught them wherever his traps were set, in the willows along the river, in the sagebrush, and on the rocks and hills. At Oakdale, in the Killdeer Mountains, he also caught them in traps set on rocky slopes, in the brush, along the creeks, and in the swamps around springs. At Sentinel Butte they were found on the open prairie, among rocks on the buttes, and in wet grassy places at the edges of ponds. At Glen Ullin he found them very common, living in burrows and among rocks all over the country. At Mandan he caught them in the brush, along the river, in rocks on the open prairie, and along fences or borders of wheatfields. At Cannon Ball, Sheldon reported them as inhabiting the grainfields principally, but also the arroyos and sandy bluffs.

These reports indicate great abundance, a continuous distribution, and perfect adaptation to a great variety of environment.

General habits.—These beautiful little animals, with large eyes, long whiskers, and large, expressive ears, show much intelligence by adaptation to a great variety of conditions of life, but are nervous and timid and do not readily accept conditions of domestication. In the woods they climb trees and are fond of living in hollow logs or other cavities, but in the Badlands they find safe retreats among the rocks, cliffs, and clay banks, and on the prairies they live in natural cavities or abandoned burrows of other animals. They probably dig burrows for themselves when necessary, but usually are able to find plenty of those abandoned by pocket gophers and other burrowing rodents. They often live in the driest situations and seem not to be dependent on a permanent water supply, although they have no objection to wet or marshy ground. Strictly nocturnal in habits, as is indicated by their large, dark eyes, they are rarely seen except when disturbed in their diurnal retreats, and although abundant, they are not generally well known. The plow often turns them out of their underground nests and they are frequently disturbed when land is cleared; after haying and harvesting they are found in haycocks or grain shocks that have been standing for some time in the fields. Wherever they take up their abode they quickly make a soft nest of fine plant fibers and seem perfectly at home if shelter and food are obtainable. They are often so numerous as to be very troublesome to the naturalist in search of rare specimens, as they fill his traps night after night until they have been thinned out.

Near the mouth of the Cannonball River one evening while it was still light enough to see fairly well, a brown-backed old *Peromyscus* ran out from under a stone. It darted about nimbly from one stone to another, then stood still and watched for half a minute, its big ears and bright eyes giving it a very animated expression. This

is one of the few times when these little mice have been seen out foraging of their own accord before daylight was entirely gone. They will often run over a person, however, while he is sleeping on the ground, and there is generally plenty of evidence of their presence about camp in the morning.

In winter on soft snow their tracks may be found leading from tree to tree, or bush to bush, or from one weed to another where they have run in search of food, but most of their tracks lead to or from holes in the snow which connect with tunnels under the snow or cavities under ground.

At Mandan and Cannon Ball late in October, 1919, the writer followed many of their tracks to nest cavities in the ground, and dug down and caught the mice in the hands. All were in old stump holes, where cottonwoods had decayed and left rotten wood or hollow spaces deep in the mellow soil of the forested bottomland. At a depth of 6 inches to a foot below the surface, nests of soft leaves and plant fibers were found, lined with cottonwood cotton and rabbit fur, and in these nests from one to four of the mice were comfortably housed for the winter. When disturbed they came out to see what was the matter and they were tied in a handkerchief or gloves and carried home for further study. Even when the temperature was —15° F. and the snow 11 inches deep the mice were out making long lines of tracks at night, in following which much was learned of their food and other habits. They seemed to know where to go directly to every seed-laden tree, vine, bush or weed, and whether to climb up or dig down to get the seeds or fruit.

Breeding habits.—The females usually bring forth four to six young at a litter and they apparently breed several times during the summer. Their increase is rapid, and but for numerous enemies their abundance would be far greater than at present.

Food habits.—The white-footed mice are dainty feeders. The contents of many stomachs examined show a mass of clean white material so carefully selected and finely masticated that there was no trace of shells or hard parts to show from what kinds of seed it came. Most of their food is of various seeds and grain, although sometimes a bit of green vegetation, some bright-colored flowers or berries, or a few insects are eaten. At Mandan the mice were feeding largely on the bullberries, which they gathered nightly from the well-laden bushes, apparently eating both the sweet pulp and seed kernels. There were bits of scarlet skins scattered over the snow and the mouse pellets neatly deposited in a cavity not far from the nest were mostly colored dull scarlet by the berries, while some of the seeds were found in mouse caches. From one cache near the nest a handful of seeds was saved and brought back for identification. Among them were seeds of chokecherry, woodbine, wild grape, smilax, buffaloberry, hosackia, dogwood, bindweed, two species of knotweed, two of pigweed, ragweed, Russian thistle, black henbane, sedge, barnyard grass, and dropseed grass. The mice seem fond of any kind of camp food, as flour, meal, oatmeal, grain, meat, butter, bread, or crackers. Rolled oats generally make the most attractive bait with which they can be tempted into traps. They are active throughout the year and do not put on fat to carry them

through the winter, but instead store up a limited supply of seeds and grain for winter use or for bad weather when they can not come out and run over the surface of the snow in search of food.

Economic status.—The small toll these mice take from grainfields would not in itself cause very serious loss, but added to that of many other species the constant drain on farm products is sometimes serious. They cut some grass in the meadows and eat the seeds of many grasses, thus, to some extent, retarding the forage reproduction and in places taking away so much seed as to form a serious check on the reproduction of other vegetation. Probably more than any other animals they check reforestation, whether this depends upon naturally or artificially sown seeds. So small, so numerous, and so widely distributed are they that they are not easily controlled, except by their natural enemies, which are numerous. They are favorite prey of all small owls and even of many of the larger owls, and form an important article of diet for weasels, skunks, badgers, foxes, and such of the other small predatory species as occur within their range. Reasonable protection of the species that prey upon them, especially the owls, forms the simplest and most effective means of keeping down their abundance.

Peromyscus maniculatus bairdii (Hoy and Kennicott)

Baird White-footed Mouse

Mus bairdii Hoy and Kennicott, Rpt. Comr. Patents. [U. S.] 1856, p. 92, 1857.

Type locality.—Bloomington, McLean County, Ill.

General characters.—About the size of *osgoodi*, but colors much darker, often dusky along the back, and less buffy or ochraceous; underparts, white. Measurements of an average specimen: Total length, 150 millimeters; tail, 60; hind foot, 19. Weight of adult male, from Fargo, 18.5 grams.

Distribution and habitat.—From Ohio and Oklahoma the little dark-colored white-footed mice (*bairdii*) extend over the eastern half of North Dakota and into southern Manitoba. In their typical form they do not reach west of the Missouri River, but at about the one-hundredth meridian they grade insensibly into the paler, more buffy *osgoodi*. There are specimens from almost every locality where collecting has been done in eastern North Dakota, from Hankinson to Pembina and westward to Linton, Towner, and Kenmare. They are found on the tall-grass prairies in the area of humidity and ample cover, where their dark color is protective in the grassy and weedy shadows.

General habits.—These little mice, like their western form, *osgoodi*, are the most abundant and generally distributed mammals of their region. They live in a great variety of situations, from brushy weedy bottoms in the woods, half-dried tule marshes, and dead-weed rows along the roadsides to the middle of grainfields and out over the wide, open, grassy prairie, making nests and homes in hollow logs or trees, in underground cavities which are found, or if necessary, excavated, or under any cover that will offer a dry bed. From *osgoodi* of the drier, more open plains farther west, they differ in habits only in adaptation to more abundant plant growth and more nearly continuous grainfields.

Where food is plentiful they congregate in great numbers, but where it is scanty they become scarce. At Stump Lake, in a line

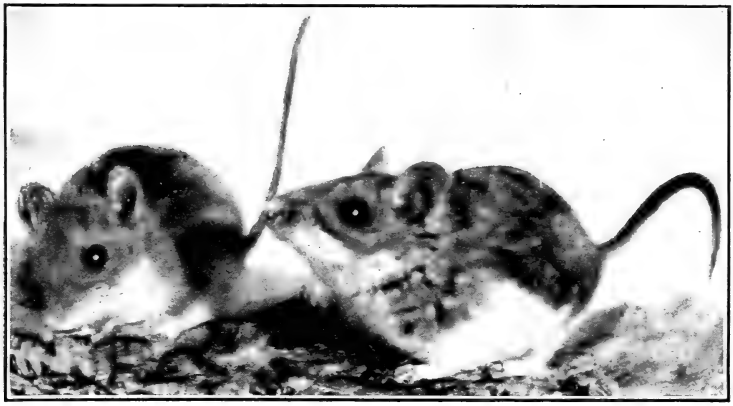


FIG. 1.—OSGOOD WHITE-FOOTED MOUSE (PEROMYSCUS MANICULATUS OSGOODI) IN CAPTIVITY

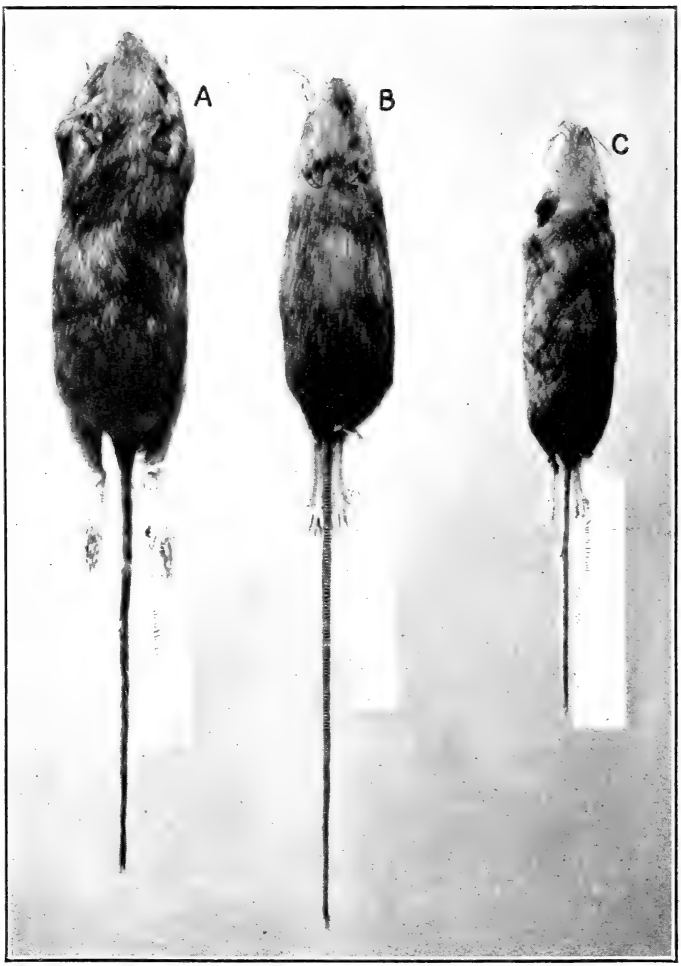
Slightly reduced

FIG. 2.—BEAN MOUSE (MICROTUS PENNSYLVANICUS WAHEMA)

Captive taken with store of ground beans near Cannon Ball. About two-thirds natural size

B252M

FIG. 3.—RICHARDSON KANGAROO RAT (PERODIPUS MONTANUS RICHARDSONI)



SKINS OF LONG-TAILED MICE

(A) Kansas pocket mouse (*Perognathus hispidus paradoxus*); (B) prairie jumping mouse (*Zapus hudsonius campestris*); (C) prairie harvest mouse (*Reithrodontomys megalotis dychei*). Half natural size

of traps set along the sandy beach, 16 of these mice were caught in one night where they were finding a choice food supply in the cockleburs which covered the sandy ground. At Crosby the writer found them feeding largely on little caterpillars. At Valley City many were caught in the rows of tumbleweeds or Russian thistles along the fences, where they were feeding on the seeds of these weeds under the cover of which they found ample protection. Eastgate reported 19 caught in his line of 41 traps the first morning after he camped near this place. They are often found in the haycocks and wheat shocks in the fields, and if these are left for a considerable time the mice are sure to make their nests in them and do more or less mischief.

In breeding and food habits these mice are essentially the same as the western *osgoodi*. Their injury to crops is somewhat greater because of the more general cultivation of land over their range. Their enemies are practically the same and if only given a fair opportunity will keep down the too rapid increase of these interesting but destructive little rodents. At Fargo in the well-cleared city parks not a mouse could be caught, while in the uncleared woods near by, where weeds and bushes protected them from the little owls, these mice filled the traps the first night.

Peromyscus leucopus noveboracensis (Fischer)

Northern White-footed Mouse; Deer Mouse

[*Mus sylvaticus*] *noveboracensis* Fischer, Synop. Mamm., p. 318 (p. 14, δ.), 1829.

Type locality.—New York.

General characters.—Largest of the white-footed mice of North Dakota, with relatively long tail and dark colors; upper parts of adults, dark buffy or tawny-gray, with more blackish or dusky about face and ankles than in *aridulus;* underparts and lower half of tail, pure white. Young and immature, bluish gray or plumbeous. Measurements of adult male from Fargo: Total length, 185 millimeters; tail, 78; hind foot, 22. Weight, 27.5 grams.

Distribution and habitat.—The northern form of the white-footed mouse is the common deer mouse or woods mouse of the northeastern United States and southeastern Canada from Nova Scotia to eastern North Dakota. It is largely a forest species, rarely found far from forest or brushland and seems not to extend over the open prairie country. Specimens taken at Fargo, Moorhead, and at Manvel, just north of Grand Forks, are fairly typical of this eastern form and certainly referable to it rather than to the paler *aridulus* of the Missouri Valley. They probably have a continuous range along the timber of the Red River Valley, but seem not to be abundant.

General habits.—Deer mice are largely forest dwellers, but have a wide range of adaptation and will go anywhere that safe cover and an attractive food supply lead them. From their original homes in hollow trees and logs or in the ground under old trees and stumps they readily follow the rail fences and brushy fence rows around the fields, taking up their quarters under grain shocks, haycocks, or haystacks, or entering new buildings erected in the clearings. They are great climbers and will run up the trunks and branches of tall trees or up vines and through bushes in search of

seeds or berries, or over walls and timbers of buildings, with ease and skill.

They are strictly nocturnal and very timid, nervous little sprites, with long, sensitive whiskers and large, thin, delicate ears that are constantly changing form and expression, apparently catching the faintest sounds; their large, prominent black eyes are owl-like in their adaptation to the darkness of night. Apparently they can see fairly well in the daytime, but are rarely natural or at ease in the light and lose much of their vivacity and beauty as usually seen when driven out of their diurnal beds or captured and held as unwilling prisoners. They are among the most beautiful and expressive of our small native rodents, to which the unfortunate name of "mouse" is generally applied, and but for their occasional mischief and nocturnal habits might be as interesting and popular as many of our song birds. In fact, they are not without voices, and certain individuals have a fine squeaking trill that might well be called a song. They have many little squeaks and low notes that doubtless mean much to them if little to us. A more common means of communication, however, consists of a rapid tapping with their finger tips on any hard surface or thin material, which produces a sound suggestive of the drumming of minute woodpeckers. These vibrations vary in length and tone and doubtless mean much to them in the way of communication.

Breeding habits.—Nests containing young are frequently found under grain shocks or haycocks, or are plowed out of hollows below the surface of the ground. They are usually as soft, well built, and well lined as those of any bird; and the delicate, naked young are found resting on silk or cotton wool from various plants or on feathers or fur or other equally soft materials provided by the parents. Usually 4 to 6 young are born at a time and apparently several litters are raised each year. The mammae of adult females are six in number, arranged in two posterior or inguinal pairs and a single pair of anterior or pectoral. Often when suddenly disturbed the mother runs from the nest with 5 or 6 young, each clinging securely to a nipple, as she drags them rapidly to some safe cover.

Food habits.—Although the greater part of their food consists of seeds, grain, and nutlets, deer mice also are fond of berries, fruit, and a great variety of such foods as the human species regards as its own and exclusive perquisite. This often leads to trouble, for the little moonlight people get into fields, gardens, granaries, and even cellars and pantries and help themselves, always to the best there is to be had. The fact that they consume large quantities of seeds of noxious weeds is generally overlooked and some easy method of lessening their abundance is sought. Unfortunately, this often takes the form of keeping cats, which may scare some of the mice away, while the cats live largely on song birds. If little owls could be kept instead, there would be no more trouble from the mice. In fact, there are usually enough little owls to keep down the abundance of the mice, where brush, weeds, and rubbish are removed so the mice will have no protecting cover.

Peromyscus leucopus aridulus Osgood

Badlands White-footed Mouse

Wiyashpena[14] [moon nibblers] of the Dakota Indians (Gilmore).

Peromyscus leucopus aridulus Osgood, North Amer. Fauna No. 28, p. 122, 1909.

Type locality.—Fort Custer, Yellowstone County, Mont.

General characters.—A pale buffy western form of the northern white-footed mouse quite distinct from *Peromyscus osgoodi* with which often associated. Differs in larger size, relatively larger ears and longer, less sharply bicolor tail, and in lacking the tiny white tuft of hair at upper anterior base of ear; otherwise the color and markings of the two species are practically identical. The young and immature are slaty gray. Measurements of type specimen: Total length, 177 millimeters; tail, 73; hind foot, 22. Weight of adult female, 27 grams.

Distribution and habitat.—The Badlands white-footed mice probably have a wide distribution over North Dakota, but are much less numerous than the smaller species and have not been so thoroughly collected. There are specimens from along the Missouri River Valley at Cannon Ball, Mandan, Sather, Fort Clark, Oakdale, Williston, and Buford, but to the eastward there are no more specimens of this group until we find *noveboracensis* in the Red River Valley. Typical specimens may be expected only from the Missouri Valley and westward. Apparently these are not prairie dwellers, as specimens have been taken only in timbered flats along the streams.

General habits.—At the mouth of the Cannonball River they are comparatively common and in August, 1915, Sheldon collected a series of 17 specimens in the forest of the river bottoms. In June of the following year the writer found them common there in the forest and caught them in traps set in thickets and at the bases of hollow cottonwood trees on the river bottoms. In one hollow tree, about 4 feet from the ground, one of the mice was found in a well-made nest lined with the silky down from the cottonwood seeds, and in another hollow cottonwood an old female was caught well up in the cavity of the trunk. At Mandan late in October, 1919, when the ground in the bottomland woods was covered with 11 inches of soft snow, some of these mice were tracked to their nest cavities in hollows where old stumps had decayed. In one of these honeycombed, rotten-wood cavities a nest was found about a foot below the surface of the ground and four of the five occupants were caught as they came out. There were an adult male, two adult females, and two immature of the year in the blue coats. They came out of a nest in one of the side cavities where a root had decayed, but they had free access to all parts of the porous wood from deep in the ground to the leaf-covered surface. Curiosity seemed to bring them up to see what was disturbing their home and they were caught and put in handkerchief and gloves and kept

[14] There is some confusion as to which species of mouse this name should apply. Doctor Beede gave it as one of the names of the bean mouse (*Microtus p. wahvema*, p. 94), but it is not the name in common use by the Dakotas and does not suggest a diurnal, ground-dwelling species, but rather a wholly nocturnal and partly arboreal one. The mice that nibble the edge of the full moon until it is all eaten up must be good climbers, and Doctor Gilmore thinks the name probably applies to one of the white-footed mice. As it is doubtful whether the Dakotas distinguished the very similar forms of *Peromyscus*, this most arboreal of their species is chosen for the beautiful name.

for many months as interesting pets. The nest was a large, soft, warm ball of dry leaves and plant fibers lined with cottonwood cotton and was evidently the home of a family. In captivity they were very friendly and sociable, making a happy family in one nest with four of *Peromyscus maniculatus osgoodi*.

Like other members of the group, Badlands mice are strictly nocturnal in habits and are rarely seen except as caught in traps for specimens or driven out of their diurnal retreats. When seen by daylight, they are beautiful little animals with beady black eyes, large expressive ears, and long trembling mustaches, which give them a keen and animated expression. They are quick and agile in habits, running with long leaps, and climbing rapidly and skilfully over the trunks and branches of trees. In fall they do not become very fat, but lay up supplies of winter food and continue active throughout the coldest weather. Their delicate lines of tracks may often be seen from tree to tree, or from some old log to a stump or brush heap, or centering around a hole in the snow through which they have access to the surface of the ground, where their winter nests and stores are hidden. Over much of their range they are found only in limited numbers, but in certain localities are exceedingly numerous and at times become very mischievous around outbuildings and granaries. As they avoid the open country, they are less mischievous in grainfields than are their smaller and more generally distributed relatives. They are not usually considered a serious pest, but locally they add their little to the constant tax of such rodents upon farm crops.

Reithrodontomys megalotis dychei Allen

Prairie Harvest Mouse

(Pl. 12)

Reithrodontomys dychei Allen, Bul. Amer. Mus. Nat. Hist., vol. 7, p. 120, 1895.

Type locality.—Lawrence, Kans.

General characters.—A slender little mouse with large ears; buffy brown upper parts, and white underparts, distinguished from the house mouse, which it somewhat resembles in size and color, by slenderer and not noticeably tapering tail, and by pure white feet and underparts. From both the house mouse and white-footed mouse it is still better distinguished by a longitudinal groove down the front surface of each upper incisor. Average measurements of adults: Total length, 133 millimeters; tail, 52; hind foot, 16.

Distribution and habitat.—From the Upper Sonoran plains and prairie regions of the Central States the little prairie harvest mice come into North Dakota along the Missouri and Dakota River Valleys. There are specimens from Cannon Ball and Fort Clark in the Missouri Valley, Ellendale, Ludden, and Oakes in the Dakota Valley, and from farther east at Lidgerwood and Hankinson, and Fargo in the Red River Valley. At Cannon Ball, Sheldon found the mice quite common over the prairie and on sandy flats, but more abundant along the brushy borders of grainfields and even out in the fields. At Fort Clark, Jewett caught four in traps set near small burrows at the edge of a wheatfield and on the high prairie. At Ellendale, Sheldon found them fairly common in the grass along the fences, in brushy places, and occasionally in wheatfields, and at Lidgerwood he took

two specimens in tules at the edge of the lake. At Hankinson, W. B. Bell found them common in the tumbleweeds along the fences on sandy soil, and at Fargo Murie took four specimens on the grassy river bank at the edge of a field.

General habits.—These little harvest mice live mainly on the surface of the ground under cover of grass and low vegetation. Their tiny runways may be distinguished from those of meadow mice by being narrower. The harvest mice like the open ground, but must have sufficient cover to protect them from a host of enemies overhead. In places they apparently live in small burrows, but generally their trails seem to terminate at neat little nest balls on the surface or in low bushes and weeds. The nests are rarely found more than 8 or 10 inches from the ground, and more often they are lightly placed on the surface under some ample cover. At Hankinson, a harvest mouse was frightened from a pretty little grass nest in a lock of hay; the nest was a compact ball of fine grass lined with soft fibers, with a tiny opening at one side for a doorway.

Breeding habits.—Usually four to six young are brought forth and cared for in these birdlike nests, but at Oakes, on June 4, Eastgate took an old female that contained seven embryos. Apparently they breed more than once during the season, and in places where there is abundant food and good cover they sometimes become very numerous.

Food habits.—The principal part of the food of harvest mice consists of seeds, largely of grasses, which are found cut in small sections and drawn down until the seed-laden tops are within reach. The mice are fond of rolled oats and other grains used for trap bait and their presence in the fields indicates a fondness for the growing grains. They do not become fat in fall and evidently do not hibernate.

Economic status.—These little mice cover so small a part of North Dakota that they are of slight economic importance, but in areas where they are widely and abundantly distributed their inroads on the grain and forage production materially help to swell the total of rodent depredations. Although they are so small that any artificial means of combating their mischievous tendencies would be futile, effective check is constantly kept on their overabundance by such predatory birds and mammals as small owls, hawks, and probably crows, jays, magpies, and butcherbirds, as well as by weasels, skunks, and badgers.

Onychomys leucogaster leucogaster (Wied)

Maximilian Grasshopper Mouse

(Pl. 13, fig. 1)

Michtika of the Mandans (Maximilian)[15]; *Michtik-tak* of the Mandans (Gilmore).

Hypudaeus leucogaster Wied, Reise in das Innere Nord-America, Bd. 2, p. 99, 1841.

Type locality.—Fort Clark, Oliver County, N. Dak.

General characters.—Somewhat resembling the white-footed mice, but recognized at once by larger size, heavier build, short, thick, tapering tails, and

[15] This name is merely a general term for mice (George F. Will).

smaller ears. Legs also shorter and feet heavier, to harmonize with their entirely ground-dwelling habits. Upper parts dark drab-brown, darkest along the back; underparts and lower half and tip of tail white; immature specimens, dark slaty gray; occasional individuals nearly black. Average measurements of adults: Total length, 164 millimeters; tail, 42; hind foot, 22.

Distribution and habitat.—In his revision of the genus *Onychomys*, Hollister (1915, p. 434), refers all of the specimens from eastern North Dakota to the typical dark-colored subspecies *leucogaster* as described by Maximilian, Prince of Wied, from specimens taken by him at Fort Clark in 1833. The species as thus restricted covers little more than the eastern half of North Dakota, reaching slightly into western Minnesota and northeastern South Dakota and northward into southern Manitoba. There are specimens from Fort Clark, Linton, Grace, Devils Lake, Minot, Pembina, Sherbrooke, and Hankinson. None has been taken in the immediate valley of the Red River nor in the Turtle Mountains, but apparently the species covers the rest of the State either in this dark form or in the paler western form. It is strictly a prairie animal occurring neither in the forest nor the dense thickets, but scattered over the open country in bare and exposed situations as well as under the cover of grass, weeds, and low scattered shrubbery. Though widely distributed it is never very abundant locally.

General habits.—These anomalous little rodents, like the badger and other predatory animals, are apparently wanderers, to some extent, scattering out singly to cover their hunting grounds to the best advantage. Traps set at different kinds of burrows and holes in the ground over the prairie, under a variety of conditions, catch them apparently at random. Sometimes a whole family will be caught in a little thicket or weed patch or a few may be caught every night along a weedy fence row, where they evidently are hunting for their nocturnal prey, but there seems to be no specific place to look for them and rarely is there any trail, burrow, or sign found that can be unmistakenly attributed to them. Most of the specimens taken are caught by accident in traps set for other species.

At Fort Clark, Jewett caught them at small holes or the deserted burrows of ground squirrels and pocket gophers over the prairie, or along the edges of fields. At Hankinson specimens were taken among the sandy dunes, often on bare sand, but also in the rows of tumbleweeds along the fences. Some were caught in burrows of other animals and some in burrows that may have been made by the mice themselves; others in trails made by scraping with the foot in the sand for a distance of 8 or 10 feet; like many other species of mice, they will follow such a trail and are easily caught in traps set across it. Often they are caught in old badger holes, where apparently they are foraging for insects.

While mainly nocturnal they are less strictly so than the white-footed mice, and the writer has seen them running through the weeds in the daytime and on one occasion he shot one about 8 a. m. Generally they are unknown to residents of the country, who probably mistake them for the common white-footed mice. Many are doubtless thrown out of their burrows by the plow, but no one seems to have recorded anything regarding their habitations or home life. At night their fine, prolonged whistle, almost insectlike in pitch and quality, was often heard around the camps, but nearly the whole

summer of 1887 passed before it was discovered to what form the voice belonged.

Hibernation.—In fall these mice become moderately fat, but whether they hibernate in this climate is still a question. Farther south closely related species are caught at all seasons, but in a region well covered with snow for a large part of the winter they would have difficulty in procuring a food supply, as apparently they do not lay up stores or make any provision for winter.

Breeding habits.—An old female caught at Grace, July 2, 1912, contained four large embryos, which seems to be the usual number of young. The mammae of the females are arranged in three pairs, two pairs of inguinal and one pair of pectoral, and probably like other species of the genus the young are occasionally five or six in number.

Food habits.—Grasshopper mice are omnivorous in their tastes, readily accepting rolled oats, bread, cake, cheese, seeds, or grain as trap bait, but show a decided preference for animal food, as indicated by the examination of a great number of stomachs. At Fort Clark, the type locality, Jewett took a fine series of specimens, both old and young, in traps set around the edges of wheatfields and baited with fresh meat or bacon. He says some were taken in meal-baited traps, but that they prefer meat. Grasshoppers, crickets, beetles, and a great variety of other insects are found in their stomachs, also often the flesh and hair of other mice which have been caught or found dead. At Hankinson many of the other mice in the traps were eaten and the stomachs of grasshopper mice caught near by often proved that they had been the trap robbers.

Economic status.—The only complaint of these mice doing any mischief seems to come from their discoverer, Maximilian (Wied, 1839–1841, Bd. 2, p. 101, 1841), in 1833, at the Mandan villages, where he reported them as common over the prairie and in winter coming into the Indians' houses, where all sorts of stores were kept. He says the Mandans call them "mihtick," as they do all kinds of mice. There is no doubt that Maximilian knew the species, as his description is full and perfect, but it is suspected that the mice which did the mischief in the Indian stores were mainly the white-footed species, which also were abundant there. At Fort Berthold, in 1872–73, Doctor McChesney (1878, p. 206) reported them abundant and inhabiting the underground caches of the Indians. Before a definite statement can be made as to the destructiveness of these mice, more complete knowledge of their habits will be necessary. The great numbers of injurious insects eaten by them and their destruction of some other and more troublesome species of mice should class them among the highly beneficial mammals. A more detailed study of their habits is likely to prove of practical value.

Onychomys leucogaster missouriensis (Audubon and Bachman)

Audubon Grasshopper Mouse

Mus missouriensis Audubon and Bachman, Quad. North Amer., vol. 2, p. 327, 1851.

Type locality.—Fort Union (now Buford), N. Dak.

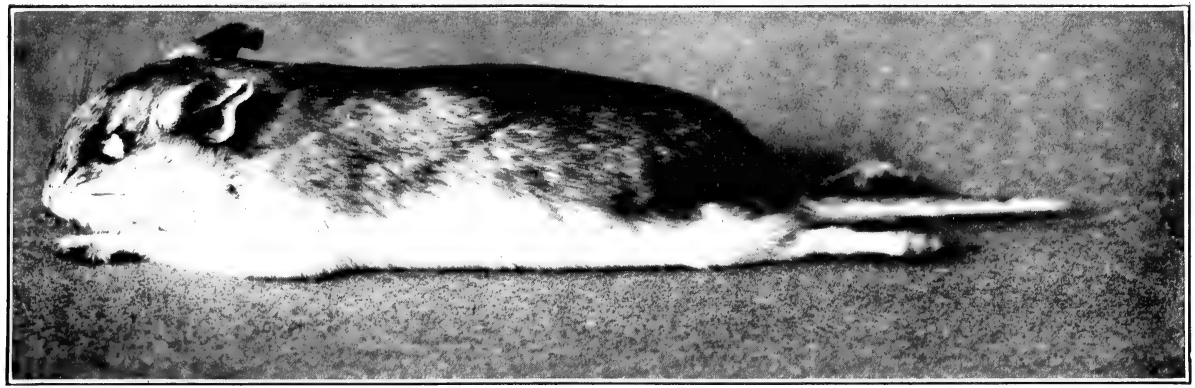
General characters.—Very similar to *leucogaster*, but slightly smaller and much paler, the upper parts being buffy brown, darker in winter pelage, and underparts white; immature specimens, slaty gray. Average measurements of adults: Total length, 150 millimeters; tail, 39; hind foot, 21.

Distribution and habitat.—The paler form of the grasshopper mouse comes into western North Dakota from a wide range over the semiarid plains of Montana, Wyoming, and Saskatchewan. There are specimens from Buford, Dickinson, Glen Ullin, and Cannon Ball. Although few specimens have been taken, the mice undoubtedly cover the whole western part of the State, grading insensibly into the darker-colored *leucogaster* near the type locality of that species, Fort Clark. They belong to the short-grass prairie or plains of the semiarid region and seem to be generally distributed over the open country.

General habits.—One of these mice brought to Audubon at Fort Union on July 14, 1843, was figured and described in his (Audubon, 1851–1854, vol. 2, p. 327, pl. 20–C, 1851) Quadrupeds of North America. Thus the species was made known and named, but nothing whatever learned of its habits. In 1887, with instructions to make a special study of the habits of this mouse, the writer visited Fort Buford. With such crude collecting traps as were available at that time a considerable number of specimens was obtained, most of them being caught alive in little tin box traps. They were common over the hills and prairies, living in burrows of other small animals, as pocket gophers, ground squirrels, other mice, and even in old badger holes. Some were caught at the burrows of the pale field mouse *Microtus pallidus*, which they were probably hunting for food. Some of the fresh burrows in which they were caught may have been of their own construction, but probably were the burrows of other mice, to which they were only paying visits in order to capturing prey. The bait first used for them was cheese and doughnuts, but since then a bit of fresh meat has been found much more attractive.

One of the mice caught in a box trap was not quite full grown and seemed so gentle and interesting that a cage was made for it and it was kept for some months. From the first it was not in the least alarmed and when handled never offered to bite nor struggled to escape, although in the cage at times it became frantic in its efforts to get back to its natural haunts. Unless very hungry it would sleep all day, but on waking up in the evening, after stretching and gaping and blinking for a while, would become thoroughly roused and eager to get out and hunt for its supper. It did not like a bright light and would show signs of discomfort by blinking its eyes, but, with its box faced away from the light, was very bright and animated. At a touch on the box it would come to the front and eagerly take whatever food was put in between the wires. Any insect put inside was quickly caught, and even flies would rarely escape it.

From the trap line the writer always brought back plenty of food for the mouse and greatly enjoyed watching it eat the different kinds of insects. In one forenoon it ate 16 crickets, 11 grasshoppers, 1 spider, 1 black bug, and 1 big fly. Its favorite food seemed to be crickets, and it would never touch anything else while there was a cricket in its box. Next to crickets it liked grasshoppers or flies, but did not seem to care much for beetles, although it would eat any kind offered including some ladybugs and a small black species that was common under sticks and stones, and it seemed to relish a potato bug found



B70M

FIG. 1.—GRASSHOPPER MOUSE (ONYCHOMYS LEUCOGASTER LEUCOGASTER)

From photograph, about natural size, of specimen in National Museum

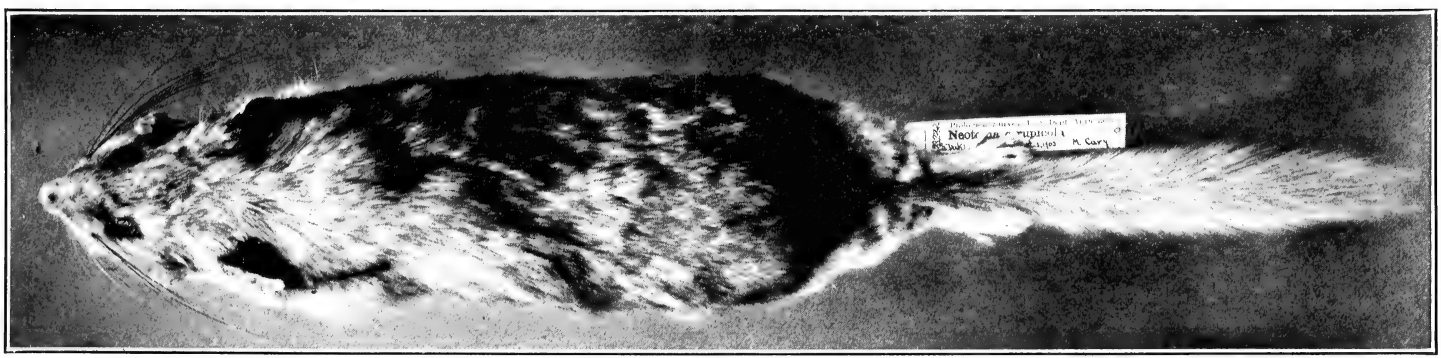


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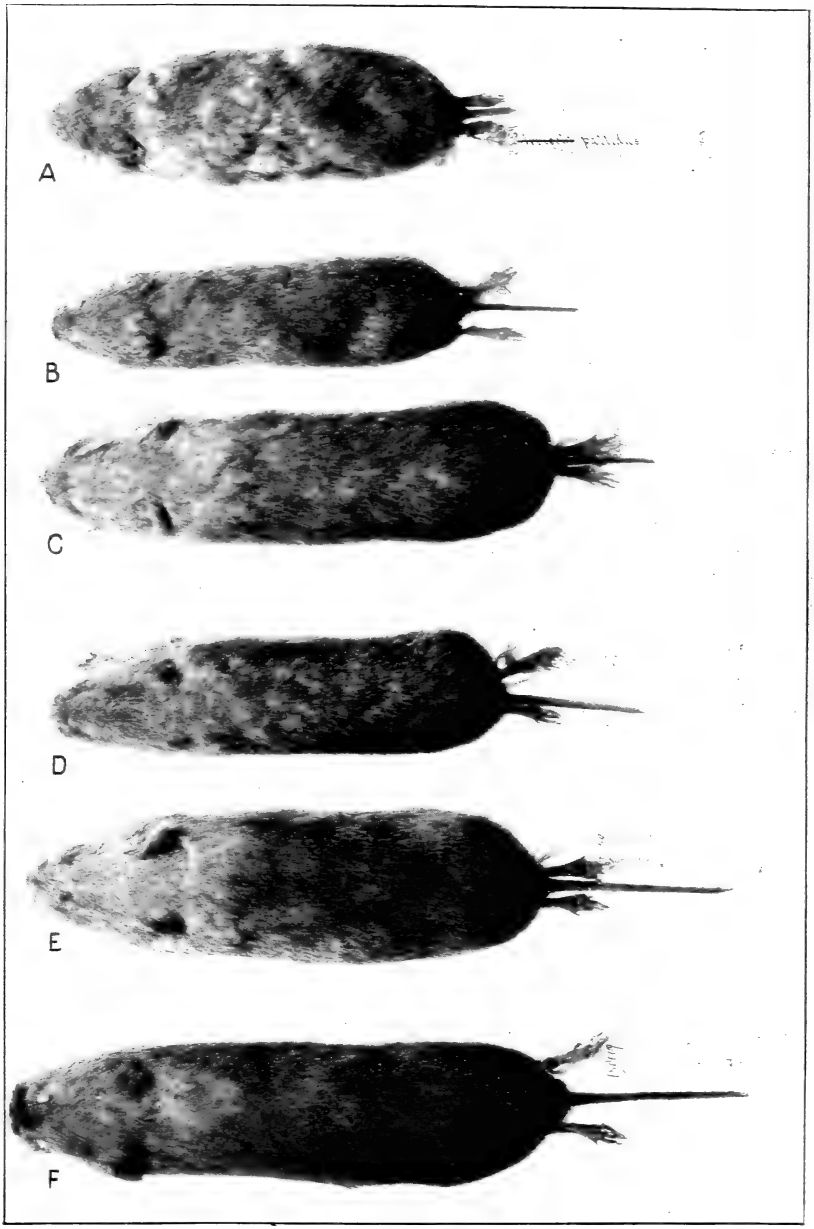
FIG. 2.—PALE BUSHY-TAILED WOOD RAT (NEOTOMA CINEREA RUPICOLA)

Specimen in National Museum. About half natural size



BI329M

SKINS OF SHORT-TAILED MICE

(A) Pale mouse (*Microtus pallidus*); (B) little upland mouse (*Microtus minor*); (C) western upland mouse (*Microtus ochrogaster haydenii*); (D) Drummond meadow mouse (*Microtus pennsylvanicus drummondi*); (E) bean mouse (*Microtus pennsylvanicus wahema*); (F) eastern meadow mouse (*Microtus pennsylvanicus pennsylvanicus*). About half natural size

for it, as it ate all but the wings and legs. One day it ate 12 crickets and 1 spider in 7 minutes; and a little later, 11 grasshoppers, 4 crickets, 1 black bug, and 1 large fly, making 29 large insects and 1 spider eaten in about 4 hours, and it still seemed hungry. On another day the mouse ate 28 crickets, 15 flies, 8 grasshoppers, and 2 beetles, in all 53 insects in less than 12 hours. It seemed to relish a common gray moth and enjoyed a black hornet until it came to the tail, when the stinger evidently pricked its nose. Ants were the only insects it ever refused and a few of these in its box would make it violently frantic.

To see it eat a large grasshopper was amusing. The mouse would hold the grasshopper upright between its hands and begin on the head, when a few vigorous kicks of the grasshopper would tip it over backward; but it would never let go until the head was eaten off and and the body devoured. The wings and legs would drop off as it progressed, and if the mouse was still hungry they would be eaten later. If a number of grasshoppers were put into its box at one time, it would first bite off the heads of all, so that none would escape, and then finish them at its leisure. One day the mouse killed and ate a small frog, but did not seem to care much for it. Only when very hungry would it eat seeds and green leaves of plants.

It pounced like a cat upon a dead white-footed mouse dropped into its box, caught it beside the head near the ear, and began biting with all the ferocity of a carnivore. The bones could be heard to crack, and when taken out a small hole was found broken through the base of the skull. Its teeth had penetrated well into the brain. The dead mouse was returned to its captor, which began to tear and pull off strips of skin and flesh from the neck, shoulders, and head, and ate both of its eyes. Another mouse that was put into its cage was treated in the same way, and a song sparrow that had been accidentally killed the mouse bit through the head and then partially ate. It ate part of a mouse of its own kind, thus proving to be cannibalistic as well as carnivorous. It was fond of bits of fresh meat and especially of brains that were given it while specimens were being prepared.

The fierceness shown in attacking mice indicated a habit of capturing and killing these animals in their free state. In spite of its savage disposition and carnivorous tastes, it was the gentlest rodent to handle, as well as one of the most interesting and attractive pets; others of closely related species generally show similar dispositions.

Breeding habits.—On May 30, 1910, H. E. Anthony caught an old female at Buford, containing four embryos. Little is known, however, of the breeding or other home habits of these mice.

Hibernation.—One adult caught at Fort Buford in September was so fat as to suggest preparation for hibernation, but the fat was not distributed in a thick layer under the skin as is the case in most hibernating mammals. The question of their hibernation in the North is still to be determined.

Economic status.—Grasshopper mice make extremely interesting pets and their field of usefulness seems well worth careful investigation. They might in certain cases be used to advantage in keeping down insect pests in greenhouses and other buildings, and it is probable that their carnivorous propensities would render them valuable in combating other more destructive mice.

Neotoma cinerea rupicola Allen
Pale Bushy-tailed Wood Rat

(Pl. 13, fig. 2)

Neotoma rupicola Allen, Bul. Amer. Mus. Nat. Hist., vol. 6, p. 323, 1894.

Type locality.—Corral Draw, southeast base of Black Hills, S. Dak.

General characters.—About the size of the wharf rat, but of very different appearance. Ears and eyes, large; mustache, very long; tail, bushy, almost squirrel-like; fur, long and soft; expression, animated. Color of upper parts, pale pinkish buff; the feet and underparts, white. Young, light buffy gray; tails, mostly white, not buffy. Measurements of average adults: Total length, 349 millimeters; tail, 144; hind foot, 43.

Distribution and habitat.—Wood rats are scattered over the State from the Missouri River Valley westward, or throughout the Badlands region. Just where they grade into the slightly darker *cinerea* is not entirely worked out, but probably somewhat west of the line between North Dakota and Montana. They are nowhere abundant or even common, but seem to be generally distributed wherever there are Badlands cliffs and ledges to afford suitable homes and protection from their enemies. Their range can hardly be considered continuous, but they have managed to scatter from one cliff to another until they have occupied almost every suitable rocky slope. There are specimens from Mikkelson, Oakdale, Wade, and the Little Missouri River near the former Dakota National Forest, and their unmistakable signs have been found at Marmarth, Deep Creek, Medora, the White House Ranch (18 miles southeast of Williston), and near Goodall and Parkin. A few were reported at Cannon Ball, and Doctor Bell caught two at Wade. In 1833, Maximilian (Wied, 1839–1841, Bd. 1, p. 438, 1839; Bd. 2, p. 89, 1841) reported them in the forest at Fort Union, at Cedar Island, and at Fort Clark. In 1869 Cooper (1869, p. 296) reported them in the rock bluffs that border the Missouri River above Great Bend. In 1872, Doctor Allen (1875, p. 42) found them more or less frequent in the timbered portions of the streams west of Fort Rice. Their principal strongholds are cliffs and ledges, but they also occupy the cottonwood forests in the stream valleys, where hollow logs and trees often offer choice homes, and dense masses of bullberry brush and impenetrable cover afford the protection necessary for their existence. They are quick to find and occupy buildings of any sort, and for this reason their presence is soon made known wherever they occur.

General habits.—In habits as well as appearance wood rats are entirely unlike the Old World rats, and it is unfortunate that they should have to bear the odious name. Their long mustaches and big ears and eyes give them an even more animated expression than that of the squirrels. While mainly nocturnal, they are occasionally seen by day when disturbed from their cozy nests in cabins or cliffs. They are timid animals, with practically no means of defense against numerous enemies except the barricades of their dwellings. Their favorite home is a cleft in the rocks where narrow cracks admit them to deeper cavities or where the openings can be blocked with sticks, stones, and rubbish to keep out larger animals. This building habit has become so fixed that their first instinct is to gather building material wherever they are. Even where it is not

needed they often pile up heaps of rubbish, sometimes in front of their doorways, sometimes in large openings that they could never hope to fill. These accumulations remain for years in the caves and caverns, or hollow logs, trees, or cabins, where the wood rats have been; as also do the long black pellets of excrement. In buildings to which they have gained access all small articles of a convenient size are usually gathered into one corner to protect the nest, but sometimes they are piled into a box, cupboard, or stove, or heaped up in some doorway that the rats would like to be able to close. In occupied buildings they are noisy and mischievous, but may soon be discovered and disposed of.

Roosevelt (1900c, pp. 66–67), on returning to his ranch on the Little Missouri when it had been unoccupied for some months, found that "within doors the bushy-tailed pack-rats had possession, and at night they held a perfect witches' Sabbath in the garret and kitchen." Half the cotton had been dragged out of a mattress and made into a big, fluffy nest that entirely filled the oven. In 1909 one of their old rubbish houses was found in the rocks not far from Marmarth and two of the animals were said to have been caught in a house at the edge of town not long before. At Medora, Jewett was told that they occasionally came into the houses, but he could not find any while there, although he found signs of their characteristic work in the rocky ledges about 10 miles farther north, and took two immature specimens near Mikkelson. At Goodall, in the Killdeer Mountains, he was told that they rarely came into buildings, but he obtained two specimens in a ledge about a mile south of town. In the little Missouri Valley, about 25 miles south of Medora, the writer found their signs and old building material quite common in the Badlands gulches, in one of which Jewett obtained a specimen. South of the Missouri River, a little below Williston, old signs were found among the rocks in several places, but no specimens were taken.

Near Goodall, Kellogg reported one caught by a cat on the Goodall ranch, but apparently they were not common in that vicinity. Near Cannon Ball, Sheldon learned of several that had been caught, one in the cellar of an old sod building, and another near the mouth of the Cannonball River in the forested bottoms. At Wade, farther up the Cannonball River, W. B. Bell collected two specimens in a cave in the cedar-covered buttes, and reported them as frequently entering houses and stables of settlers, where they occasionally did considerable mischief.

Breeding habits.—Wood rats, like the other members of the group, probably have two or sometimes four young, which are raised in the soft birdlike nests of their safe retreats. Apparently only one litter of young is raised in a year, so that reproduction is not rapid and there is little danger that these rodents will become very numerous.

Food habits.—Examination of stomachs shows that the food of wood rats consists largely of green vegetation. One taken on the Little Missouri River had green foliage and buffaloberries in its stomach. About their occupied dens there are always traces of various plants brought in for food, and apparently these are brought in for the foliage more than for seeds. The rats, however, are eager for rolled oats, grain, fruit, or bacon used as trap bait and are easily

caught wherever they occur. They do not become fat in fall nor show any signs of hibernation during the coldest winter weather. Generally they lay up stores of green plants, berries, and seeds, which become dried and well cured for winter food, the dry vegetation forming the great bulk of the winter stores.

Economic status.—In North Dakota wood rats are not sufficiently abundant to be of any great economic importance, although related species in other parts of the country are very injurious to crops, forage, and native vegetation. Here they merely add a feature of interest to the picturesque cliffs of the Badlands, with which they are closely associated. They have a strong and not unpleasant musky odor which apparently comes from the glands of the skin; it in no way affects the flesh, which is sweet and delicate as that of young rabbits. Although too small to be of any value as game animals, wood rats are in every way suitable for food. There is a possibility of their serving as interesting pets for children, if properly tamed and kept within bounds.

Evotomys gapperi loringi Bailey

Red-backed Mouse

Evotomys gapperi loringi Bailey, Proc. Biol. Soc. Washington, vol. 11, p. 125, 1897.

Type locality.—Portland, N. Dak.

General characters.—In size somewhat smaller than the meadow mouse and of the same general form; ears small, nearly concealed in the long fur; tail, short; legs, short; eyes, small. Whole back, rich chestnut brown, lighter brown in winter; sides, gray; underparts, whitish. Average measurements: Total length, 123 millimeters; tail, 31; hind foot, 18. Weight, 18 to 22 grams.

Distribution and habitat.—Red-backed mice, which represent a small, pale form of a wide-ranging Boreal forest species, occupy the woods and thickets of the Transition-Zone plains region of North Dakota and central Minnesota. Specimens have been taken at Pembina, Grafton, Portland, Larimore, Devils Lake, Stump Lake, Valley City, Kathryn, throughout the Turtle Mountains and Pembina Hills, at Towner, Williston, Buford, Goodall, Elbowoods, Oakdale, Fort Clark, and Cannon Ball. In most of these localities the mice are abundant in the thickets and timber and it is probable that they occupy every suitable locality within the State.

General habits.—In the Turtle Mountains red-backed mice were abundant throughout the woods and brush, and many were caught in traps set under logs, near old stumps, at the bases of trees, in holes in banks, and on smooth ground where the leaves were scraped off to make an easy runway. At Portland, Loring reported them common, many being caught in traps set under logs and roots of trees. At Stump Lake the writer found them numerous in the woods, along the lake shore, and in the thickets out on the prairie. After dark one evening, the writer entered a dense thicket and, scraping away the leaves, set seven traps at random within a radius of 6 feet; the next morning five contained red-backed mice. At Cannon Ball he found the mice common in the forest on the river flats, and at Fort Clark and Oakdale, Jewett found them in similar situations. At the White House Ranch, 15 miles southeast of Williston, Doctor Bell and his party caught several among the dense growth of reeds

(*Phragmites*) at the edge of the woods, and at Fort Buford, Anthony found them common in the brushy river bottoms. Unlike meadow mice, they rarely make trails or roadways, but run at random over the leaves and open ground in the woods and bushes, or, preferably, under the cover of thickets and brush, so that little sign of them is noticed, even where they are abundant. They are by no means strictly nocturnal; occasionally the little animals are seen rustling about in the leaves and grass and nearly as many specimens are caught during the day as at night. To some extent they burrow in the ground, but any natural cavities in or under logs, stumps, or trees seem to answer their purpose for homes and nests.

Breeding habits.—Many of the females taken for specimens are found to contain embryos varying in number from 4 to 6, and occasionally 8. These are found at all times through the summer, which would indicate that several litters are raised in a season. As the mice do not hibernate, the breeding season probably covers all but the midwinter period.

Food habits.—The examination of stomach contents of red-backed mice shows usually a combination of seeds and green vegetation. Considerable grass and many small plants are found cut and partly eaten on their feeding grounds and some of these are drawn under the logs and brush where the animals live. They are always eager for rolled oats and will take almost any kind of grain or seed used for trap bait. At Walhalla, Williams caught one in his hands in the daytime, as it was eating a piece of bread crust in front of his tent. At Portland, Loring caught a large series of specimens by baiting his traps with meat, and found that occasionally they eat their own kind or other varieties of mice caught in traps where they run. For the greater part of the year, however, their principal food is green vegetation, which they find abundant even under the deep snow of winter, for they plow along the surface of the ground and come in contact with the tender shoots of frozen grass or roots under the leaf mold, or if these are not sufficient they gnaw the bark from bushes and small trees as high up as the snow offers concealment from their enemies above.

There is some evidence that the red-backed mice may be one of the bean-storing species of the Missouri River region. In attempting to discover what animal was really responsible for these caches of food which the Indians find, specimens of all of the small mice occurring at Cannon Ball were trapped, but the only evidence obtained in September, before the mice had begun making their winter stores, was the fondness shown by these mice for the mouse-beans (*Falcata comosa*). In one bean patch seven traps set on the bare ground, each baited with a half of one of these large, juicy underground beans, caught four of the mice in one night. The eagerness of the mice for the beans and their abundance in the localities where the beans grow suggests that the species may be in part responsible for the stores which have been an important food of the Indians and a boon to many early explorers.

Economic status.—As the red-backed mice occupy mainly woodland and thickets they are of no great economic importance in the grainfields or meadows, but wherever they come in contact with or-

chards and shrubbery, if present in great numbers, they are capable of doing considerable mischief, for trees and bushes girdled by them under the snow are usually killed or seriously injured. Their chief enemies are the small owls and hawks, weasels, skunks, and badgers, and these afford the principal protection we have from their depredations.

Microtus pennsylvanicus pennsylvanicus (Ord)

Eastern Meadow Mouse

(Pl. 14)

Mus pennsylvanica Ord, Guthrie's Geogr., 2d Amer. ed., vol. 2, p. 292, 1815. (Reprint by S. N. Rhoads, 1894).

Type locality.—Near Philadelphia, Pa.

General characters.—Size rather large for a meadow mouse; ears, tail, and legs, short; body, heavy and compact; fur, long and soft in winter, thin and harsh in summer. Colors, dark brown or blackish above, slightly paler and more grayish below. Average measurements of adults: Total length, 171 millimeters; tail, 46; hind foot, 21.2. An adult female from Grafton measured 162, 34, and 19, respectively, and weighed 43.6 grams.

Distribution and habitat.—From a wide range over the northeastern United States the abundant meadow mice, *pennsylvanicus*, barely reach into eastern North Dakota along the upper Red River Valley, and even here they are becoming slightly smaller than typical, in a very gradual gradation toward the little *drummondi*, which continues to the northwest. To this race are referred the Red River Valley specimens from Fairmount, Blackmer, Hankinson, Lidgerwood, Wahpeton, Fargo, Larimore, Grafton, and Drayton. Here, as in most of the range of the species, they inhabit mainly the marshes, but are occasionally also found on the uplands under any tall grass or dense vegetation.

General habits.—As their build and color suggests, meadow mice are ground dwellers and spend most of their lives under the shadowy cover of dense vegetation. They burrow in the ground, which is often perforated with their little round tunnels, while over the surface they make well-defined roads or runways from one burrow to another or from their nests and burrows to feeding grounds, but always under the protecting cover of grass or other plants. They are partial to moist ground and prefer rough meadows where moisture is abundant and where water often stands over part of the surface. They are good swimmers and seem as much at home in water as on land, swimming from side to side of little streams or ponds and diving and swimming under water when necessary. Their runways often lead through wet places, but dry banks or hillocks are always sought for their nest cavities. In summer they frequent the meadows and low moist ground, but in winter they leave their low underground burrows and push out under the snow of the uplands, extending their tunnels along the surface of the ground and building warm grass nests on the surface wherever they find an abundant food supply. In this way they often range over uplands, fields, and orchards in great numbers; and when the snow goes off in their winter nests exposed, they burrow into the ground again and spring, leaving their network of winter roads, their grass piles, and do not all get back into the meadows until the dry weather of summer compels their return to the moist lowlands.

Apparently they are about as much diurnal as nocturnal, although they appear to be most active in the early evening hours. Some are caught in traps during any part of the day or night, but they seem to fill up the collector's trap line more rapidly during the evening than at any other time. They do not become fat or hibernate and are active throughout the year without regard to weather.

At Hankinson, in July, 1912, they were found common in places where there was tall grass on the prairie, but more especially so in the meadows and among the tall tules on wet ground. After the hay was cut on the meadows they gathered under the haycocks in considerable numbers, and as these were loaded and hauled away the mice were forced out into the open stubble, where hawks or owls were constantly hunting them. As many of the extensive tule marshes in this region are never cut, they afford a safe harbor for the mice in which to multiply and from which to spread over the meadows and prairies. Similar conditions were found at Wahpeton, near Fargo and Grafton.

Breeding habits.—Meadow mice are very prolific and seem to have no well-defined breeding season. Females taken at any time of year from May to October are found to contain from 4 to 6 embryos and sometimes 8. Occasionally even in winter small young are found in nests or females are found with embryos. At times they increase very rapidly and remain abundant for a period, after which they become scarce, the variation presumably being correlated with protection from enemies and the abundance and quality of food. Their waves of abundance, which at times suggest migrating hordes, are undoubtedly due to favorable conditions for rapid reproduction.

Food habits.—During the summer the favorite food of meadow mice consists of tender vegetation, as the young shoots of grass, growing grain, clover, alfalfa, and a great variety of plants. Acceptable food is always abundant. Sometimes the tender bases of grasses are chosen, and again the seed-laden tops are drawn down within reach by cutting the stems into inch-long sections. Seeds and grain are always favorite foods, when they are available late in summer and in fall, but in winter the mice thrive equally well on the frozen grass and roots that they get under the snow, or on the bark from bushes or trees which they gnaw off with their sharp cutting teeth, under cover of deep snow.

They are particularly fond of the bark of many fruit trees, especially apple, but will eat the bark of almost any tree or shrub that is not too thick and hard for them to gnaw into. Aspens and willows are found peeled and killed by them, but most of the larger woodland trees are protected by their harsh outer bark. In trapping them rolled oats are a favorite bait, but they will take any kind of grain or seeds and are specially fond of fresh meat, fat pork, or bacon. Their carnivorous propensities are seen in trapping, as they almost invariably eat their own kind or other mice found dead in traps.

Economic status.—Over a wide range of rich farming country these are the most abundant mice in meadows, fields, timber, and orchards, and their total destruction of forage, hay, crops, trees, and shrubs annually causes an enormous loss in agricultural products. Among these losses nothing is more exasperating than the destruction of a few choice fruit trees in an orchard, or some choice shrubbery in

the yard, during the period of deep snow in winter. Orchards are infrequent in North Dakota, so that the few choice, hardy fruit trees that can be raised are of special importance, and if the bark is gnawed from the base, even on one side, the trees are often weakened so as to be unable to resist the severe climate to which they are exposed.

In wild-grass meadows the hay is not of sufficient value for the mice to cause much loss, but in meadows of clover and timothy and fields of alfalfa their mischief is much more serious. They enter grainfields as soon as the growing crop is sufficiently high to afford protection, and cut the grain shoots for food; then when the grain is headed out, they cut off the base of the stems, drawing down the heads in order to reach the green and ripening grain. After harvest they congregate in the grain shocks and if these are left long in the field considerable grain is eaten or shelled out and destroyed. As either these meadow mice or closely related species with similar habits cover all of North Dakota, the total loss from them is by no means insignificant. The importance of placing every possible check on their increase is obvious.

That they can be successfully poisoned when necessary has been demonstrated, but the expense suggests this method as a last resource. The most practical method of controlling the abundance of such small rodents is by protecting their natural enemies, among which the owls and certain species of hawks are foremost. The little owls, during the dusk of evening and all night long, are watching for them and miss no opportunity to pounce upon an unwary mouse that exposes itself. The marsh hawk, or mouse hawk, as often called, sailing low over the meadow and prairie, with eyes intently fixed on the ground, drops suddenly into the grass and secures a mouse more often than it does any other prey. Many other hawks feed upon them extensively, as do also foxes, badgers, skunks, and weasels. But for these enemies the mice would overrun the farms with disastrous results.

Microtus pennsylvanicus drummondi (Audubon and Bachman)

Drummond Meadow Mouse

(Pl. 14)

Arvicola drummondii Audubon and Bachman, Quadr. North Amer., vol. 3, p. 166 [1854].

Type locality.—Rocky Mountains, vicinity of Jasper House, Alberta, Canada.

General characters.—Similar to *pennsylvanicus*, but much smaller and slenderer, and slightly lighter, more yellowish brown in coloration. Average measurements of adults: Total length, 145 millimeters; tail, 39; hind foot, 17.8.

Distribution and habitat.—None of the North Dakota specimens of the little prairie or meadow mice are typical, but they are too small and slender-skulled to be called *pennsylvanicus* and can best be referred to *drummondi*, toward which they are slowly grading to the northwestward. The large series of specimens now available from many localities over the State show conclusively continuous range and complete intergradation between the two forms, and, *drummondi* is here placed as a subspecies of *pennsylvanicus*. To

it are referred specimens from Crosby, Lostwood, Kenmare, Towner, Turtle Mountains, Walhalla, Pembina, Sweetwater Lakes, Devils Lake, Stump Lake, Portland, Valley City, Lisbon, La Moure, Oakes, Ludden, Napoleon, and Dawson. This carries the range over the high glacial-prairie region between the Red and Missouri River Valleys to the southern boundary of the State and marks its southern limit from a wide range over western Canada to Alaska.

Over their part of the State Drummond meadow mice are very abundant and occupy the high open prairie, rich bottomlands, and grassy meadows. To some extent they are found in woods and thickets, but primarily they are dwellers in grasslands, wherever the low vegetation affords food and cover. In the Turtle Mountains, the writer found them abundant in marshes, meadows, banks, and grassy fields, and even in damp woods, but they were most numerous in the meadows, where the ground was perforated with their runways. In spots nearly half the grass had been cut down for food, leaving the earth strewn with the fragments. At Walhalla, in the Pembina Hills, Williams reported them inhabiting woods, grainfields, and meadows. On Bird Island, in the arm of Devils Lake, where cormorants nest, the grass was full of runways. At Stump Lake the runways were found in the prairie grass apparently without regard to whether the ground was wet or dry. At Valley City Eastgate reported them common along the river valley, around the marshes, and in prairie meadows, and the writer caught them around some seepage springs high up on the side of the bluff. At Lisbon, Doctor Fisher caught one in a swampy thicket; and so on over the State they have been reported from a great variety of localities.

General habits.—If their habits differ at all from those of *pennsylvanicus*, it is only in a more ready adaptation to high open ground, such as the grassy prairies of their range afford. Their more open habitat may well account for this slightly paler coloration. Their little roadways are often conspicuous through the prairie grass, especially where the old grass has fallen down and made a protecting cover over the surface of the ground. Old winter nests are found scattered over the surface, but rarely are they occupied during the summer; the principal nests are then in underground cavities to which the burrows lead.

Occasionally an occupied nest is found in some old haycock or grain shock that has been left out over winter, and at Crosby a nest was found occupied by young in a heap of last-year's weeds by the roadside. The nest, as usual, was made of soft grass blades, built into a neat hollow ball, clean and fresh, and with a soft lining inside. It was placed in a slight depression in the ground, where it was well protected from rain and snow by the mass of matted vegetation overhead. The four small young inside, with their eyes just opened, were of a beautiful golden-brown color, quite different from the sooty, or slaty gray, young of *pennsylvanicus* of the same age.

Breeding habits.—In the latter part of June, 1912, in the Turtle Mountains, great numbers of these mice were caught in traps so that many were thrown away after series were selected for specimens. There were all sizes and ages, from little fellows just out of

the nest to nearly full-grown young of the year, indicating at least two litters of young of that season, while many of the females contained small or large embryos, usually 6, 7, or 8. The mammae are arranged in two posterior and two anterior pairs, so that 8 is probably the normal maximum number of young. Apparently breeding continues throughout the summer, if not throughout the year, and reproduction is so rapid that only through a host of enemies are their numbers kept down to a safe limit.

Food habits.—Grass and weed stems are found cut in little sections near the runways and on the feeding grounds of these mice and over considerable areas where much of the grass has been cut by them. The mice are fond not only of seeds but also of grain, and enter fields readily and help themselves to growing crops. Although never fat, they are always well fed and their stomach contents show various mixtures of green plant tissue, white pulpy root and bulb tissue, and the meal or dough of finely masticated seeds and grain.

Economic status.—Over an immense area of rich grain-producing land these mice swarm in greater or less abundance, varying with the seasons and with the abundance of their enemies. It would be almost safe to predict that at times, through disturbance of normal conditions in the agricultural development of the country, these mice will increase so as to do serious injury to crops. In such case it may become necessary to use artificial means of destroying them, but as with other small rodents, a wise protection of their enemies will generally produce sufficient check on their abundance. The destruction of weasels for fur and too great a reduction of skunks and badgers are likely to have a marked effect on the abundance of these mice, while any wanton destruction of owls and mouse-feeding hawks would certainly be followed by an inordinate increase in the numbers of the rodents.

Microtus pennsylvanicus wahema[16] Bailey

Bean Mouse; Hetunka

(Pl. 11, fig. 2; pl. 14)

Hi^{n}tu^{n}ka of the Dakotas; *Gipápuli* of the Hidatsas; *Sakch* of the Arikaras; *Bidábaho itáhu* of the Hidatsas (all, Gilmore).

Microtus pennsylvanicus wahema Bailey, Journ. Mamm., vol. 1, p. 72, 1920.

Type locality.—Glendive, Mont.

General characters.—A pale form of *pennsylvanicus*, slightly smaller and very much paler and grayer than the eastern meadow mouse, which it represents in the arid Badlands region. Upper parts buffy gray; sides clear gray, underparts and feet and lower surface of tail pale gray or buffy white. Measurements of type specimen: Total length, 178 millimeters; tail, 43; hind foot, 20. Weight of adult female, from Cannon Ball, 30.8 grams.

Distribution and habitat.—Bean mice occupy the Badlands section of the Missouri River Valley and range westward over southwestern North Dakota and eastern Montana. There are specimens from near the mouth of the Cannonball River, Bismarck, Mandan, Fort Clark, 10 miles south of Williston on the west side of the river, Oak-

[16] Omaha name contributed by Doctor Gilmore, *Intshunga wahema*, the burying mouse, from its habit of storing food in the ground.

dale, Glen Ullin, and Sentinel Butte. This indicates a continuous range over the Badlands and sagebrush semiarid section of the State. In places the mice are found in marshy bottoms, but more often in the long grass of draws and on grassy benches of the ridges and buttes. Near the White House Ranch, about 12 miles south of Williston, a fine typical specimen was caught in 1913, on a grassy bench near the top of the Badlands border of the valley. At Fort Clark Jewett found others on high grassy slopes back of the valley bottom, and at Mandan on the high ridges wherever the grass was sufficiently dense to hide the animals and their runways. At Oakdale he found them about a small marshy place near a spring, where they were occupying the tall grass of a limited area. At Glen Ullin he found them common in the tall grass on moist ground along Curlew Creek, where their fresh runways were abundant. At Sentinel Butte he took specimens high up on the grassy slopes of the large butte south of town and others in the grass of a small slough near the station. Near Cannon Ball, Sheldon took specimens on the flats near the mouth of the Cannonball River and also on the high buttes to the north. In June, 1916, the writer collected them on the river flats near the mouth of the river and saw abundant signs in grassy places over the prairie and fields; and on October 30, 1919, took two of the mice at their nest and bean cache on the flats near the mouth of the river.

General habits.—In habits these mice differ from *pennsylvanicus* and *drummondi* only as their more arid habitat places them more in the open, sparsely covered, and grayer soil of this semiarid region, where they are evidently more exposed to light and to the numerous enemies overhead. The light-colored soils and minerals and general gray tone of sagebrush and prairie plants is evidenced in the color and, to some extent, in the habits of these little animals. They are less uniformly distributed over the area than are species in more fertile regions and in places they seem almost colonial, so locally are they gathered in the most favorable spots. In summer they were not easily caught in traps, as they seemed not to care for any bait that was offered them, and the few specimens taken merely ran through the traps set in their little runways under weeds and grass.

There has long been a question of whether these could be the bean-storing mice of the Indians of the Upper Missouri River, mentioned by Lewis and Clark and other early explorers as laying up such ample stores of wild beans, bulbs, and tubers, for a winter's supply of food that they formed one of the important sources of food supply for both Indians and whites. To decide this question many specimens of these, as well as of the other species of mice living along the Missouri Valley, were collected in localities where the Indians said the mouse stores were especially abundant. Some of the Indians and white men, who were familiar with the mouse stores, picked out the present species as the one which they had seen running away from the beans, but others were just as positive that the storers were the red-backed mice, white-footed mice, harvest mice, grasshopper mice, and pocket mice, while some thought the deposits were made by pocket gophers, ground squirrels, or chipmunks. Even the weasel was accused of storing these winter sup-

plies. The stores were frequently described and all seemed to agree as to their contents.

With pockets filled with underground beans of *Falcata comosa* (*maka ta omnicha*) and long tubers of wild artichoke, *Helianthus tuberosa* (*pa"gi*), and the little white tender roots of wild morning-glory, the writer was able to question the Indians intelligently about the stores and the way they were found and gathered and cooked. Although the mouse bean seemed to be the principal part of the stores that were sought by the Indians, the artichokes and morning-glory were said to be usually found with them, and one Indian insisted that the tipsin, *Psoralea esculenta*, was also sometimes found in the caches. One man insists that when driven away from their stores the mice often climb and take refuge in trees.

In describing the cache the Indians say that the mouse burrows enter the ground from several sides and the cavity where the food is stored often holds a peck or a pailful of beans and tubers. One Indian, who makes a special business of gathering these beans in the autumn, positively asserted that he could find enough in a day to fill a 2-bushel sack. The method of finding the stores is by noting either the burrows and runways centering at a certain point, or the tracks of the mice in the fresh snow leading to and from them. With a sharp stick the ground is probed, the cavities are soon discovered, and the beans removed. The fresh and wholesome vegetables were at one time an important adjunct to the meat diet of these hunting Indians, but at the present time their fields of vegetables and grain furnish an ample variety of food and the mouse stores are sought only by a few. The Indians claimed that it would be impossible to find the stores until late in October or early in November.

In October, 1919, six years later, the writer returned to the mouth of the Cannonball River in the hope of being able to settle the question of identity, and on next to the last day of the month succeeded in finding his first cache of beans and capturing the mouse with them. The night before he had trampled down the soft snow and in the morning found several fresh mouse holes made during the night, entering different sides of a mass of snow and leaves. Digging in one of these holes with the left hand the writer saw a mouse soon pop out on the other side, only to be caught in the right hand, and placed in a glove, and carried home alive. The cavity was then carefully dug out and examined. A warm nest of grass and soft plant fibers was found about 6 inches below the surface in a cavity where an old stump had decayed. In another cavity near the nest was a small collection of the mouse beans or ground peanuts, with artichokes and a few roots of the wild morning-glory. As the season had been very dry and both mice and beans were scarce, the cache was meager, but the cavity, which would have held several quarts or a peck, showed the old skins and remains of the previous year's collections. The store would doubtless have been added to until the ground froze so hard that no more beans could be dug. Though there may be other mice which store these beans, this meadow mouse is the first one actually caught at its cache and identified.

The Indians describe the cache as easily recognized by the little roads leading up to it from all sides, and tell how the mice drag

home loads of the beans on leaves. They have many legends and stories relating to these mice and their stores, which have been well translated by Doctors Beede and Gilmore, stories telling of the respect and reverence of the Indians for their little helpers, the mice people, of the payment in corn or other food for the beans taken, of the punishment of the hard-hearted woman who took all of the beans and left no exchange in food, and of the threat to fight any white man who attempted to capture or injure the mice or take their stores.

History.—The use of these ground beans evidently dates far back. Mr. Will (1917, p. 66) in speaking of the mythical origin of the Hidatsas from a hole in the ground in the vicinity of Devils Lake, says: "At that time the people cultivated ground beans and wild potatoes, two crops that were not really cultivated at all but merely gathered."

Apparently the first white men to mention the beans were Lewis and Clark (1893, p. 161, 263), in 1804, on their visit to the "Ricaras" (Hidatsas), when among other presents of food they were given "a large rich bean which they take from the mice of the prairie, which discover and collect it." The next spring their "Bird Woman," Sacagawea, gathered these food stores of the mice, which must have lasted over winter.

In 1833 Maximilian (Wied, 1843, p. 276) includes this bean among the plants used by the Mandan Indians as food under the name "feverolles (*Fabia minor equina*), a fruit resembling the bean which is said to grow in the ground but which I did not see."

Again, Father De Smet (1905, p. 655), an early missionary to the Indians of the Upper Missouri, as he left Fort Union in 1851 wrote in his journal:

> The earth pea and bean are also delicious and nourishing roots, found commonly in low and alluvial lands. The above-named roots form a considerable portion of the sustenance of these Indians during winter. They seek them in the places where the mice and other little animals, in particular the ground-squirrel, have piled them in heaps.

In 1855 Lieut. G. K. Warren (1856, p. 78) wrote:

> The groundnut, or *Apios tuberosa*, is very useful to the Indian. It grows very abundantly along the river bottoms, and is gathered in large quantities by a kind of wood-mouse for his winter store. The squaws make a business, during the months of October and November, of robbing these little animals, and I have often seen several bushels of the tubers in a single lodge. They are boiled with dried buffalo meat, and make a rich and palatable dish.

Thus a long and useful career has been shown for these little animals and we can well appreciate the feeling of regard for them still held by the older Indians. Now, however, that most of their range has become valuable grain land, their services are no longer needed and their inroads on grain, grass, and other crops are likely to prove as serious as those of other related species in agricultural areas. It is safe to say, however, that they will not be exterminated nor their numbers greatly reduced by the presence of the white man's civilization. The only danger is that under cover and stimulus of cultivated crops they may increase to such abundance as to become a menace, but if their natural enemies, owls, hawks, and weasels, are given a fair chance any overabundance will be effectively checked.

Microtus ochrogaster haydenii (Baird)
Western Upland Mouse

(Pl. 14)

Arvicola (Pedomys) haydenii Baird, Mamm. North Amer., p. 543, 1857.

Type locality.—Fort Pierre, S. Dak.

General characters.—A medium-sized field mouse of the subgenus *Pedomys*, with short ears, legs, and tail, the tail about twice as long as the hind foot. Color dull gray with a cinnamon tone, only slightly paler below. Fur long and lax, giving a pepper-and-salt effect of light-tipped hairs over dark underfur. Measurements of adult female from type locality: Total length, 180 millimeters; tail, 47; hind foot, 22.

Distribution and habitat.—The pale western form of *Microtus ochrogaster* of the central prairie States occupies the semiarid Plains region from Kansas to Montana, and comes into North Dakota west of the Missouri River. There are specimens from Cannon Ball and Wade, and the writer saw runways and burrows near Stanton that undoubtedly belong to this subspecies. Unlike the meadow mice, they avoid low or wet ground and usually are found on the high, dry prairie in rather open situations. In many places they occupy little thickets of rose and wolfberry bushes, but their characteristic runways and burrows are often found on the open ground, fully exposed to view.

General habits.—At Cannon Ball, the upland mice were found to be common over the prairie and on the dry valley bottoms. In places they were living under a good cover of prairie grass, where their little roadways over the surface of the ground led to the burrows and some old surface nests that had evidently been used during the winter. In other situations they lived in the thin prairie grass, where their runways were easily followed. In some locations they were living near the edges of thickets, where it would have been an easy matter for them to gather the mouse beans had they been inclined to store them. Specimens were easily caught by setting traps across the runways, baited with rolled oats, or even set unbaited, as in running along their roads the mice would trip over the trigger and spring the traps. To a certain extent they seemed colonial in habits, but probably this is merely because in a good location the family increases until the place is well stocked before the members of the colony begin to scatter out. At times they become very numerous locally, but, generally, the open nature of their habitat exposes them to so many enemies that they do not last long.

Food habits.—The food of this mouse is largely green vegetation, including the stems and leaves of grass and a great variety of little plants that are found cut in sections in their runways. It also eats the flowers and seeds of many plants, is usually eager for rolled oats or other kinds of grain used as trap bait, and will often eat its own kind found dead in traps. Preference for high and dry ground brings it much in contact with cultivated fields, where it finds choice food in the green or ripening crops.

Breeding habits.—Females taken for specimens often contain four to six embryos and the mammae are arranged in two posterior and one anterior pairs. Apparently they breed many times during the season and are only a little less prolific than meadow mice.

Economic status.—In North Dakota these mice have been so little observed that any injury to crops has escaped attention, but in other parts of their range, where farms and orchards have been of longer standing, they have been known to occasion serious losses by killing fruit trees and by destroying grain and grass in fields and meadows. Potentially they are dangerous occupants of any agricultural region and with unchecked abundance might become a serious pest.

Microtus minor (Merriam)
Little Upland Mouse

(Pl. 14)

Arvicola austerus minor Merriam, Amer. Nat., vol. 22, p. 600, 1888.

Type locality.—Bottineau, N. Dak.

General characters.—Smaller even than *drummondi*, with short ears, short tail, and coarse, lax fur. Color, coarse pepper-and-salt gray, produced by pale-buff tips of long hairs over black underfur; underparts but little paler. Adults measure in total length approximately 140 millimeters; tail, 33; hind foot, 17.

Distribution and habitat.—In a range extending from southern Minnesota to Edmonton, Alberta, the little upland mice cover approximately the eastern half of North Dakota. There are specimens from Bottineau, Kenmare, Starkweather, Goodall, Devils Lake, Stump Lake, Valley City, Sherbrooke, Oakes, Lidgerwood, Fairmount, Hankinson, and Blackmer. Over the prairie they are usually found on dry ridges or sandy soil, in which they delight to burrow. They seem to avoid low, damp ground and their habits as well as their fur mark them characteristic upland mice, a group quite apart from typical meadow mice.

General habits.—Apparently colonial in habits, the upland mice are usually found abundant in favorite spots and in no others for long distances. Often their burrows enter the ground in groups of half a dozen or more and are more or less connected below the surface. Some of these groups suggest a family colony, and others are more extensive and scattered along for a considerable distance in irregular formation. At Bottineau, in the summer of 1887, these mice were abundant over the dry prairie in small colonies, usually on mellow, somewhat sandy soil. At Kenmare, near the top of a high ridge or point of the prairie running out on the edge of Des Lacs Valley, their little runways and burrows were found numerous over the dry slope. The ground was covered with a network of fresh trails through the short prairie grass and there were three sets of burrows, in each of which 10 or 12 holes entered the ground within a radius of 2 or 3 feet. These seemed to be family or colony dens and several of the mice were caught around each group. Fresh earth was being thrown out on all sides and from each opening a trail led off to the feeding grounds or to other dens and burrows.

A number of traps were set and in one night about 20 of the mice were caught. Many were young of the year and of various sizes, but enough adults were obtained for a good series of specimens. Mouse traps were sunk in the ground across their runways and baited with rolled oats and ripe and green wheat, all of which were eagerly

accepted as bait. Near Blackmer, Sheldon and the writer found four distinct colonies in an alfalfa field and one on the prairie sod on the Clarey farm, not far from the station. Those in the alfalfa fields were the most extensive, covering from 2 to 3 square rods of ground each and consisting of 20 to 50 burrows and innumerable trails. The ground was thickly perforated by the burrows and generally half the alfalfa had been killed over the range of the colony. Much was cut and eaten on the surface, but considerably more was killed from below, evidently by having the roots eaten off in winter. As pasturing kept the crop low, there was no trouble in finding the mice, observing their habits, and obtaining a good series of specimens. A pair of short-eared owls were nesting in the adjoining field, and served to keep the mice within bounds, but if the alfalfa had been allowed to grow to full height the mice could have increased without interference.

At Valley City, the writer caught one on the high prairie under tumbleweeds, where a few of their old trails were found, though the mice seemed to be scarce. At Sherbrooke, Loring took six specimens in traps baited with meat and rolled oats, set along their beaten runways through the weeds. On the Peterson farm, 10 miles west of Portland, he took two in the daytime in runway traps, and at Portland caught others in similar manner. At Towner, Kellogg secured a specimen in an upland meadow, and at Goodall he found a colony on the sandy flats close to the river bank.

On the short-grass prairies these mice are exposed to view from overhead, but on the dark prairie soil in their little roadways they are protectively colored, and their habit of keeping close to their burrows and darting quickly from one burrow to another seems to be their main protection against numerous enemies.

Breeding habits.—As in other members of this subgenus (*Pedomys*) the mammae of the females are arranged in two pairs inguinal and one pair pectoral. Females have been taken containing four and eight embryos, but the normal maximum number of young is probably not more than six. Evidently the young are born at irregular times throughout the season, but the length of the breeding season and the number of litters have not been definitely determined.

Food habits.—Grass stems and many prairie plants are found cut in sections along the runways of these mice and near the burrows, while in numerous places little prairie bulbs, as those of the wild onion and the blazingstar, have been dug up and eaten. In the alfalfa field at Blackmer both the green leaves and tender stems of alfalfa plants were eaten, and underground the roots had been extensively gnawed. The fondness of the mice for rolled oats, grain, and meat, used for baiting traps, indicates a wide range of food.

Economic status.—From the nature of their habitat in fields and on the uplands these mice are likely to prove as injurious to crops as any of the other species, and under favorable conditions of food and cover, such as are found in extensive alfalfa fields, they might well become a serious pest. Where exposed to their natural enemies, however, they are not likely to do more than merely swell the total loss chargeable to small rodents.

Microtus pallidus (Merriam)

Pale Mouse

(Pl. 14)

Arvicola (Chilotus) pallidus Merriam, Amer. Nat., vol. 22, p. 704, 1888.

Type locality.—Fort Buford, N. Dak.

General characters.—Recognized by its small size, compact form, and very short tail, which is but little longer than its hind foot; fine soft fur of a light buffy gray color over the upper parts and creamy white below; ears and nose conspicuously yellow. The type, an adult female, measures in total length, 121 millimeters; tail, 20; hind foot, 18.

Distribution and habitat.—The rare little pale mouse (subgenus *Lagurus*) is known from only a few scattered localities from western North Dakota, Montana, and Alberta. Two localities only are represented by specimens from North Dakota—Fort Buford and Glen Ullin. In September, 1887, the writer first found them on a Badlands butte, 2 miles east of Fort Buford, where they seemed quite common in the half-barren ground just below the top on the north slope. The only reason that could be suggested for their choice of location on the north sides of the hills was that the twilight, their favorite time for activity, was longer on the shady slopes. The vegetation seemed to be about the same all the way around the summits of the hills and at best was only scantily represented. At Glen Ullin, Osgood collected three specimens in September, 1901. This is on the high dry prairie, but no report was made of the exact location at which they were caught.

Apparently this is one of the rare species which occurs only at widely scattered localities, and may be nearing extinction. No mammal has been more sought for by collectors in the region where it occurs, and with so little success. In 1915, and 1919, the writer again visited the butte where the type was collected, but could find no trace of burrows or runways on this or any of the neighboring buttes.

General habits.—Apparently all that is known of the habits of the pale mouse is the little gleaned from the few specimens collected at the type locality, where they were living in a colony along the shady slope of the butte. The little round burrows entered the side-hill at frequent intervals along the well-worn runways leading around the slope. In places the runways passed over grassy ground, where they were well packed by the little feet constantly using them. In other places they passed over naked soil and were only detected by the smoothly worn surface. At that time no suitable traps for catching such little animals were available and the mice seemed strangely suspicious of the clumsy box traps. Only four specimens were taken, although the colony was quite extensive and probably contained a dozen or more individuals. Rolled oats and traps now used had not been invented in those days and the mice did not care for any of the baits offered them.

Food habits.—A large part of the food of these mice seemed at that time to consist of the flowers of the little silver sage (*Artemisia frigida*) and the blazing star (*Liatris graminifolia*), and the stems and pieces left from these plants were scattered along the runways and about the entrances of the burrows; heads and seeds of winter-fat (*Eurotia lanata*) also were eaten. Many grasses and other plants

had been cut, apparently for food. A partly eaten bulb of the blazingstar was found near a runway, where it had been dug up. Corn and oats, and the seeds of cactus and other plants and also bread, cake, and cheese, were placed around the burrows, but it all remained untouched. None of the specimens taken showed any signs of becoming fat and it is improbable that they hibernate, even in this northern latitude.

As a young naturalist, for the first time away from his home fauna and among new and strange animals where the thrill of discovery was not infrequent, the writer recognized this mouse as something strange and probably new, and it was with the keenest pleasure that a communication was received from Doctor Merriam, stating that he, also, had been unable to identify it as a member of any described species.

Fiber zibethicus cinnamominus Hollister

Great Plains Muskrat

Zih-zirukka of the Hidatsas (Maximilian); *Si^{n}kpé* of the Dakotas (Gilmore); *Shantshuke* of the Mandans (Will); *Citakh* of the *Arikaras* (Gilmore).

Fiber zibethicus cinnamominus Hollister, Proc. Biol. Soc. Washington, vol. 23, p. 125, 1910.

Type locality.—Wakeeney, Trego County, Kans.

General characters.—Size medium for a muskrat, not so large as the more northern nor so small as the southern species. Fur, dense and soft; ears, short; tail, long, nearly naked, flattened and rudder-like; hind feet, large and webbed; musk glands, well developed. Measurements of adults: Total length, about 496 millimeters; tail, 240; hind foot, 73 or 74. Weight, about 2 or 3 pounds.

Distribution and habitat.—The bright-colored Plains form of the muskrat, as defined by Hollister (1911), covers the central Plains region from Oklahoma to Manitoba, including all of North Dakota. There are specimens in the National Museum collections from Fairmount, Oakes, Lisbon, Valley City, Grafton, Fish Lake, Wood Lake, Towner, Elbowoods, Grinnell, Buford, and Dawson. It is safe to say there are muskrats in every suitable slough and lake, marsh and stream in North Dakota, in numbers ranging from a few individuals in the smaller ponds to thousands in some of the extensive marsh and lake areas. While it is impossible to obtain a reliable estimate of their numbers, or of the numbers taken for fur each year, they certainly are the most abundant and valuable fur-bearing animals of the State, as they are of the whole United States.

General habits.—In the lakes and extensive tule marshes near Hankinson, the writer found muskrats abundant in 1912, and there were many old muskrat houses along the shores and numerous bank burrows leading up from under water along the margins of the lakes. As usual, much trapping kept the animals down to a small part of the number that the lakes could profitably carry. They were common at Wahpeton in the river and sloughs, and at Fargo, where they live in the Red River banks, and at Stump Lake and Devils Lake in the tule-bordered sloughs over the prairie; they were scarce, however, in the brackish and alkaline water of the lakes.

In the Turtle Mountains they were found in the lakes and sloughs with which this hilly and forested region abounds, and were especially numerous in the beautiful clear water of Gravel Lake, where a novel use was found for them near the fish hatchery, and where trapping was not allowed. The lake had been stocked with trout, perch, and bass, and the muskrats were protected and allowed to build their houses along the shores in order to keep breathing holes open to prevent the ice from closing up so completely as to smother the fish. Both fish and muskrats were thriving and multiplying rapidly and the system seemed to be working remarkably well. The muskrats were comparatively tame and it was a pleasure to watch them swimming, diving, and feeding out in the water. They would often lie stretched at full length on the surface, eating roots which they held in their hands above the water. Others would sit in round furry balls on the ends of logs or on the edges of their half-submerged houses, munching the green plant stems or tender roots and bulbs, which they had procured from the bottom of the lake or from the grassy banks.

Just across the ridge from this lake, at the fish hatchery, other muskrats were doing considerable mischief in the fish-breeding pond by tunneling through the banks and letting out the water. The half dozen animals that were doing this mischief could have been caught with very little trouble and the banks protected, but the feeling seemed to be growing that the muskrats were a great nuisance, fostered probably by the lake full of valuable fur just over the ridge. Wherever the lake banks are high enough for burrows the muskrats live mainly in bank dens, but in the wide tule-bordered lakes and sloughs, where the water is so deep that the winter ice will not reach the bottom, they build large winter houses out in the water. Thus the abundance of muskrat houses in one situation is no indication of a greater number of the animals than in adjoining lakes where none are seen.

Around the Sweetwater Lakes muskrats are generally abundant in spite of much trapping, as the marshes are very extensive and the conditions ideal for them. About Castleton, Loring reported them wherever any water could be found. Sheldon reported them common along the lake shore near Dawson, and Kellogg reported them in Wood Lake, and especially abundant in Muskrat Lake, Sullys Lake, along Shell Creek, in Turtle Creek, and at many points along the Missouri River and adjoining sloughs and streams, from Grinnell to Bismarck. In 1915 Sheldon found them abundant across the southern part of the State, from Fairmount and Oakes to Napoleon and Cannon Ball and the Badlands farther west. Along the Little Missouri River Valley, in 1913, Jewett found comparatively few in the creeks and sloughs.

Although leading mainly aquatic lives, muskrats are perfectly at home on dry land, and often when their stream or pond dries up will strike out across the prairie to find a new home. Their peculiar tracks, showing the large hind feet and small front feet, with a narrow line where the tail drags, are often seen in dusty roads and in trails between sloughs. They are sturdy fighters, and if cornered will combat anything that comes along, but if taken when young and tamed they make gentle and interesting pets.

They are great builders and work industriously to make the walls of their houses thick and firm before cold weather comes. It is often said that the larger the houses and thicker the walls, the colder the winter is going to be, but even muskrats sometimes make mistakes in their forecasts. As long as open water is available underneath, cold weather has no terrors for the animals in their winter homes; but the thicker and icier the walls of their houses, the safer they are from all enemies except man and his traps. Usually two or more openings lead from the nest chamber in the center of the house down into the water, and as long as these openings are kept clear the animals are free to come and go as far as water extends under the ice. Air holes through the ice are kept open in the vicinity of the houses or bank burrows and apparently the animals obtain plenty of oxygen from these and the bubbles lying under the ice, or from the air carried in their dense coats of waterproof fur.

Breeding habits.—The young are usually brought forth in bank burrows, apparently sometime in May, and in June they are first seen swimming about as little quarter-grown muskrats. Apparently six to eight to a litter are the usual numbers; some credit them with two or three litters during a season. Half-grown young occasionally caught in fall are generally supposed to be from second litters, but they may be merely the first litters of late young of the previous year. Apparently the young of the year do not attain full size and weight the first fall, but by the following spring it is difficult to distinguish between most of the yearling and older animals. They are very prolific, have few enemies except man, and will quickly and abundantly restock suitable grounds where they are given protection. Like other rodents, they show no signs of mating for more than a brief temporary period. The whole care of the family devolves upon the mother, for after the young are born the male has no further place in the family life. Apparently the males fight for supremacy, as occasionally one is caught with its skin cut full of slits, evidently by the incisor teeth of an opponent.

Food habits.—In summer the muskrats feed on the tender shoots and stems of numerous grasses, tules, cat-tails, and water plants along the shores, on roots and bulbs, which they take from the bottoms and banks, and to some extent on mussels and other animal food. In July, 1893, Doctor Fisher reported that in the Sheyenne River, near Lisbon, where they were common, he found piles of mussel shells at various places along the banks where the muskrats were in the habit of feeding. In Apple Creek, near Bismarck, they were found in the same ponds with the beavers and several were caught in beaver traps. Many little heaps of fresh-water mussel shells were found along the banks where muskrats had been feeding, and Doctor Bell actually saw a muskrat bring up and cut open one of these shells. In many places where they are in the habit of feeding, the accumulation of grass and plant stems builds up little mounds or platforms on which they sit while eating their meals. They are said to be very fond of carrots and parsnips, which are often used for trap bait.

Economic status.—Under certain circumstances muskrats do serious damage, as when they get into irrigation ditches, artificial ponds with dams or raised banks, or in roadways through marshes.

Their burrows will quickly destroy ditch banks and dams. In 1916, they had nearly ruined a graded road running west from Devils Lake for about 2 miles through a large marsh. In about 50 places they had burrowed into the sides of the grade and in many cases clear across under the road, causing the surface to break through into the soft mud below. They had also made hollow dens under the road into which passing horses had broken through. The road was graded only about 2 feet above the surface of the marsh, but even if it had been raised much higher the burrows and dens would have been a constant menace. It would have taken at least $100 to repair this road at the time it was examined, and repairs would have been useless as long as the muskrats were left there. This seemed a serious situation, but it could have been controlled with no expense, merely by allowing and encouraging thorough trapping, in this particular marsh, where every muskrat could have been caught at a profit. In very few places in North Dakota, however, is there any complaint of mischief done by muskrats, while the annual income from their fur reaches many thousands of dollars, well distributed among the residents of the State.

Fur farming with the muskrat in its native marshes has been successfully carried on in many sections of the country, as fully described by Lantz (1910, 1917), in Farmers' Bulletins 396 (issued in 1910) and 869 (issued in 1917) of the United States Department of Agriculture.

Family CASTORIDAE: Beavers

Castor canadensis canadensis Kuhl

Canada Beaver

Ah-mik' of the Ojibways; *Ah-misk'* of the Crees (Seton).

Castor canadensis Kuhl, Beitr. Zool., p. 64, 1820.

Type locality.—Hudson Bay.

General characters.—Beavers, largest of all our rodents (sometimes weighing 60 pounds or more), are heavy-bodied, strong, powerful animals, with large, webbed, hind feet; broad, flattened, naked, scaly tails; dense, fine underfur, and long coarse outer hair of a dark chestnut-brown color; and short ears and huge chisel-like incisor teeth well adapted for cutting wood. In fresh fall fur they are dark, rich chestnut-brown in color, which fades to a somewhat lighter brown before the spring molt. An adult female from Mouse River, near Towner, collected by Remington Kellogg, July 30, 1915, measured: Total length, 1,150 millimeters; tail, 400; hind foot, 195; and weighed 53 pounds; it is unusually dark brown, but otherwise seems to be typical of the northern beaver. The young of all ages agree closely with the adults in coloration.

Distribution and habitat.—Although there is very little material from which to judge, it seems safe to assume that all beavers in the Hudson Bay drainage, including the Mouse River and Red River Valleys, are of the typical form (*canadensis*), and very different from those of the Missouri River drainage (*missouriensis*). Formerly beavers were abundant in all the streams and many of the lakes of North Dakota, but to-day they are restricted to a few scattered localities where colonies have received sufficient protection to enable them to regain a foothold since the days of overtrapping.

In 1800 Alexander Henry (1897, pp. 117, 143, 145, 154, 175, 177, 408) said that beaver houses were numerous along Red and Goose Rivers, near Grand Forks, and more numerous than elsewhere on the upper Sheyenne River. Two of his trappers, from a trip up the Red River, brought in 60 beaver skins on November 17, two others, 60 skins from the Hair Hills on Park River, and the next spring two men brought in 30 skins from the vicinity of Grand Forks. Two other trappers on Park River took 25 skins in two days, and so for six years Henry's bands of Indian trappers scoured the branches of Red River and trapped in the Pembina Hills and Turtle Mountains for the furs that were poured out through the waterways eastward, to be shipped to England. As a result of this systematic destruction, Henry, in 1806, further records that where formerly plentiful beavers were becoming very scarce. Following is a partial record of beaver skins taken by his parties from the Red River Valley during the years 1801–1808: In 1801, Reed River, 832, Park River, 643. For the winter of 1802, Grand Forks, 410; Hair Hills, 200. In 1803, Turtle River, 337; Hair Hills, 30; Pembina River, 550. In 1804, Grand Forks, 356; Hair Hills, 182; Park River, 147; Pembina River, 211. In 1805, Hair Hills, 121; Park River, 160; Pembina River, 829. In 1806, Grand Forks, 342; Pembina River, 776. In 1807, Pembina River, 565. In 1808, Grand Forks, 150; Hair Hills, 53; Pembina River, 339. Although these localities merely indicate the camps from which his men worked out in all directions, the records give a good idea of the fur harvest in its prime, and also of the rapidity with which the beaver was reduced to numbers that no longer paid the trappers for their time and effort. As early as 1848 David Thompson (1916, p. 249) wrote that the beaver had become very scarce in the Red River Valley near the mouth of Park River.

The former abundance of beavers in these streams shows conditions favorable to their habits and in many instances marks the places where they could now be maintained in considerable numbers as an attractive and profitable form of livestock.

In 1887 no trace was found of beavers along the Red River Valley nor were any colonies heard of on the way down the valley to Pembina.

In 1893 Doctor Fisher noted a few in the Sheyenne River, near Lisbon, but in 1912 Eastgate reported them as extinct there 16 years before, although he found old cuttings and dams. It is possible that there are still a few beavers along the banks of the Red River, but no one has been able to get any trace of them in recent times.

In the Turtle Mountains, in 1912, only one colony of beavers was found, and that was carefully protected by the owner of the property, who was anxious to have them multiply as rapidly as possible. All through these mountains, however, old traces of the former abundance of beavers was found, while dams closing the outlets of ponds, marshes, and lakes showed where they had been responsible for retaining the richness of the land and spreading it out instead of having it washed away by the spring floods. The best of the meadows in this region are all old beaver ponds that have been filled up with silt. There are also numerous lakes where the beavers used to live in the banks, as shown by old burrows, and where to-day

the interesting animals might live in considerable numbers without doing harm. If adequate protection could be afforded they would soon increase and restock this whole region, once a trappers' paradise.

One morning before daylight in 1915, Kellogg counted 15 beavers about 8 miles north of Towner, where they had built a big brush house on the bank of the Mouse River. At this place the water was about 15 feet deep, but a dam had been built part way across the river to increase the depth. In the early days beavers had been very numerous along this stream, and old settlers told Kellogg that its course had often been changed by their dams. At the time of Kellogg's visit there was another colony 4 miles farther up the river.

At Kenmare, in 1913, there were complaints of beavers doing great damage to property on Carl Swensen's place on Mouse River, about 20 miles northeast of there. On the bank of the river just below the McKinney Bridge, three or four beaver houses and the places where timber had been cut along the borders of the stream were examined. Apparently there were 20 or 30 beavers occupying the half mile of stream examined, and they were said to be equally numerous below there and above to the Canadian line. C. E. Booth, a taxidermist, reported later that beavers were common in the Mouse River near Minot, and that there were eight dams across the stream just above Burlington. There is considerable small timber scattered along the course of this river and in a great prairie region even small timber is highly prized. At Mr. Swensen's place the beavers had built winter houses along the banks of the stream by piling up the sticks which they had cut, often a wagonload or more, in a heap 5 or 6 feet high, above their rooms and nest chambers in the bank and plastering them over with mud. During the visit the houses were not used to any extent, as the beavers were living mainly in bank burrows, but before winter all of these houses would be repaired and put in good condition to protect the dens from freezing during the winter.

The beavers were not cutting many trees at that time, but seemed to be feeding mainly on the green vegetation along the river banks and on willow stems and roots. Mr. Swensen showed the bank where they had cut trees the previous fall and the writer counted about 40 stumps of small ash, 2 to 6 inches in diameter, about 20 boxelders, and a dozen elm stumps of the same general size. The largest ash which they had cut was about 10 inches in diameter and another about that size had been killed by being girdled. Seven boxelders 8 or 10 inches in diameter, entirely or partly girdled, were either dead or dying. Most of these trees were in a narrow strip about 40 rods long on the bank of the river opposite the ranch house. Mr. Swensen estimated that the beavers had killed 200 or 300 trees for him and more for some of his neighbors. A few of these trees were large enough for fence posts but the greater number were too small to be of any value except for shade and protection from the cold winter winds. The Swensens were much interested in the beavers and their work, but strongly objected to feeding so many of them on their choice trees.

It would seem a simple matter for State officials or game wardens to be detailed in such cases to control the abundance of beavers

where they were doing mischief, and to capture alive and remove any surplus to other parts of the State where they would be of value in stocking suitable waters.

Castor canadensis missouriensis Bailey

Missouri River Beaver

Capa of the Dakotas (Gilmore); *Midapa* of the Hidatsas (Matthews); *Wahrapa* of the Mandans (Will); *Citukh* of the Arikaras (Gilmore); *Zhaba* of the Omahas (Gilmore).

Castor canadensis missouriensis Bailey, Journ. Mamm., vol. 1, p. 32, 1919.

Type locality.—Apple Creek, 7 miles east of Bismarck, N. Dak.

General characters.—Slightly smaller than *canadensis;* colors, paler and duller brown; back, bright hazel brown; sides, duller brown; and underparts, smoky gray. Young, same color as adults. Measurements of type (about 18 months old and not full grown): Total length, 900 millimeters; tail, 270; hind foot, 170. Weight estimated at 35 or 40 pounds.

Distribution, habitat, and general habits.—Apparently the light-brown subspecies of beaver occupies the Missouri River drainage, at least from Nebraska north and west to Montana. In North Dakota it still occupies the Missouri River and many of its tributary streams. A number of skulls in the National Museum were collected by Lieutenant Warren, along the Upper Missouri, probably in North Dakota. There is also a skull from old Fort Stevenson, part of a skull from the Little Missouri, and a broken skull from Medora, besides the type and one immature specimen from Apple Creek, but much more and better material is needed before a satisfactory diagnosis of the form can be given or the details of its distribution fully made known.

In 1804–5 Lewis and Clark (1893, p. 194) found beavers abundant along the Missouri River throughout the North Dakota section of their journey, even in close proximity to long-established Indian settlements. At the Mandan villages they speak of two French trappers coming into camp with 20 beavers that they had caught near there. Trappers were then just beginning to find this river a rich field for their fur harvest.

In 1833, Maximilian reported 25,000 beaver skins bought during the year at Fort Union (now Buford). Among his many observations along the Missouri River he (Wied, 1839–1841, Bd. 2, pp. 54, 55, 1841) wrote on November 5, from just above the mouth of the Little Missouri:

* * * we lay to for the night on the south bank where the forest was completely laid waste by the beavers. They had felled a number of large trees, chips of which were scattered about on the ground. Most of the trees were half gnawed through, broken down, or dead, and in this manner a bare place was formed in the forest. Not far off we saw in the river a beaver den, or as the American sometimes call it a beaver lodge, to which there was a very well trodden and smooth path, which we availed ourselves of to go to and from our boat. Nature appears to have peculiarly adapted these remarkable animals to the large thickets of poplar and willow of the interior of North America, where the whites on their first arrival found them in countless numbers and soon hastened to sacrifice these harmless creatures to their love of gain.

Ten years later Audubon (1897, p. 76) at Fort Union, wrote in his journal about the beavers "once so plentiful, but now very scarce. It takes about 70 beaver skins to make a pack of 100 pounds; in a good market this pack is worth $500, and in fortunate seasons a trapper sometimes made the large sum of $4,000."

Already the quest for rich fur harvests had swept beyond this region, but fortunately, where the beavers had the protection of the deep water and high banks of the larger rivers, it had not quite exterminated them. With characteristic tenacity they still cling to their old haunts or merely scatter out to establish new colonies in tributary streams, but the love of gain has not entirely disappeared from the land and these new colonies are rarely able to keep their coats on their backs for any great length of time.

At Buford, in 1910, Anthony reported a few in the Missouri and Yellowstone Rivers, apparently about as many as were found there in 1887. In 1913, Doctor Bell and the writer found many signs of their presence along the Missouri River near Williston and about 18 miles to the southeast, on the west side, found a dam where a few were living in a creek.

At Fort Clark, in 1913, Jewett reported beavers common along the Missouri River and one colony located on a small creek about a mile south of the town. The willows had been cut for houses and dams, and some were also scattered along the river shores, where they had been used for food. In the Killdeer Mountains, Jewett reported beavers common in all suitable creeks in the region; there was a small colony on Jims Creek, 3 miles south of Oakdale, and another colony on Charlie Bob Creek on the east slope of the mountains. Their dams and houses were well protected by the owners of the land. At Medora he saw several fresh cuttings along the banks of the Little Missouri and beavers were reported to him as common in places above there.

From Medora down the river to Quinion, Jewett found beavers in several localities along the Little Missouri and on Magpie Creek. In the river at the mouth of Magpie Creek a few had been caught the previous fall, and on Magpie Creek, near Quinion, a beaver dam of aspen, willow, and chokecherry bushes had been built across the creek. The dam was about 8 feet high and 20 feet long between the creek banks and had formed a pond from 5 to 8 feet deep and half a mile long. The colony had been there for several years and was well protected by the ranchers.

In the deep ponds of the Little Missouri River, near what was then the North Dakota National Forest, about 25 miles south of Medora, Doctor Bell and the writer found where beavers had been cutting cottonwood trees and building houses on the banks. Just below the camp they had a large house on the bank of the river made mainly from the branches of several cottonwoods which they had cut down near by. The largest tree cut was about 10 inches in diameter, and others still larger had been cut half way through or the bark eaten from one side. Only cottonwoods and willows had been taken, and as these were abundant and of little value the beavers were not doing serious damage in this section. Along Deep Creek, on the national forest, where there was no timber and only willows and chokecherry bushes, the beavers had made numerous dams and

some good-sized ponds. On Bullion Creek, south of Sentinel Butte, a colony had built a dam of willow and chokecherry bushes and maintained a large pond, which kept the creek flowing throughout the year where it had formerly gone dry in summer.

In Apple Creek, just east of Bismarck, in 1914, beavers were reported to have destroyed $1,000 worth of timber. To get at the facts, a trip was made to Bismarck and their work all along the stream carefully examined. The beavers were not numerous at that time, but the half dozen old dams that had been cut and broken out showed that the animals had previously been there in much greater numbers. In a distance of about 6 miles, the writer estimated 15 to 20 beavers, including two families of young, but there had probably been twice as many the previous year. In all about 75 stumps of small trees that had been cut down were found mainly elm and ash, but 1 oak and 1 boxelder had been cut and 1 cottonwood had been girdled and killed. Most of these were not 5 inches in diameter, and they would average about 2 inches. Most of the wood, probably 3 or 4 cords, had been hauled to the ranches. The majority of the bushes cut were diamond willows and chokecherry, which are used both for food and for building dams and houses. The actual value of all other timber cut along this creek would not exceed $20. In a prairie country where timber is scarce every little tree has a value for shade and protection as well as for the relief it gives to the monotony of open country, but the beavers also add life and interest to the country, and in addition have a cash value usually greater than that of a few small trees.

Other complaints were made of damage done at the same time by beavers along Sweet Briar Creek, just west of Mandan, but when Doctor Bell went to investigate he found a few small trees cut for food and building purposes, but very few beavers were left. Most of them had been caught and the trappers and farmers were clamoring for permission to catch the rest. In other places, however, the beavers are given adequate protection by residents who are interested in having them on their farms.

In 1915 Kellogg found traces of beavers along the Missouri River and Antelope Creek near Goodall, and reported a fair-sized colony near Expansion, a large colony below Independence, a freshly built dam across Deep Water Creek below Shell Village, and another colony on a lagoon at Armstrong. On the Knife River he found two beaver houses, and near Sather, in Burleigh County, a few houses and some fresh beaver work. Near Sawyer he reported one small colony, and another in a bend of the river near Painted Woods, while from there to Bismarck he found the houses at almost every bend of the river where there were groves of diamond willow and small cottonwoods.

At Cannon Ball, in 1916, the residents said that there were still some beavers along the Missouri River and also along the Cannonball River, its side streams, and old sloughs and channels. At Parkin, about 8 miles above the mouth of the Cannonball, there were a number of beavers in the deep parts of the river, with dens in the high banks. They were cutting willows and cottonwood brush along the shores. One evening as it was getting almost dark a big old fellow came up on the bank of the river and, climbing out

on a stump, reached up and quickly cut off a cottonwood branch about 6 feet long, dragged it to the water, and then swam down the river, towing it after him, eating it under cover of a steep bank below. Farther up the Cannonball, at Wade, in 1913, W. B. Bell reported a considerable number of beavers in both branches of the river and photographed a dam on the south fork just above the juncture of the two streams. They had done some damage here by cutting down cottonwood trees up to 18 inches in diameter. One ranchman, Mr. Twigg, estimated that 300 trees had been cut on his ranch. On October 23, 1910, O. N. Dvergsten wrote to the Biological Survey from still farther up the Cannonball, near Stowers, inquiring what he could do with beavers that were destroying his little trees along the creek. A few of the animals had come there the previous year, built their winter home, and kept on building and cutting his trees in spite of his efforts to discourage them. Their house had been torn out, but they had rebuilt it and insisted on remaining.

In 1919, after two years of open season on beavers, many of the colonies had disappeared or had been sadly reduced in numbers. A few traces of their work were found along the Missouri River at Sanish and Bismarck, and there were said to be a few beavers still in Apple Creek and Burnt Creek. Near the mouth of the Cannonball River they were very scarce, although they had been fairly common up to 1916.

In a deep loop of the Heart River near Mandan late in October there was still a small colony. Here they had cut down a few scrubby cottonwoods and a large number of willows along the bank and had stacked the green branches and sections of trunks in deep water for winter food. The top of this mass of green wood and brush reached to the surface and was securely held together by several inches of ice. There was one beaver house on the bank and many burrows and dens in the steep banks, which were about 15 feet above the water. Several vent holes opened out from 50 to 80 feet back from the river and warm air was steaming out of them on cold mornings. These beavers were well located for an experimental beaver farm or for a wonderful city-park colony at the edge of Mandan.

Beaver houses.—Large beaver houses are often built out in ponds where the surrounding water is 6 or 8 feet deep, with walls of matted sticks and mud rising 4 or 5 feet above the surface of the water, inclosing safe and comfortable living rooms. The nest chamber, usually just above the water level, has its only doorway leading down through deep water under the house to the pond outside.

Bank houses are generally smaller but equally well-built structures of sticks and logs well plastered with mud. They are commonly built on low banks to protect the dens from outside enemies. In high banks the burrows generally enter water and come up well back in the banks into nest chambers that are unmarked by any external building material.

Beaver dams.—The dams are generally built of brush, sticks, limbs, and trunks of trees that have been cut into sections of a convenient size to be carried, dragged, or floated to the desired spot, pushed into place, and covered with mud from above the dam. Well-built dams

show a steep lower face of crisscross sticks and a sloping upper face of mud or firmly packed earth. They offer a wonderful resistance to floods and the wear of time, and many old beaver dams may be found to-day that have not been used for a century or more.

On small streams beaver dams are usually of a simple type, built across the channel so as to raise the water above them to sufficient depth for good ponds. A depth of 6 or 8 feet is required to protect the houses, dens, and bank burrows, and to insure a winter swimming pool under the ice. Much deeper water is preferred and the beaver will usually leave and hunt for better quarters if a depth of a least 6 feet can not be maintained.

Large and rapid streams are rarely dammed, except by large colonies of beavers left undisturbed for a long term of years. Some of the old dams show great skill and industry, but the best results seem to be due to persistent efforts in the face of many failures, rather than to the high order of mentality usually attributed to the beavers.

Food habits.—The food of beavers varies with the season. In summer it is mainly grass and other green vegetation. At Apple Creek, in August and September, the beavers were feeding on coarse water grasses and sedges along the shores of the creek. The grass blades were scattered over the surface of the ponds and lodged against the dams and in many places the banks were well cropped. All of this was waste material that could not be cut for hay or grazed by stock. The stomachs of the beavers collected contained large quantities of green pulp, apparently of this material, with the addition of a little of the bark and twigs and roots of willow, and some other plants that could not be identified. The trees and bushes cut at that time had been used mainly for building material rather than for food.

In fall beavers begin to cut down bushes and trees to be stored under water for winter food. Sometimes tons of green brush mixed with limbs and sections of tree trunks are sunk to the bottom in deep, still water, where under the ice it keeps fresh and green and is available all winter. The bark is eaten off the larger stems and the twigs and buds are browsed where they lie or are carried into the houses to be enjoyed at leisure.

That willows are the principal winter food, as well as the favorite building material, is evident from the food stores, the remains of meals and structure of houses and dams. Cottonwoods and aspens are preferred for food where available. The hardwoods—elm, ash, boxelder, birch, and even oaks—are sometimes cut for building material, but rarely for food. On Apple Creek, some elm and ash, one small bur oak about 2 inches in diameter, a small boxelder, a thorn-apple bush, and a few hop vines had been cut, all of them evidently for building material, as they showed no indications of having been eaten. Boxelder and bullberry bushes were abundant along the stream, but were rarely touched by the beavers. One thorn-apple bush full of red fruit had been cut and placed on the dam. The rootlets of willows, which grow in dense masses under water along the banks, are also a choice food for both summer and winter, and in deep water, where beavers are scarce and timid, they get much of their food from these tender roots without exposing themselves on the surface.

Breeding habits.—Usually four to six young are raised at a time and it is doubtful if more than one litter is raised in a year. Increase is therefore not rapid and the young do not get their full growth for several years.

Beaver parks.—Near Jamestown, in 1914, W. B. Bell visited a beaver colony that had been protected for a number of years and allowed to build a good dam across the Dakota River. The animals were comparatively tame and could be watched at their work on the dam or on the banks, or swimming about in their pond during the daytime, and were a source of much interest and pride to the community.

The beginning of a valuable and educational zoological park was here developing spontaneously without any expense or trouble beyond the mere protection of the animals. Unfortunately, a grainfield extended down to one edge of the beaver pond and naturally the beavers accepted the grain as a part of their food supply. Even after the grain was cut they pulled the bundles out of the shocks and carried them to the water for food and building material. The loss of grain, though scarcely appreciable, naturally irritated the owner and roused a sympathetic feeling for him and against the beavers, until, as a result, the colony was destroyed.

If a woven-wire fence had been placed along the river bank and woven wire wrapped around the bases of a few trees, the beavers might have remained as a harmless and delightful interest for the public. No more interesting or simple and inexpensive zoological park can be maintained by any community than a good beaver colony.

Beaver farming.—In many sections of North Dakota conditions are excellent for raising beavers under control and partial or complete domestication in small lakes or ponds or in fenced sections of creeks and small rivers on owned or leased land. If beavers were included in the list of fur-bearing animals permitted to be raised under special license (North Dakota, 1923, pp. 317–318), a valuable industry might be added to the State, and much waste and unprofitable land made to yield returns to the owners. The selection of stock for beaver farming is of great importance, since the dark, richly colored animals, as found in the Hudson Bay drainage or, still darker, from northern Michigan and Wisconsin, have far greater fur value than the light-brown beavers of the Missouri drainage, and as far as possible should be used for breeding stock.

Beaver meat.—If properly prepared, beaver meat is good and wholesome. In the adults it is dark, tender, rich, and of good flavor. There is usually a layer of fat over the surface next to the skin, and the tail is always of a soft, fatty tissue which if well cooked is especially delicious. Among the trappers beaver tail has always been considered a luxury equal to buffalo tongue.

Lewis and Clark (1893, p. 276), in their journal of April 17, 1805, say, "Around us are great quantities of game, such as herds of buffalo, elk, antelopes, some deer and wolves, and the tracks of bears. * * * We obtained three beavers, the flesh of which is more relished by the men than any other food which we have." This is almost the unanimous testimony among trappers.

In skinning the beaver care must be taken not to get on the flesh a trace of musk from the large gland located under the skin of the

belly. The beaver should be hung up by the head and skinned without touching the meat with the hands. It is impossible to handle the skin without getting the hands scented by this very clinging, although not unpleasant odor.[17]

Family ERETHIZONTIDAE: Porcupines

Erethizon epixanthum epixanthum Brandt

Yellow-haired Porcupine; Rocky Mountain Porcupine

Pahi of the Mandans (Will); *Pahi* of the Dakotas (Gilmore); *Apadi*[n] of the Hidatsas (Matthews); *Suunu* of the Arikaras (Gilmore).

Erethizon epixanthus Brandt, Mém. Acad. Imp. Sci. St. Pétersbourg, t. 3 (ser. 6), pt. 2 (Sci. Nat.), p. 390, 1835.

Type locality.—Northwestern America.

General characters.—Heavy, wide-bodied, short-necked, short-legged animals with short, stout tails, long curved claws, flat, naked soles and an armor of quills; upper parts densely covered with very keen barbed quills, embedded in black fur and partly concealed by long yellow-tipped outer hairs; underparts mainly without quills. An adult male from Montana measures in total length 875 millimeters; tail, 314; hind foot, 112. Weight, approximately 20 to 30 pounds.

Distribution and habitat.—From a wide range in the Rocky Mountain region the yellow-haired porcupines reach their eastern limit, so far as known, in North Dakota. They are fairly common in the Missouri Valley and westward in the State, but east of the river valley they are rare and scattered. A specimen collected by U. S. Ebner in the Turtle Mountains in 1914, and now in the collection of the North Dakota Agricultural College, at Fargo, marks the easternmost authentic locality for the species. Near Warwick, just south of Devils Lake, in 1915, Kellogg reported a yellow-haired porcupine killed by two boys the previous year; at Towner on the Mouse River, one killed by Almond Larson in 1905, and another found dead by Clyde Coss in 1911. In 1913 there were reports of porcupines having been killed near Kenmare and Minot, but there was no real clue to the form represented. It was undoubtedly, however, the yellow-haired. At Buford and all the way down the Missouri River through the State porcupines have been reported common from 1910 to 1915 by Anthony, Kellogg, and Jewett, and apparently their numbers have not changed much since the days of Lewis and Clark, Maximilian, and Audubon. In 1913, Doctor Bell reported them fairly common at Wade, on the Cannonball River, where two had been recently killed near Mr. Wade's ranch and a skull of one obtained for a specimen. In 1919 they were found common about Sanish, in the brushy gulches on both sides of the Missouri River.

General habits.—Although well safeguarded by their own spiny armament, the porcupines often seek additional safety in the Badlands and brushy stream bottoms, in the protection of little caves and hollows in the banks or the dense, thorny cover of buffaloberry thickets. Near Williston, the writer found their characteristic oval

[17] For further information on the habits and control of beavers, see U. S. Dept. Agr. Bul. 1078 (Bailey, 1922) and Misc. Circ. 69 (Bailey, 1926).

pellets in the little caves of the Badlands, which seemed to be their favorite dens. Often, however, the animals are met in the open and at night they follow trails and roads for long distances, as shown by their double rows of oval, flat-footed, denticulate tracks in the dust.

Although their ordinary gait is not much faster than that of the turtle, they are patient and persistent travelers and sometimes their tracks may be followed for miles. When met with, the porcupine usually attempts to escape, but if crowded, bristles up, erects its quills, and stands at bay awaiting attack. The quills are pointed out at all angles and as the enemy approaches within reach, fierce blows of the heavily armed and muscular tail are struck sideways or upward and the barbed quills thus driven into anything within reach.

The common belief that the quills are thrown to a considerable distance has no foundation in fact, although some are occasionally scattered on the ground if the animal is roughly handled. Porcupines evidently realize that their lower surface is unprotected, as any effort to turn them over is frantically resisted, and when threatened the quickness with which they will wheel and strike is surprising in animals so clumsily built.

Their long, very hooked claws enable them to climb trees readily, and the animals are as much at home on the trunks or branches as on the ground. They also climb about in the bushes and seem to enjoy the tops of the very spiny buffaloberry bushes, which probably give them a feeling of added protection along their own lines of defense. The tops of these bushes are often eaten bare of bark, leaves, and berries and left in a very mutilated condition. The writer has never seen any evidence that porcupines dig burrows, but quite probably they dig out or enlarge some of the cavities in which they dwell.

Breeding habits.—The mating season is said to be in October and one or sometimes two young are born early in spring. At birth the young are unusually large and well developed; their eyes are open, and they are provided with a good set of fur, quills, and incisor teeth. They follow the mother until weaned and apparently before they are half grown each one is able to shift for itself and to begin its solitary life. With this slow rate of reproduction the species would soon disappear but for its armored protection.

Food habits.—During the summer, porcupines feed on a great variety of green vegetation, accepting apparently almost anything that comes in their way and stuffing their enormous stomachs to the limit of their capacity. At Stanton, Kellogg found one feeding in an alfalfa field with its stomach well filled with alfalfa; he said they were reported to do some damage in the grainfields between Washburn and Bismarck. Jewett reported them as fairly common in the brushy gulches near Sentinel Butte, where they had gnawed the bark from many of the chokecherry bushes. Near Sanish they had eaten the bark and twigs from buffaloberry, black haw, chokecherry, and rose bushes. In 1913, on the former Dakota National Forest, about 25 miles south of Medora, they were found fairly common in the Badlands gulches and on the forested ridges. Many of the yellow pines had been gnawed more or less extensively by

them. On some of the forested ridges about half of the small trees showed peeled spots from which the bark had been eaten and some had been completely girdled and killed. Most of the old trees showed some scars from earlier gnawings.

Still farther south, along the Little Missouri, near Marmarth, where yellow pines grow irregularly over the buttes, the writer found fully a fourth of the young trees damaged through having the bark gnawed from them by porcupines. In some cases the bark had been eaten from the tops and branches; in others the trunks had been girdled, so that many of the trees were either ruined or killed outright. The old pines showed a long struggle with their enemy, the bushy tops and gnarled forms being largely due to the girdling of tops or branches at different times during their lives. Here, as in many other parts of the country, the bark of yellow pines seems to form the favorite food of the porcupines, at least during the winter season. The rough outer coating of bark is rejected and the tender inner growth eaten as it is scraped clean from the wood of the trunk. Apparently the bark from a space the size of a hat is required for a square meal. Any tree that happens to be conveniently near the porcupine's den is sure to suffer and may be stripped of all of its bark from top to bottom.

Economic status.—Although most wild carnivores have become sufficiently accustomed to porcupines either to let them alone or, by taking advantage of their unprotected bellies, to kill and eat them with little harm to themselves, many dogs gain their first knowledge of the species by sad experience. The greatest complaint of the settlers against the porcupines comes from this injury to their dogs, for if a dog attacks one recklessly as it would any other animal it may be seriously or fatally injured by the quills. The destruction of crops by porcupines is usually of small consequence, but their destruction of many species of pines and other conifers often causes great loss to the forests within their range. It is not improbable that they are largely responsible for the scarcity of timber in the Badlands region; were it not for them a fair stand of pines might have spread over this rough country. If reforestation of these areas is attempted, it will be necessary to first eliminate the porcupines, as where they are common no young trees can reach a well-developed maturity.

Erethizon dorsatum dorsatum (Linnaeus)

Black-haired Porcupine; Canada Porcupine

[*Hystrix*] *dorsata* Linnaeus, Syst. Nat., ed. 10, t. 1, p. 57, 1758.

Type locality.—Eastern Canada.

General characters.—Color, black and white instead of black and yellow; upper parts covered with white, black-tipped quills, mixed with black fur and obscured by long black, white-tipped hairs. Usually not so large as the yellow-haired porcupine from farther west. An adult male from Minnesota measures in total length 740 millimeters; tail, 195; hind foot, 115; an adult female, 735, 195, and 100 respectively. Weight of female, 16 pounds; of male, probably 20 pounds.

Distribution and habitat.—The black-haired porcupines occupy the timbered Canadian Zone area of the northeastern United States and Canada west to the Great Plains, where they probably meet the range of the yellow-haired porcupines. They are common in northern Minnesota, but for North Dakota there seem to be only two or three

probable records and these unsubstantiated by specimens. M. A. Brannon writes that while at the university, at Grand Forks, he had a small black-haired porcupine for a pet, but it met with an untimely death and was not preserved for a specimen. It was given to him and was said to have come from the Red River Valley, near Pembina. H. V. Williams reports a porcupine of the small dark-colored type, almost black, killed at Hamilton, in Pembina County, on July 31, 1916. The description fits this species, which on geographic grounds ought to be found there rather than the large yellow-haired species which has been taken no farther east than the Turtle Mountains; but the young of both species are blackish, so that identification depends in part on age. The boys at the Indian school near Wahpeton killed a porcupine on the river bank near town in 1914 and described it but no specific characters could be gathered from the description. Others will probably be found along the Red River Valley, and it is hoped that a specimen may be preserved to determine the species positively.

Family ZAPODIDAE: Jumping Mice

Zapus hudsonius campestris Preble

Prairie Jumping Mouse

(Pl. 13)

Zapus hudsonius campestris Preble, North Amer. Fauna No. 15, p. 20, 1899.

Type locality.—Bear Lodge Mountains, Wyo.

General characters.—A medium-sized mouse with very long, slender hind legs and feet and small front feet; tail, very slender and longer than head and body; ears, small. Upper parts, bright buffy yellow along sides, darker along the back; underparts, pure white. Average measurements: Total length, 222 millimeters; tail, 135; hind foot, 30.5.

Distribution and habitat.—As its name implies, the prairie jumping mouse is a plains species covering practically the whole of North Dakota and the surrounding prairie country. There are specimens in the National Museum from Wahpeton, Fairmount, Blackmer, Hankinson, Ellendale, Fargo, Harwood, Lisbon, Pembina, Neche, Turtle Mountains, Devils Lake, Fort Totten, Valley City, La Moure, Ludden, Cannon Ball, Fort Clark, Grinnell, and Buford. Specimens have also been recorded in the Field Museum from Bottineau, Minot, and Jamestown. Although generally distributed over the State, these jumping mice are found mainly in thickets, weed patches, meadows, or tall grass areas rather than on the high open prairie, where the grass is short and the cover scant.

General habits.—Under the protecting cover of bushes, weeds, and tall grass, these timid little jumping mice make their summer homes on the surface of the ground and their winter homes in burrows deep underground. They do not make roads or runways, but go through the grass with long leaps or little hops and occasionally with a slow creeping motion on all fours. When startled, they go bounding away with long jumps, suggesting frogs, and usually make two or three leaps before stopping to see if they are pursued. Generally, if the last leap is well noted, one can creep up cautiously and catch the mouse by clapping the hand over it. When caught in this way the mice rarely offer to bite or make much effort to escape,

but may be handled and examined freely if held gently in the hollow of the two hands. Evidently they are not entirely nocturnal, as they are often startled from their feeding grounds in the daytime, but more often they are disturbed in their nests, from which they bound away when one steps close to them in the grass.

The summer nests are placed on the surface of the ground, well concealed under grass or other vegetation; they are neat little balls of fine grass with a tiny opening at one side and a soft lining in the central chamber. When the grain is cut and the hay mowed the nests are disturbed and the jumping mice go to live in the shocks of grain and cocks of hay, where they are discovered when the hay and grain are being loaded on wagons. As they bound from under cover to the open ground they are somewhat dazed by the light and can usually be watched for some time as they sit blinking in the open or progress by long leaps through the air.

Hibernation.—Unlike most of the mice, these little fellows become excessively fat in autumn and with the first frosty nights retire to their warm underground nests and curl up for a long winter's sleep. The thin oily fat is deposited in a layer of white fatty tissue over the whole inside of the skin as well as over much of the surface of the body and fills the inside cavities until the animal is about twice its natural size and weight. This fat supplies sufficient nutriment and fuel for the long winter sleep and probably carries the animal through the early springtime of breeding activities when food is scarce.

Breeding habits.—The five or six young are brought forth in the nests usually in May or June, and are barely full grown by the time their winter sleep is to begin. In this latitude it is doubtful whether more than one litter of young is raised in a summer.

Food habits.—In the examination of a great many stomachs of these jumping mice, nothing has been found but the fine white pulp of carefully shelled, well-masticated seeds. Generally these are from grasses, although grain and a variety of other plant seeds are eaten. The mice are fond of rolled oats used for trap bait, and are easily caught in a variety of traps set where they are in the habit of running. To obtain the seeds of grass, on which they mainly subsist, they cut off the tall stems as high up as they can reach, draw them down and cut them off again, and repeat this until the seed-laden tops can be taken. Little heaps of grass stems cut in sections about 3 inches long are found through the meadows where the jumping mice live and are unmistakable evidence of their presence, being always much longer than the grass cuttings of meadow mice and other short-legged species. Apparently these rodents do not store up food, but live a very care-free life in the midst of abundance while the summer lasts.

Economic status.—Generally the jumping mice are not sufficiently abundant to do any great harm to the yield of grass and grain, but in places over limited areas in the meadows their cuttings might aggregate 2 or 3 per cent of the grass. They cut down and eat or destroy a small quantity of grain along the edges of some fields, but on the whole are far less numerous and injurious than the meadow mice. Still, they help to swell the total of the tax levied by rodents on farm products and only fail through lack of numbers to form one

of the serious rodent pests. Their natural enemies are the same as those of the other nocturnal mice, chief of which are owls, weasels, badgers, and skunks, through the good offices of which their numbers are kept within bounds.

Family HETEROMYIDAE: Pocket Mice, Kangaroo Rats

Perognathus fasciatus fasciatus Wied

Maximilian Pocket Mouse

Apapsá of the Hidatsas, *Zhizhina* of the Dakotas (Gilmore).

Perognathus fasciatus Wied, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur., t. 19, pt. 1, p. 369, 1839.

Type locality.—Upper Missouri River near its junction with the Yellowstone, northwestern North Dakota.

General characters.—Considerably smaller than the white-footed mice, with small ears, slender tails, and conspicuous fur-lined pockets on the cheeks, opening externally and not connected with the mouth; hair, short and glossy; upper parts, olive gray; underparts, pure white, bordered by a buffy line along each side. Average measurements: Total length, 135 millimeters; tail, 65; hind foot, 17.

Distribution and habitat.—Maximilian pocket mice are scattered over a large part of western North Dakota and adjacent areas of the semiarid plains. There are specimens from Buford, Crosby, Minot, Dunseith, Fort Clark, Cannon Ball, Wade, Dawson, Oakes, Bowdon, and the Little Missouri River north of Medora, but the range is probably more extensive and continuous than these scattered localities indicate. They are animals of the open prairie, where they live in tiny burrows in the barest situations or on the short-grass plains, for, unlike most mice, they avoid the cover of vegetation.

General habits.—In 1833, Maximilian, Prince of Wied (1839, p. 373), found this anomalous little pocket mouse near Fort Union, at the junction of the Yellowstone and Missouri Rivers, and in 1839 first described it as a new genus and species of rodent. For more than 50 years no more specimens were obtained, and the name was confused under another species and not put in its proper relationship until 1889, when Doctor Merriam (1889, pp. 2, 4, 11) published his revision of the North American pocket mice.

In 1887 the writer visited Fort Buford and collected a small series of specimens that served to verify Maximilian's excellent description of the genus and species. At that time he was unacquainted with animals of their general habits and had only common steel traps, old-fashioned choke traps, and little tin box traps, and knew of no more tempting bait than cheese, bread, cake, or meat, none of which they would touch, so that although instructed to look out for them and get specimens, he then failed to catch any in his traps. Their characteristic little burrows were common and their tiny tracks recognized as undoubtedly belonging to the species, were found every morning about the traps, although no attention was paid to the bait. Other methods were evidently necessary to obtain specimens.

During the dusk of evening as the writer walked over the prairie, sometimes one of these little mice would dart over the ground near

him, and by dropping his gun and making a quick spring he could catch it in his hands. All but one of those seen were caught in this way, but in that one case his fingers came down on the mouse's tail and the rest of him escaped. This kind of hunting, though exciting at times, nearly ruined his shotgun, which invariably was dropped on the ground at the first move of the mouse, although he resolved each time to lay it down carefully when the next one was seen. The half dozen specimens obtained served to reestablish the identity of the species, but they did not add much to knowledge of its general habits. Only in later years was it learned that with modern traps baited with rolled oats the mice could be caught in abundance wherever they occurred; since then naturalists have been able to learn more of their habits.

Their little burrows are usually found in groups of two or three on some dry, open spot, often at the edge of a cactus or sunflower patch, or close to sagebrush, and are easily recognized by their very small size. A little fresh earth is occasionally found thrown from some of the burrows, but in most cases the entrances are unmarked and inconspicuous. In 1910, Anthony collected specimens at Fort Buford and reported burrows found sparsely on the prairies and hilltops, usually in the sides of banks or slight elevations. One specimen was taken in an open space in the sagebrush near the river. At Crosby, in 1913, the writer caught one under some old Russian thistle at the edge of a flax field. At Minot, on October 12, 1919, he tracked one over a soft snow from a strawstack to a hole under a furrow, and digging back about 2 feet found it in a cup-shaped nest of soft plant fibers, captured it alive, and kept it for several months for study. At one edge of the nest cavity it had a small collection of seeds, mainly pigeon grass and Russian thistle seeds, which proved its favorite food in captivity. At Fort Clark, Jewett found these mice fairly common about the wheatfields and high dry prairies back from the river, where they were readily taken in traps baited with rolled oats and set near the small burrows. At Cannon Ball, Sheldon found them common in the grainfields on the sandy places and along the flats of the river. At Wade, farther up the Cannonball River, W. B. Bell collected a specimen for the agricultural college museum. In 1892, Theodore Roosevelt caught a specimen on the Little Missouri River, 40 miles north of Medora, which he contributed to the Biological Survey collection.

Small, inconspicuous, and mainly nocturnal in habits these little pocket mice, even where most abundant, generally escape the notice of all but naturalists or keen observers. It has remained for a local naturalist, Stuart Criddle (1915), of Treesbank, Manitoba, to study their habits in a careful and thorough manner. In excavating their winter burrows he learned more of them than was ever known before. He found their burrows penetrating as far as 6 feet below the ground, where the winter nests and stores were well protected from frost. Apparently enough seeds were provided to carry them through the winter. Their winter stores consist mainly of seeds of noxious weeds, and Criddle's conclusions were that the mice are mainly beneficial in their foods habits. Such careful studies of mammal habits by local naturalists are of inestimable value for the better understanding of native species.

Hibernation.—These mice are rarely if ever found with sufficient accumulation of fat to suggest hibernation, but Criddle says that when exposed to moderately cold atmosphere they become very sluggish and he thinks that they spend much of the winter in sleep. The writer has found them active up to October 6 in Montana, and to October 12 in North Dakota, and they have been taken even later farther south. A captive specimen was active well into the winter, but in a warm house. The question of hibernation is not yet fully settled.

Breeding habits.—A female caught on May 13 contained six embryos, and Criddle reports one containing four. The mammae are arranged in two pairs of inguinal and one pair of pectoral on four distinct mammary glands. It seems probable, therefore, that six is the normal maximum number of young. There are no data to indicate more than one litter in a year.

Food habits.—In 1887 these pocket mice were found feeding mainly on the seeds of pigweed and knot grass, and at Crosby in 1913, they were living under the Russian thistle, which apparently furnished them food as well as cover. At Buford, Anthony reported their pockets filled with small angular seeds, which were probably of knot grass, and at Fort Clark, Jewett reported several caught at the edges of wheatfields with grains of wheat in their pockets. Others have been taken with their pockets filled with grass seeds, lambsquarters, red root, and tumbleweed, and Criddle found in their homes and pockets seeds of grass, blue-eyed grass, bug seed, wild buckwheat, and puccoon. He also discovered grasshopper eggs stored in their tunnels and found many places where these had been dug out of the ground. One of the mice that he kept in captivity preferred meal worms to seeds.

Economic status.—From the evidence gathered it seems that these mice are very slightly, if at all, harmful, while in many ways they are decidedly beneficial; but there still remains much to be learned of their habits and tastes.

Perognathus flavescens perniger Osgood

Dusky Pocket Mouse

(Pl. 15)

Perognathus flavescens perniger Osgood, Proc. Biol. Soc. Washington, vol. 17, p. 127, 1904.

Type locality.—Vermilion, S. Dak.

General characters.—About the size of *fasciatus*, but more intensely colored, with the rich buff on the upper parts much obscured by a wash of bright black, and the underparts chiefly rich, buffy ochraceous. Measurements of type: Total length, 140 millimeters; tail, 68; hind foot, 17. Weight of live adult, 10 grams.

Distribution and habitat.—The silky little dusty pocket mice come into southeastern North Dakota from their range over the prairie country of western Minnesota, eastern South Dakota, and the adjoining corners of Nebraska and Iowa. There are specimens from Hankinson, Blackmer, Lidgerwood, Napoleon, and Finley, and the writer picked up a dead one in the town of Parkin, about 10 miles above the mouth of the Cannonball River, too mangled to be saved for a specimen. The range of the form somewhat overlaps that of

fasciatus, from which it is entirely distinct. Apparently this is merely a dark-colored prairie form of the paler *flavescens* of the semiarid Plains region farther south and west. Sandy prairie soil is their favorite habitat and their little burrows are usually found in the mellow and often barren soil among prairie grasses.

General habits.—In the old lake-shore sand dunes, a little south of Hankinson, these little animals were found fairly abundant. On the crests of many of the low ridges or mounds that had once been dunes, from one to a half dozen of their burrows or groups of burrows were found. There was generally a little mound of sand like a small gopher hill, and, whether freshly made or old, the entrances to the burrows were invariably closed. Often two or three other burrows, just large enough for the end of the finger, would be found near the closed one, but these were inconspicuous and rarely showed any trace of dirt having been thrown out. Traps baited with rolled oats and set at any of these holes, or across a long trail made by scraping the foot in the sand, readily caught the mice, for while they do not make trails of their own, they invariably follow any clear road through the grass. Often in the morning their tiny tracks were found over the open, drifting sand. A few specimens were taken in traps set near the tracks which led from the burrows to the feeding grounds. Although more easily located on the open sand, the mice were much less numerous there than in the scattered vegetation, which afforded some cover.

At Blackmer two were caught in a sandy field where boys said mice were often turned out by the plow. At Lidgerwood, Sheldon found them common in the grainfields and a series of specimens was taken in traps set in the fields. At Parkin the writer found many of their characteristic burrows and tracks in sandy ground near the edge of the town that had just sprung up on the prairie and picked up a dead mouse in the grassy street.

Breeding habits.—Three females collected at Elk River, Minn., on July 30 and August 12, 1912, contained four embryos each. The mammae are arranged in two pairs of inguinal and one pair of pectoral, which for the present constitutes our total knowledge of the breeding habits of this species.

Food habits.—At Hankinson the traps were baited with a mixture of rolled and whole oats, but as ants carried away most of the rolled oats during the day the whole grain was usually the only attraction for the mice. Most of the specimens caught had in their pockets some of the whole oats, from which they had removed the hulls, and some had also the seeds of needle grass (*Stipa spartea*), while the pockets of others were entirely filled with these long grass seeds, hulled and neatly packed in little bundles. There were occasionally also a few seeds of bindweeds and small wild beans. Of course, their food varies with the time of year, and at this season, July 19 to 27, the abundant *Stipa* seeds were just falling to the ground and the mice were busy gathering their harvest. At Lidgerwood, Sheldon found that the pockets of all of those caught in wheatfields contained weed seeds, with the exception of one that had gathered up a few particles of cracked corn; some of them also had included a few kernels of oats from his trap bait. The one picked up at Parkin had its cheek pouches full of little bean seeds, probably of *Astragalus*,

which was common there. In Minnesota the writer found where the mice had been feeding extensively on the seeds of sand bur, one of the most troublesome of weed grasses.

In the underground winter storerooms of these mice there were seeds of two species of pigeon grass, a few other grasses, and wild buckwheat. In captivity their favorite food has proved to be first of all the pigeon-grass seeds from their own winter stores, then Russian thistle seed, millet, wild sunflower, hemp, and rolled oats. They nibble a little cabbage, turnip, cooked potato, lettuce, celery, or green grass, but apparently more for the moisture than for food, as in a dry, furnace-heated house, they become very thirsty and eagerly suck water from saturated cotton or drink from a small dish.

None of the animals caught showed any indications of becoming fat as in hibernating species, but it is evident that they store up much food in the form of small seeds.

Economic status.—Too scattered in their distribution to be of any serious consequence one way or another, the habits of these little mice appear to be mainly harmless. Their consumption of weed seeds probably counterbalances any possible mischief in grainfields.

Perognathus hispidus paradoxus Merriam

Kansas Pocket Mouse

(Pl. 12)

Perognathus paradoxus Merriam, North Amer. Fauna No. 1, p. 24, 1889.

Type locality.—Banner, Trego County, Kans.

General characters.—Size, large; tail, long; ears, small; pelage, glossy but coarse and hispid; external cheek pouches, conspicuous; upper parts, yellowish-brown with scattered black hairs over the back; sides, clear yellowish; underparts, white. Average measurements of adults: Total length, 222 millimeters; tail, 108; hind foot, 26.

Distribution and habitat.—These large pocket mice have an extensive range from Mexico over the Lower and Upper Sonoran semiarid plains region to western South Dakota, and one specimen has been taken in North Dakota. This was collected by Doctor Bell, in August, 1913, at Wade, on the Cannonball River. The specimen is now in the agricultural college collection, at Fargo, and is of special interest as marking the northern limit of the known range of this species. It is a large female, measuring in total length 220 millimeters, tail 114, and hind foot 27, and was caught in a trap set on the prairie at the edge of a sandy area on the Wade ranch. At this locality the species represents an element of the Upper Sonoran Zone, which is sparingly shown also by the native vegetation.

General habits.—Over their wide range these mice are generally scattered and not abundant, but occasionally get into the collector's traps set in open country. They live in burrows of their own construction, which are often recognizable by their size and form, as they are larger than ordinary mice burrows and not so large as those of kangaroo rats. Moreover, they often go straight down into the ground like a smooth auger hole, around the entrance of which no trace of earth is found. Always at some place not far away, however, is a burrow at which considerable earth has been thrown

out, showing that the unmarked openings are those that have been opened from below. Sometimes the burrow at which the earth is thrown out is closed at the entrance; at other times it is left open.

The underground habits of the pocket mice are little known, except that specimens taken often have their cheek pouches well filled with seeds, grain, or trap bait, which they are carrying home, evidently to be stored for food. They are very fond of rolled oats and are readily caught in traps baited with them. A great variety of seeds is eaten, but the mice do not usually show any signs of accumulating fat for winter, and it is doubtful whether they regularly hibernate. Over most of their range farther south they may be caught at any time during the winter.

Perodipus montanus richardsoni (Allen)

Richardson Kangaroo Rat

(Pl. 11, fig. 3)

Dipodops richardsoni Allen, Bul. Amer. Mus. Nat. Hist., vol. 3 (1890–91), p. 277, 1891.

Type locality.—Beaver River, Beaver County, Okla.

General characters.—Big head and short body, long brush-tipped tail, long hind legs and feet, small hands, and ample fur-lined cheek pouches combine to produce a most unique and striking appearance. Upper parts, bright buffy-yellow with a white band crossing each flank and white spot over each eye; underparts and stripe along each side of tail, white. Measurements of Montana specimen: Total length, 264 millimeters; tail, 145; hind foot, 40.

Distribution and habitat.—Richardson kangaroo rats are common in eastern Montana and western South Dakota, and undoubtedly occur in North Dakota, although no specimens have been taken and the only actual evidences of their presence are some groups of burrows described by Doctor Bell, at Wade, on the Cannonball River. He describes groups of large burrows on a strip of sandy ground on the Wade ranch, with considerable earth thrown out around the entrances, exactly as had been found around their dens at Glendive, Mont., and in other parts of their range. The species can only tentatively be included in the North Dakota list, but should be watched for and will undoubtedly be found in a few localities over the western part of the State. The animals can not fail to be recognized, and usually their burrows and the long-paired tracks of their hind feet are unmistakable.

General habits.—As indicated by their large, dark eyes, the kangaroo rats are strictly nocturnal, and for this reason are rarely seen except as caught in traps or accidentally driven out of their burrows. They are gentle, timid little animals, depending entirely on speed and their deep dens for protection. In running they hop along on their hind feet, and when hard pressed take flying leaps through the air, balanced by their long, tufted tails. The little front feet are used as hands and rarely allowed to touch the ground.

Food habits.—The food of this species consists of a great variety of seeds and grain, which are gathered and carried in the cheek pouches to the dens, to be eaten at leisure. Most of the rats collected for specimens are found with more or less food and sometimes with the pouches distended with various seeds or grains.

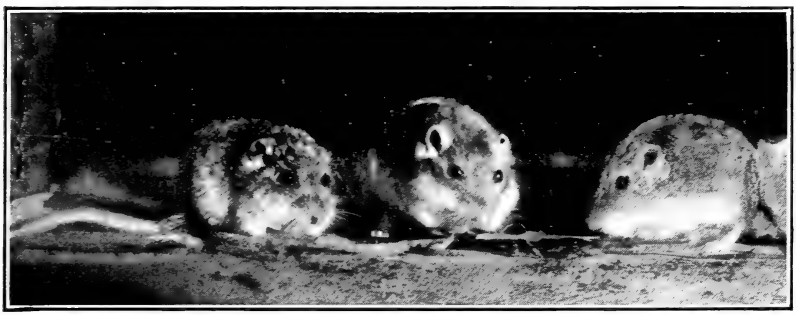


FIG. 1.—DUSKY POCKET MOUSE (PEROGNATHUS FLAVESCENS NIGER)

Photograph of captives kept for study. Slightly reduced

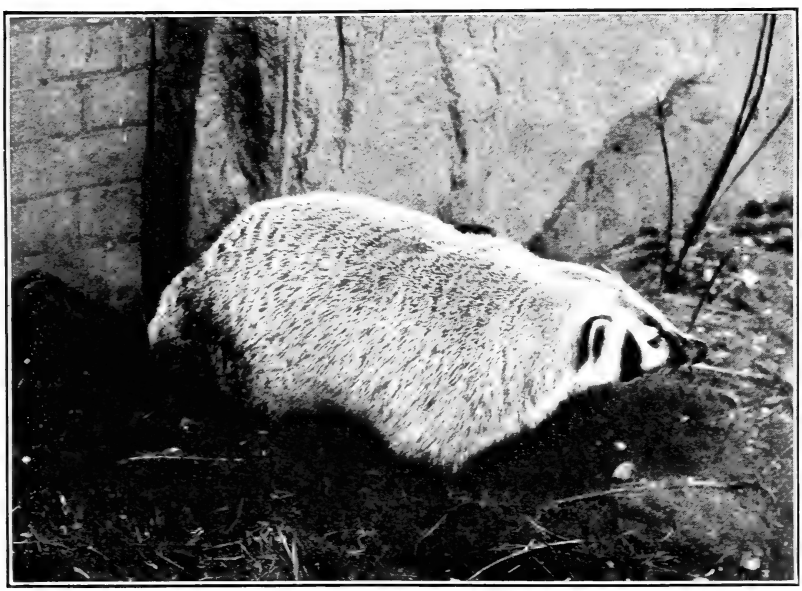


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FIG. 2.—BADGER (TAXIDEA TAXUS TAXUS)

"Topsy," a pet at the Agricultural College (photographed by W. C. Palmer)

MISSISSIPPI VALLEY POCKET GOPHER (GEOMYS BURSARIUS BURSARIUS)

Photographed in the act of digging a burrow in the prairie. About one-fourth natural size

Economic status.—It is perhaps fortunate that these interesting rodents do not reach farther into the State, as in grain-producing country they often levy a considerable tribute on the crops. Where they are abundant, the quantity of grain carried away, eaten, and stored in their dens for future use is sometimes a serious loss.

Family GEOMYIDAE: Pocket Gophers

Geomys bursarius (Shaw)

Mississippi Valley Pocket Gopher

(Pl. 16)

Mus bursarius Shaw, Trans. Linn. Soc. London, vol. 5, p. 227, 1800.

Type locality.—Unknown; somewhere in the Upper Mississippi Valley.

General characters.—Characterized by heavy build, large front feet, and long, heavy, digging claws, conspicuously grooved upper incisors, and deep fur-lined pockets on the cheeks extending back under the skin to the shoulders; eyes and ears, small; tail, small and nearly naked at tip; fur, short, smooth, and glossy. Color, light chestnut-brown above, slightly paler on the belly. Average measurements: Total length, 270 millimeters; tail, 80; hind foot, 35. A large female at Grand Forks measured 290, 75, and 35 millimeters, and weighed 14 ounces.

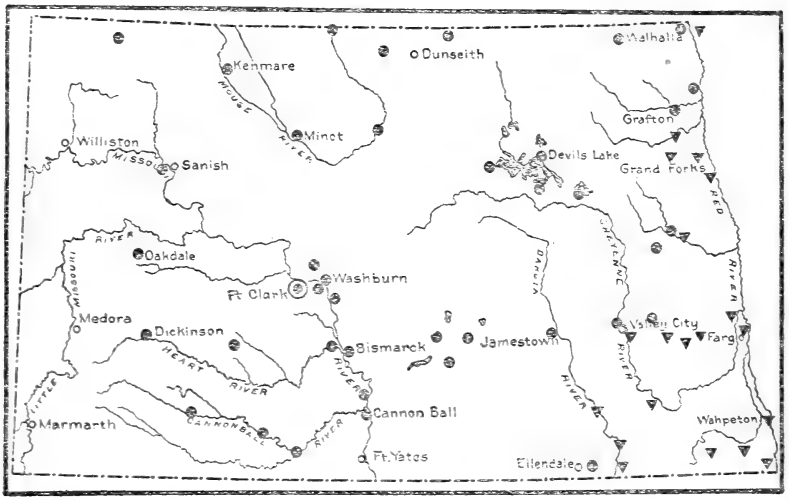

FIG. 7.—Records of two species of pocket gophers in North Dakota: Triangles, the Mississippi Valley pocket gopher; circles, the Dakota pocket gopher; dot in circle, type locality. The paler sagebrush pocket gopher from the extreme western part of the State is not shown on this map

Distribution and habitat.—The Mississippi Valley pocket gophers enter eastern North Dakota and range as far west as Ludden, Oakes, Larimore, Valley City, 10 miles west of Portland, Manvel, Grand Forks, and to the vicinity of Pembina (fig. 7). At Hankinson, in 1912, the writer found them abundant over the prairies, especially in mellow, sandy soil. On the high clay hills south and west of Lake Elsie they were scarce or entirely absent from extensive areas. A fondness for mellow soil seems to be a potent factor in outlining the range of the species. At Fairmount, Sheldon found them occupying mellow

soil along the river and a few scattered out on the wide, low prairies. At Oakes he found a few and at Lidgerwood they were abundant and very destructive to crops. At Wahpeton, Kellogg and the writer found them common along the river valley, and noted a few over the prairies, where they were doing considerable mischief in grain and alfalfa fields. At Lisbon, in 1912, Eastgate took a few specimens, but reported the animals scarce. In 1892, Loring took specimens at Valley City, Castleton, Wheatland, Buffalo, Erie, Portland, and vicinity. At Fargo, in 1912, their hills were abundant over the valley, except on some of the farms where the pocket gophers had been trapped. The hills were large and a long row of them across a green field of young wheat showed up strikingly. At Larimore, in 1915, Kellogg was told by the residents that these large pocket gophers had been the original species there, but the little gray form, *Thomomys talpoides rufescens*, had come in recently; at Manvel, Grand Forks County, he collected a specimen of *Geomys* and reported it as the common gopher of that region and especially numerous along railroad tracks. At Grafton only *Thomomys* was caught, but the large hills of *Geomys* were seen at Minto, 10 miles farther south. In 1916, the writer took *Geomys* just across the Red River from Pembina, where gopher hills were common on a strip of mellow soil, and specimens have been taken at Emerson, just above the Manitoba line. Thus the range has been rather fully worked out and found to extend on the west little beyond the old beach lines of post-glacial Lake Agassiz.

General habits.—For a distance of more than 1,000 miles, roughly from Pembina to El Paso, the ranges of *Geomys* and *Thomomys* meet without any extensive overlapping, *Geomys* occupying generally the mellow soil of the fertile valley country and *Thomomys* the higher, drier, and often more sterile soils to the west. The reasons for this division of territory have caused much speculation, and to obtain some evidence on the question, the writer made a special effort to get living specimens of both to test their dispositions when placed together. A live *Thomomys* was placed in the cage with the larger *Geomys*. Without a moment's hesitation the old 14-ounce *Geomys* pounced upon the 5-ounce *Thomomys* and began to chew it up, catching it by the ribs and crushing its bones, ribs, neck, skull, shoulders, and legs. When convinced that it was entirely dead the *Geomys* left it and showed no further interest in the victim. Its bones were broken to bits, but the skin was not cut through, probably because the teeth of the *Geomys* had been dulled on the wires of its cage. This fierce animosity seems to afford a reasonable explanation of the division of range between the two genera, the larger and more ferocious occupying the choice, fertile portion of the country and leaving the rest to its weaker relative.

To test further the disposition of *Geomys*, two that had been caught alive were placed near together, the old female that had chewed up *Thomomys*, and a half-grown young male caught near her home and quite probably one of her last spring's young that had been long ago sent out to dig its own way in the world. As they met face to face both hissed, struck out with their hands, and clashed their incisors together, the larger forcing the smaller one backward, but they did not clinch, and neither gave the other a chance to get

a hold. Again and again they jumped at each other, hissing and blowing, striking or pushing with their hands, and striking their incisors together with loud clicks, but doing no damage. The smaller animal was constantly forced backward and evidently would have retreated into its burrow had it been within reach. They were separated before any damage was done, but not until they had fully demonstrated the fact that they are not sociably inclined.

Later, while in a cold room in a little hotel, the writer placed a meadow mouse, *Microtus drummondi*, in the glass bowl with the smaller *Geomys*. Both were chilly and it was hoped they would keep each other warm. At first "Mike" jumped at "Geo" and bit and squeaked at him, but did not stir up any trouble, so he went over to one side of the bowl and made a nest for himself in the grass. It was thought they were going to be friendly and would be company for each other, but later in the evening Mike was heard to squeal; when the writer reached him Geo was making his bones crack. It was too late to intervene, and when Geo let go Mike was limp and dead. He was left to see what would happen, and in the morning the victim's bones were found broken to bits, although his skin was intact and no attempt had been made to eat him. While the *Microtus* may have started the trouble, for its disposition is not amiable, this further demonstration of the unsociable nature of *Geomys* is worth recording.

Later, after Geomys had become perfectly tame and was no longer interested in eating the writer nor in running away from him, its real nature and disposition were more apparent. It had no objection to being picked up and petted, but if startled would throw up its head as if ready to bite, so that it seemed safer to avoid its nose. If not startled, it would take food and climb into the hand to be taken up and carried about.

It would make a large, warm nest in its nest box by carrying in grass, paper, cotton, or any soft material until the box was well filled, then going in would stuff the doorway full and remain buried in its nest, sometimes for 12 or 24 hours at a time. It would sleep longer and eat less in cold weather than in warm.

When awake it would insist on strenuous exercise, eating, chewing up nest material, digging, scratching, and gnawing, or, if out of its box, running around the room for an hour or more at a time at a steady, rapid trot. At first it would butt into every object encountered as it followed the walls around and around, but later seemed to recognize and avoid every obstacle. Finally it became so familiar with the room that it would run in a large circle, missing all the furniture, unless something was moved into its path, when it would promptly bump into it. Its eyes were generally kept open while running, but in a lighted room they seemed to be of little help. In the dark it seemed to see well at close range, and when a nut was held in the fingers well inside its nest door it would take the nut gently without touching the fingers with its teeth. This, however, may have been due to the sensitiveness of its abundant short mustache more than to sight.

Its hearing seemed very dull, except for certain sounds. A touch, scratch, or jar on his house or its nest box would rouse the animal instantly from sleep and put it on the alert, while loud talking,

music, or open-air sounds seemed to make no impression on it. At first a puff of air or a door being opened across the room would attract its attention, and it could be stopped in its headlong race across the room by a quick puff of the breath.

Mentally it seemed dull and apathetic, although physically powerful and energetic. It has never shown any play instinct, but was probably too old when captured.

The animal was unable to swim. When put in a bathtub half full of water it floated with its head and back well out, but kicked or tried to run with its usual one-foot-at-a-time gait, and made no progress whatever. Apparently pocket gophers are unable to swim, and this may account for some peculiarities in their distribution in other parts of their range.

Pocket gophers have been supposed to have no voice. When caught in a trap or held in the hands against their will they make a hissing or blowing sound by forcing the breath rapidly out and in. This was supposed to be their only sound, but the tame pet on several occasions when hurt or troubled made a low, throaty *chur, chur, chur* in a complaining tone that seemed to be a real voice.

These powerful little burrowing animals live solitary lives almost entirely below the surface of the ground, and most of the time in total darkness behind closed and well-packed doorways. Their eyes and ears are of little use to them and have become almost rudimentary, but their tails, with sensitive tips, serve an important function in guiding their retreats in their shuttlelike motions back and forth through their extensive tunnels.

With their powerful claws they dig up the earth and push it before them to some point where a temporary opening is made through which it is thrust to the surface of the ground. The little mounds, or gopher hills, that dot the fields and prairies where they live are rapidly made. Load after load of the loose earth is pushed in front of the hands and breast to the entrance and thrown out with a little toss until the gallery is cleaned, and the last few loads are firmly packed in the entrance to close the burrow. Sometimes a few quarts and sometimes a bushel of earth are thrown out in one heap, but there is always the little circular dent, where the last load was pushed up and left in the mouth of the burrow, and often the direction of slope to the burrow below may be known from the greater quantity of earth on one side of the doorway. Later another doorway is opened up to the surface 10 or 20 feet away and another hill thrown up, and so on, day after day, until a long line of hills is formed, or a group if the burrows wind about and among each other.

In 1887, the writer counted the fresh hills thrown up by three pocket gophers 12 days after a rain, and the number of mounds that had not been rained upon were 28, 35, and 40. These hills averaged about 6 quarts of earth each, or approximately 17 quarts a day thrown out by one pocket gopher.

In summer the tunnels are about 10 inches or a foot below the surface, but in winter they run deeper and probably keep below the frozen earth, except at the entrance, where many are kept open to the surface. From these openings the animals push their way through the snow along the surface of the ground, leaving tunnels that later are filled with the loose earth from their burrows.

Pocket gophers do not become fat or actually hibernate, but they store up food to some extent, probably for winter use.

Breeding habits.—Long and widely known as these animals have been, it seems strange that there is so little information available regarding their breeding habits. Once on a Minnesota farm, two naked young were found in a nest chamber in the burrow. Their eyes were closed, their skin was delicate, pink, and hairless, and their little round heads and fat chubby hands were almost baby-like. The number of young, as shown by embryos in females collected for specimens, is 2 to 6, with apparently 4 the most common. The mammae of the females are arranged in two pairs of inguinal and one pair of pectoral. Only the small young are found in the burrow with the mother. As soon as they are old enough to dig for themselves, and before half grown, they branch off into new galleries, which finally become closed behind them when their solitary careers begin. Most of their lives are solitary, but in the mating season in spring a male and female are occasionally caught in the same burrow. The male soon leaves, however, and takes no further interest in the family affairs. Their reproduction is not rapid, but they are so well protected from enemies above that they increase steadily unless their abundance is controlled by artificial means.

Food habits.—The food of pocket gophers consists entirely of vegetable matter, largely roots encountered in their underground tunnels but also a great variety of green plants from above ground. When the opening is first made to the surface, the pocket gopher examines the plants close by and usually cuts them and fills its pockets before throwing out the earth, sometimes making several trips back to empty its pockets and fill them again before it throws out the earth and closes the doorway. Thistles, dandelions, clover, alfalfa, and leguminous plants generally are favorite foods, but grass, grain, and a variety of other plants are taken as encountered, and the pockets are often stuffed with leaves and stems intended for food or nest material. The many little bulbs, as wild onions, lilies, and the tuberous roots of native plants, are sought for food, but the soft and tender roots of many other plants are eaten, as well as the bark from even the woody roots of shrubs and trees. The contents of stomachs of pocket gophers usually show a combination of green plant tissues and the finely chewed white or light-colored pulp of roots and bulbs. At times ripe grain is eaten, but generally green food seems to be preferred, or is more easily obtained.

Economic status.—In many localities pocket gophers are among the most destructive of rodent pests, as they prefer many of the cultivated crops to wild food and steadily gather into fields where potatoes, turnips, or other root crops are raised, and also into fields of clover and alfalfa and the best of tame-grass meadows. In grain-fields they do extensive damage, but are partly kept out by the plowing of the land and by the long period of scant food in the stubble. In orchards and dooryards they also do much damage, eating the roots from fruit trees and ornamental shrubs, and often killing many of the choicest varieties. Their destruction is imperative in any well-kept agricultural land, and in limited areas this is not difficult. They are easily trapped or poisoned, and detailed methods for their

most economical destruction have been worked out by the Biological Survey. Circulars or leaflets giving the best methods can be had on application.

Thomomys talpoides rufescens Wied

Dakota Pocket Gopher

Machtóhpka of the Mandans (Maximilian); *Mánica* of the Dakotas (Gilmore); *Cipans* of the Arikaras (Gilmore); *Kipapudè* of the Hidatsas (Gilmore).

Thomomys rufescens Wied, Nova Acta, Acad. Caes. Leop.-Carol. Nat. Cur., t. 19, pt. 1, p. 378, 1839.

Type locality.—Fort Clark, N. Dak.

General characters.—Smaller and slenderer than the Mississippi Valley pocket gopher, which comes into eastern North Dakota. Upper incisors, not noticeably grooved except in a fine line near inner edge of each tooth; large fur-lined cheek pockets on each side of face reaching back under skin to shoulders; front feet and claws, large; hind feet, comparatively small; tail, nearly naked at tip; fur, short, smooth, and glossy. Color of upper parts, dull brownish-gray; underparts, buffy-gray, often with white markings on chin, throat, and breast. Measurements of adults: Total length, about 240 millimeters; tail, 70; hind foot, 31. Weight of adults, 5 or 6 ounces.

Distribution and habitat.—The Dakota pocket gophers cover the greater part of North Dakota and extend into eastern South Dakota and southwestern Manitoba. Their range covers practically the whole State except the low part of the Red River Valley, south of Grafton, and the western edge of the State, where a slightly different form occurs at the junction of the Yellowstone and Missouri, and probably along the Little Missouri River Valley. The eastern border of their range in the State is marked by Pembina, Drayton, Grafton, Larimore, Portland, Valley City, and a point 4 miles southeast of Ellendale, in an irregular line following closely the old shore line of Lake Agassiz, and also marking the western edge of the range of the larger Mississippi Valley pocket gopher, *Geomys bursarius*. The cause for this limitation of range may be due to antipathy of the two species, or to combination of factors; nowhere do the two overlap to any great extent. The fact that *Thomomys* avoids low or wet ground and is partial to high, dry prairies may be one of the determining factors of this border line.

Over all the high open prairie country and often in the timbered areas of the Turtle Mountains and Pembina Hills, these pocket gophers are found in dry meadows, fields, clearings, openings in brushy land, and sometimes even in scattered timber. At Pembina, in 1887, the writer found them common everywhere, except in the thickest growths of trees along the river, and took specimens on both sides of the river as well as on both sides of the border line. A few were found in fields, but they were most abundant over the unbroken prairie, where their favorite food plants were growing. In 1892, Loring succeeded in trapping a specimen at Portland, but in six days' subsequent trapping found no others, so that evidently this was somewhat beyond their regular eastern limit. At Larimore he found them abundant 4 miles west of town, but none farther east, and at Sherbrooke he found them common, as also at Valley City and Jamestown. In the northwestern corner of the State,

about Kenmare and Crosby, pocket gophers were comparatively scarce in 1915, as their characteristic little mounds were noticed only in scattered localities.

At the type locality of the species, which was visited in 1909 to obtain specimens for determining the validity of Maximilian's name, the pocket gophers were common over prairie and river flats on both sides of the river, occupying both the dry, sandy bottomlands and the high heavy-soiled prairie. Later in 1913, Jewett also found them common over that part of the valley, in the Killdeer Mountains, and farther south in the vicinity of Glen Ullin and Mandan. In 1893, Fisher reported them very common at Bismarck. In 1915, Sheldon traced them across the southern part of the State, from a point 4 miles southeast of Ellendale, westward continuously to Napoleon, Dawson, and Cannon Ball. The same year Kellogg traced them across the northern part of the State from Grafton to Devils Lake, Towner, the Missouri River at Oakdale, and thence down the river to Bismarck. Thus the reports cover practically the whole State and indicate fairly definitely the range and abundance of the species.

General habits.—In many places throughout their range these pocket gophers will average one or more to the acre and their total numbers over the State are enormous. Their presence can always be recognized by the little mounds of earth heaped up in the prairie grass and containing usually from 2 quarts to a peck of earth. Many of these mounds, however, are enlarged by repeated excavations until they contain a bushel or more, and some measured at Pembina, in 1887, were 3 by 3 feet, and 7 inches high; 4 by 4 feet, and 10 inches high; 4 by 5 feet, and 6 inches high; and 4 by 5 feet, and 7 inches high. These, however, were all composite mounds where the earth had been thrown out several times on successive days.

Practically the whole life of the animals is spent underground, where they burrow continuously from point to point, usually 6 inches to a foot below the surface of the ground, bringing out the loose earth by pushing it to the surface in the familiar little mounds, then securely closing the doorways, so that no enemy can enter their homes. Sometimes the row of mounds stretches away for 50 to 100 yards in almost a straight line; they are usually 6 to 8 feet apart, but sometimes 10 to 20 feet, while between some of the larger hills a space of 27 feet has been measured. More often the tunnels wind about and they sometimes form groups, where one of the animals has worked all summer on a few square rods of ground, so that the lines of old and new mounds crisscross and overlap.

The burrows pass through ground that is full of choice food in the form of roots, bulbs, and tubers. Some green food is gathered and tucked into the pockets at the entrance of their burrows, but aside from this the animals rarely come out on the surface of the ground unless for a few seconds at a time when they are throwing out the earth. The earth is pushed out in front of them in little loads about half the size of their bodies, and so quickly that it has the appearance of being thrown from them. Most of the people living in the country where they are abundant never see them, and often their rightful name of pocket gopher is misapplied to the ground squirrels. In winter they go deeper so as to escape the

frost, but keep their burrows open to the surface and often come out under the snow and tunnel long distances to obtain green vegetation, afterwards filling these surface tunnels with earth from below. They do not become very fat and evidently are active throughout the winter.

Breeding habits.—Apparently but one litter of young is raised in a season and judging from the immature specimens caught in July and August these are born some time in June. A record of five embryos, about one-third developed, taken at Carberry, Manitoba, June 29, 1892, by Ernest Thompson Seton (1909, vol. 1, p. 567), seems to furnish the only positive data available for this subspecies, although records for other forms of the same group, with the same arrangement of mammae, two pairs of inguinal, two pairs of abdominal, and one pair of pectoral, indicate a normal litter of six young. Practically nothing is known of the nest and underground habits of these animals, and the small young seem not to have been recorded. Few animals are more solitary in habits, and only during the mating season in spring are a male and female occasionally trapped from the same burrow. The male soon leaves, however, and probably never sees the young. The mother cares for her family until they are about half grown, when they start burrows of their own and are soon shut off from parental care, each beginning a life that is to be mainly solitary. Although breeding but once a year, their increase is comparatively rapid, as they are unusually well protected from enemies.

Food habits.—These pocket gophers live almost entirely on roots and green vegetation, and although they are very partial to certain species of plants, they will eat almost anything that comes in their way if better food is not available. The prairie clover (*Psoralea argophylla*), prairie turnip (*Psoralea esculenta*), and wild licorice bush (*Glycyrrhiza lepidota*) are apparently their favorite wild foods over much of the prairies, and their mounds often become very numerous where these plants are abundant. In their pockets are found the leaves and stems of a great variety of other plants, including grass, lupines, and other legumes, and occasionally roots and tubers, but apparently these are not often brought to the surface. Sometimes the pockets are found stuffed so full of green vegetation that they more than double the apparent size of the animal's head. They are used only for carrying food and not, as is sometimes reported, for carrying earth out of the burrows. To what extent roots, tubers, and bulbs are stored for winter food is not well known, but occasionally well-filled storage cavities are found along the lines of the tunnels.

Economic status.—Next to the ground squirrels, these gophers are generally the most destructive rodent pests of the region where they live. Although for ages they have been industriously plowing and mellowing the prairie soil, burying the surface vegetation and enriching and improving the land, they at once become the farmer's enemy when occupying the ground with his crops. Even on the prairies they destroy or consume much of the choice grass that would otherwise be available for stock, and cover up and prevent the economical cutting of much of the wild hay on the prairie and the best parts of the dry meadows.

In fields, gardens, and orchards, however, they do the most harm. Entering through their safe tunnels, they find choice food in the clover and alfalfa fields, and if nothing better can be found will live all summer on the green stems, leaves, and heads of grains. In vegetable gardens they are even more destructive, cutting the peas and beans above the ground and drawing them into their burrows to be eaten, or, without the risk of appearing at the surface, taking the onions and turnips or following a row of potatoes and cleaning the tubers from each hill in succession. Nowhere is their mischief more exasperating than in a clean and well-kept orchard, where, lacking other food, they often eat the bark from the roots of the trees and leave them to die, or even cut off so many of the roots that the trees dry up and tip over with the first wind.

Fortunately, pocket gophers are easily controlled, and it is only necessary to know how to poison or trap them in order to protect crops and trees. Where only a few are doing mischief, the simplest method is to trap them by merely opening their doorways and setting traps that will catch them as they come out to close the openings. Armed with a few modern traps and an old table knife, anyone can, with a little practice, catch all the pocket gophers in an ordinary garden or orchard without much loss of time. Where the mischief is on a larger scale, poison is a more rapid and economical control measure. Simple directions can be obtained from the Biological Survey for the most effective methods of administering poison.

Although excellent food and in every way perfectly suitable as a food animal, pocket gophers are not large enough to be of importance as game. In places where it is necessary to catch considerable numbers of them, however, they can be used to advantage as food, and if properly dressed and cooked are as good as rabbit or squirrel.

Thomomys talpoides bullatus Bailey

Sagebrush Pocket Gopher

Thomomys talpoides bullatus Bailey, Proc. Biol. Soc. Washington, vol. 27, p. 115, 1914.

Type locality.—Powderville, Mont.

General characters.—Very similar to *rufescens* but noticeably lighter and brighter colored, with conspicuously larger audital bullae. Measurements of type specimen; total length, 238 millimeters; tail, 72; hind foot, 30. Weight of female, from Buford, 5 ounces.

Distribution and habitat.—The arid sagebrush-valley form of pocket gopher occupies mainly the Yellowstone and Missouri Valleys of Montana, but comes into North Dakota at Buford and is probably the form occupying the Badlands part of the Little Missouri Valley, as specimens have been referred to it from the valley just below the southwest corner of the State. In an arid, open habitat, often with sandy or light-colored soils, these pocket gophers have become adapted to their environment in coloration, but in general habits show only such differences from *rufescens* as are occasioned by the conditions under which they live. Over the open range country they are of little economic importance, but as many of the valleys are brought under irrigation with intensive cultivation, they become of serious consequence and their destruction is necessary to satisfactory returns from the cultivated areas.

Order LAGOMORPHA: Rabbitlike Animals

Family LEPORIDAE: Rabbits

Sylvilagus floridanus similis Nelson

Nebraska Cottontail

Wahboos of the Chippewas (Wilson); *Ma^{n}shti^{n}-sapana* of the Dakotas (Gilmore); *Mo^{n}stinga* of the Omahas (Gilmore), generic term.

Sylvilagus floridanus similis Nelson, Proc. Biol. Soc. Washington, vol. 20, p. 82, 1907.

Type locality.—Valentine, Nebr.

General characters.—Rather compact, with relatively short ears and short legs. Colors essentially similar in summer and winter. Upper parts, rusty gray, darkened by numerous long, black-tipped hairs; rump, clear dark gray; throat, belly, and under surface of tail, pure white. Adult measurements: Total length, approximately 408 millimeters; tail, 52; hind foot, 99; ear from notch, 50. An adult male taken at Fargo by O. J. Murie on November 7, 1919, measured 405, 52, 98 millimeters, and weighed 2 pounds 1½ ounces.

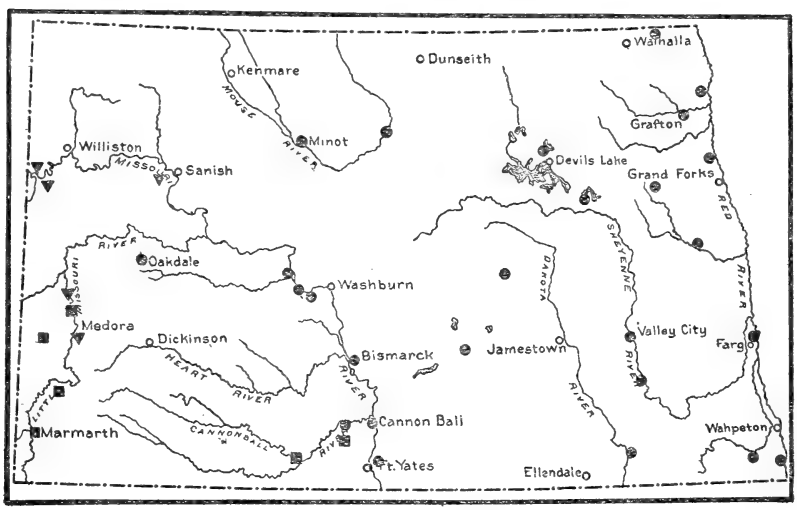

FIG. 8.—Three species of cottontail rabbit in North Dakota: Circles, the Nebraska cottontail; triangles, the Black Hills cottontail; squares, the Wyoming cottontail

Distribution and habitat.—Over the central Great Plains from Kansas to near the Canadian line Nebraska cottontail rabbits occupy the stream valleys and thickets of a mainly prairie region (fig. 8). In North Dakota there are specimens from Fairmount, Oakes, Fargo, Kathryn, Portland, Valley City, Larimore, Grafton, Hawks Nest, Dawson, Stump Lake, Sweetwater Lakes, Towner, Oakdale, Stanton, Fort Clark, Deapolis, Bismarck, Cannon Ball, and Winona. These are mainly brush rabbits, not commonly found at any great distance from the wooded or brushy bottoms. Apparently they have not yet reached the Turtle Mountains, although since the settlement of the country their range seems to be slowly extending northward in the

State. In 1887 there was found no trace of them in North Dakota, nor nearer than Fort Sisseton, S. Dak., and Browns Valley, Minn. Eastgate says they first reached Larimore in 1900.

In 1913 Mr. Booth, a taxidermist, reported that cottontails were abundant at Minot, and had first arrived about 1890. No trace of them was found farther north, at Kenmare, Crosby, or Bottineau. In 1912, on a wagon trip from Linton, in the southern part of the State, to Stump Lake, no trace of cottontails were found until Hawks Nest Butte was reached, where a specimen was obtained and tracks were seen in the timber, and on the south side of Stump Lake the rabbits were common in the timber. In 1919, at Walhalla, Eugene D'Heiley told the writer that cottontails came there in 1912, but soon disappeared, though they were still found at Neche, 20 miles farther east. In 1913 Jewett collected a specimen at Fort Clark and one at Oakdale in the Killdeer Mountains, and reported them as fairly common in the thickets and brushy gulches. In 1915 Kellogg took specimens at Larimore and reported them common at Manvel, Grand Forks County, and at Grafton, Walsh County. He was told that they were common at Drayton, Pembina County, although he did not find any. At Towner he took one immature specimen in the meadow and saw several others, and he reported the species common along the Missouri River from Stanton to Bismarck.

General habits.—These little short-legged rabbits are such an easy prey to dogs, wolves, and foxes that it is necessary for them to keep within the protecting cover of thickets or dense vegetation. Usually where they occur their roadways or trails may be found in every thicket or leading from one thicket to another. At Hankinson, they were found abundant in the woods and brush patches around the lake shores and in the thickets among the sand dunes. On the Hankinson ranch cottontails were frequently seen in the dooryards and about the buildings, in spite of several dogs and cats which were constantly hunting them. A family of half-grown cottontails living in some burrows under the roots of a tree gave the dogs a great deal of exercise in chasing them to cover and digging and barking at their burrows. The rabbits did not seem to care and were getting the best kind of training for life on the ranch.

At Fairmount, Sheldon reported them as frequenting farms and deserted buildings. At Lisbon and Valley City, Eastgate reported them as very common in the thickets and in both the natural timber and planted groves. As the country fills up with farm buildings, orchards, and garden shrubbery, these rabbits seem to increase in abundance and extend their range on the open prairie, where formerly it was impossible for them to exist because of numerous native enemies.

In the older, more settled parts of the State they are conspicuously most abundant. Along the Missouri River bottoms, where the thickets are dense and often thorny, they find the most perfect protection and satisfactory conditions of environment. At Washburn, in 1909, the writer found them abundant all over the brushy river bottoms, where in summer they had the added protection of hosts of mosquitoes, which rendered hunting almost impossible. At Fort Clark, in 1913, Jewett reported them common in the wooded and brushy bottomlands, to which they were closely restricted; on a

short walk along the river-bottom roads in the evening, he would usually see five or six. At Cannon Ball, in 1916, they were found very common in the brushy bottoms along the Missouri and Cannonball Rivers, and at Parkin, a few miles up the Cannonball, they were common in the wooded and brushy bottoms. One was living in a lumber pile in the middle of the new town just starting up on the prairie, and a bulldog spent much of his time chasing it from one lumber pile to another, but the rabbit seemed to realize its advantages and not to worry over the noisy demonstrations of the dog.

Breeding habits.—Cottontails are prolific breeders and usually raise several litters of young in a season. At Fairmount, on May 28, Sheldon collected a female which was nursing young. On the Sheyenne River, north of Valley City, Eastgate took one on May 17, 1912, which contained seven embryos; and at Grafton, on May 10, 1912, Williams took one containing six small embryos; one collected by Jewett at Fort Clark, on July 22, 1913, contained five small embryos. Although born in a naked, blind, and helpless condition, the young develop rapidly and are soon able to shift for themselves, leaving the mother to resume her parental duties with a new family.

Food habits.—Rabbits are mainly grazing animals, and their list of food plants includes in large proportion both native and cultivated vegetation. They take the leaves and tender blades from grasses, clovers, and most of the wild leguminous plants with which they come in contact, and are especially fond of the cultivated clovers, alfalfa, and most garden vegetables. They also eat the bark and buds of many shrubs and small trees in summer and in winter depend largely upon browse and bark for their food. At Kathryn, in Barnes County, Eastgate reported them feeding in the evenings along the edges of the grainfields, where it was common to see six or eight at a time. They always find an abundance of food and as one kind of vegetation dies or dries up, other plants are accepted in its place.

In times of deep snow the rabbits forage out from their well-protected burrows and pick buds and green tips and branches from the shrubs and such plants as are exposed above the snow, every increase in the depth of snow lifts them to a fresh supply. Their runways in the snow are always packed and frozen, so that a rapid retreat to safe cover is assured, and as more food is needed the runways are extended farther out through the brush or from one thicket to another.

Economic status.—Numerous inquiries among farm residents made it evident that these rabbits are not generally considered a pest, although where abundant they occasionally do considerable mischief. The small quantity of grain that they cut along the edges of a field, the forage crops eaten, and the fruit trees and shrubbery occasionally killed or damaged, is readily forgiven them because of their value as food and game. To many of the country boys they furnish the only available hunting, and usually before the winter is far advanced they have become so scarce as to leave barely enough to restock the country the following spring. In this northern clime they accumulate considerable fat during the fall, and are

among the choicest rabbits for food, being especially healthy, plump, tender, and well flavored. They have also a market value, and if they ever become overabundant, ample protection against damage to crops and trees may be had by extending the hunting season. In rare cases it may be necessary to poison those around orchards and gardens. Full directions for destroying them in this way will be furnished by the Biological Survey on request.[18] Generally, however, the few individuals that are doing mischief can be shot and utilized for food. The young of the year are especially delicious, broiled or fried, while the old individuals, well stewed with a little bacon or fat pork, afford an acceptable variety for any table.

Sylvilagus nuttallii grangeri (Allen)

Black Hills Cottontail

Nis of the Arikaras, and *Itakshipisha* of the Hidatsas (Gilmore).

Lepus sylvaticus grangeri Allen, Bul. Amer. Mus. Nat. Hist., vol. 7, p. 264, 1895.

Type locality.—Hill City, S. Dak.

General characters.—About the size of *similis*, but lighter gray, with slightly longer ears and distinctive skull characters. Slightly smaller than *baileyi*, with shorter ears and feet. Very similar in color, but brighter rusty on nape and legs. Average measurements: Total length, 385 millimeters; tail, 46; hind foot, 95; ear (measured dry), 56.

Distribution and habitat.—The little pale-gray Black Hills rabbits barely reach into extreme western North Dakota from their wide distribution over the arid interior of Nevada, Utah, Wyoming, and Montana (fig. 8). There are 5 specimens from Buford, 2 from Goodall, 2 from Medora, and 1 from Mikkelson on Roosevelt Creek, 23 miles north of Medora. They occupy the same Badlands country with *baileyi* but appear to confine themselves mainly to the dense thickets along the stream courses. At Medora, Jewett reported them as not common, but a few were found in the banks of the Little Missouri River, where a female was shot on January 15 as she sat in front of her burrow. Only three were seen in this locality. Farther down the river a few were seen usually in thick growths of buffaloberry bushes. In other localities the writer has found them taking shelter among rocks and in hollow banks, but more often under dense growths, as sagebrush or thorny thickets of bullberry bushes. The three distinct species of cottontails of North Dakota have amicably or otherwise divided the ground among themselves, in a way that seems best to fit the needs of each, *grangeri* taking the place of *similis* in the arid brushy bottoms, while *baileyi* occupies the rougher and more open uplands.

Sylvilagus audubonii baileyi (Merriam)

Wyoming Cottontail

Lepus baileyi Merriam, Proc. Biol. Soc. Washington, vol. 11, p. 148, 1897.

Type locality.—Spring Creek, Bighorn Basin, Wyo.

General characters.—Size about the same as *similis*, but with ears and legs conspicuously longer and colors lighter. Upper parts, light gray with a buffy tinge, neck clear buffy; underparts, white; tail, large and puffy and three-

[18] See Farmers' Bul. 702 (Lantz, 1916).

quarters white, with relatively narrow stripe of gray above. Measurements of adult male, from Little Missouri River: Total length, 399 millimeters; tail, 48; hind foot, 102; ear (measured dry), 67. Measurements of type specimen, 418, 50, 100, and 94.

Distribution and habitat.—The long-eared Wyoming cottontails come into extreme western North Dakota along the Little Missouri Valley (fig 8). There are specimens in the Biological Survey collection from Marmarth, the former from North Dakota National Forest, Sentinel Butte, and the Little Missouri River, 25 miles north of Medora, and one in the agricultural college collection, at Fargo, collected by Doctor Bell, at Wade, on the Cannonball River. At Parkin, near the mouth of the Cannonball, the writer recognized these long-eared rabbits as common in 1916 around the Badlands buttes, and Sheldon reported one seen at the Palace Buttes a little north of the mouth of the river.

General habits.—To a great extent these are Badlands cottontails, and instead of keeping to the brushy bottoms they are more often found along the broken slopes and among the rock piles and Badlands gulches of the roughest parts of the country. At Parkin the writer found them along the steep slopes of the high butte near town, running from one rock pile to another and taking refuge under the rocks and in washed-out cavities of the Badlands slopes. Their long ears, big white tails, and yellow-gray color mark them at once as different from the short-eared and more compact little Nebraska or Black Hills cottontails of the brushy bottomlands. Along the northern edge of the North Dakota National Forest early in August of 1913 they were found abundant in the banks of the river valley and in the rough gulches of the rocky slopes of the Badlands, where they would quickly gain cover in some rock pile or washed-out hollow in the banks or else take refuge in an impenetrable jungle of buffaloberry bushes or tangle of brush that offered equally good protection. About 8 miles south of Sentinel Butte Jewett obtained a specimen at the entrance of a deep crevasse in a rocky gulch on the side of the big butte. In an open country, where life frequently depends on getting quickly to safe cover, these rabbits have developed long ears and long legs for quick hearing and rapid flight. In other ways they have the general habits of most cottontails. As food they are equally as good as the brush-inhabiting species and as game generally more difficult to shoot.

Lepus americanus americanus Erxleben

Varying Hare; White Rabbit; Snowshoe Rabbit

(Pl. 17, fig. 3)

[*Lepus*] *americanus* Erxleben, Syst. Regni. Anim., p. 330, 1777.
Lepus bishopi Allen, Bul. Amer. Mus. Nat. Hist., vol. 12 (1899), p. 11, 1900; type from Mill Lake, Turtle Mountains, North Dakota.[19]

Type locality.—Fort Severn, Keewatin, Canada.

General characters.—About midway in size between jack rabbits and cottontails. Ears and legs, moderately long; tail, small; feet, large and hairy, especially in winter. In summer upper parts dark buffy gray, with blackish on tips of ears and top of tail; feet, buffy brown; chin and middle of belly,

[19] This form, based on an abnormal skull in the type and only specimen available at the time of its description, appears on examination of a good series of specimens from the type region to be typical *americanus*.

whitish; lower surface of tail, gray. In winter pure white, except black narrow border of ear, and dark eyes. Fur, very long and soft; on soles of feet, long, dense, and coarse. During change from white winter coat to gray summer coat, after loss of the long white cover-hairs and before gray summer coat comes to the surface, there is a short time when the yellow underfur is exposed; also during the fall change from gray to white the color is much mixed and often patched. Average measurements of adult specimens from North Dakota: Total length, 451 millimeters: tail, 34; hind foot, 125; ear from notch (measured dry), 60. Weight, 3 to 3½ pounds (Seton).

Distribution and habitat.—Snowshoe rabbits, which turn from gray in summer to white in winter, are more or less common in the forested areas of the Turtle Mountains, Pembina Hills, around Devils Lake, and along the wooded parts of the valleys of the Red, Mouse, and Missouri Rivers. There are specimens in the Biological Survey collection from Grafton,[20] the Turtle Mountains, Devils Lake, Stump Lake, Elbowoods, and Buford. Throughout the timbered and brushy areas of the Turtle Mountains they are especially abundant and specimens have been collected near Metagoshe Lake, Fish Lake, Diansley, Birchwood, and Mill Lake. On January 21, 1913, W. B. Bell reported one collected near Fargo and mounted for the agricultural college collection, and in 1919, Murie reported them as occasionally found there. In 1887, the writer was told that they were found in the woods near Grand Forks, and at Pembina he found them common. At Kenmare, in 1913, he found them common in the thickets and woods of the side gulches along the Des Lacs Valley, where their trails and signs were abundant and several of the rabbits were seen. C. E. Peck said that in the fall and winter the boys killed them there by dozens in the thickets of aspens and other northern trees and shrubs. Mr. Booth, a local taxidermist, was certain that they were common in the woods along the Mouse River near Minot. At Buford, in 1910, Anthony reported them common in the brushy river flats, where their well-beaten runways and patches of peeled willow brush were conspicuous and where several were seen and one specimen obtained. At Elbowoods, in 1915, Kellogg collected one specimen and reported them as quite common in the forest along the river bottoms. At Stanton and Sather he reported them scarce. At Cannon Ball, in 1916, the writer found their unmistakable signs and trails in the thickets along the river bottoms and was told by the residents that they were not very common. At a spot where one had been killed and eaten and its fur scattered about, the writer collected the tail as positive proof of the species. At Devils Lake, in 1916, Kellogg found one of these rabbits dead on Sullys Hill and saved the skull for a specimen. The following year a young one was taken on the north shore of the lake about a mile from the town of Devils Lake and signs of them were found throughout the woods along the north and south shores. Williams reports them abundant at Grafton at times.

[20] Two specimens collected at Grafton on March 30, by H. V. Williams, are in the yellow spring coat after the disappearance of most of the white outer fur. In one of these a spot of the new summer coat is shown and this agrees with the buffy-gray color of *americanus* rather than with the warm brown of *Lepus americanus phaeonotus* Allen of Minnesota. Although the type locality of *phaeonotus* is just across the Red River Valley at Hallock, Minn., the specimens from Grafton are evidently nearer to the typical subspecies than to the Minnesota varying hare.

General habits.—The varying hares are strictly woods rabbits, depending on dense forest and thickets for cover, protection, and food. They rarely come into the open, except along the edges of brush patches, where they can quickly dash back out of sight into their well-beaten trails and runways, which carry them under the brush in perfect safety from most of their enemies. In summer their dusky-gray colors render them invisible in the brushy shadows, and as they sit with ears low on their backs they seem fully aware of the advantage of their protective coloration and often allow passersby almost to step on them before bounding away into the thickets. Though mainly nocturnal in habits, they are usually seen in the evening or early morning sitting in the roads or trails that wind through the forest, and in a good rabbit year, when their numbers are at the maximum, a late or early drive along the wood roads usually sends them hopping out of the way at frequent intervals. At times they become very scarce, and often for a period of several years are seldom seen. Many theories have been advanced to account for the waves of abundance and scarcity, which seem to be more or less periodic, but much remains to be learned by close and continuous observation of the real causes. A very full account of their fluctuations through the north country is given by Preble (1908, p. 199), in North American Fauna No. 27; Seton (1909, vol. 1, pp. 621–652) also gives an interesting account of their habits in his Life-histories of Northern Animals.

Breeding habits.—On June 18, 1916, some one found a very young rabbit that had been killed by a dog in a patch of silver-leaf bushes on the shore of Devils Lake, about a mile from town. It was not so large as one's fist and had evidently been dug out of the nest or hollow in the leaves of the little brush patch, and as it had just been killed it made an excellent specimen and showed the beautiful long crinkly, coarse gray fur of the juvenal coat. Although apparently not a week old, its fur was very long, soft, and full, and the color even more highly protective than in the adults. Apparently the dog had eaten or carried away the other members of the family, so the number in the litter could not be determined. Usually with this species there are 3 or 4 young at a birth, and farther north in Canada Preble records 2 to 6 embryos. A female examined at Fort Clark by Maximilian in 1833 contained 4 embryos. The species is generally supposed to raise 2 or 3 litters of young during a summer, but data on this point are meager.

Food habits.—In summer these rabbits feed on a great variety of green vegetation, including grasses, grains, many of the wild and cultivated clovers and leguminous plants, and some buds and leaves of shrubbery. In winter they depend mainly upon the bark and buds of a great variety of shrubs and eat higher up as the snow becomes deeper. In spring the bushes neatly clipped at various levels show the depth of snow from which the rabbits fed at different times during the winter; often these clippings reach 4 or 5 feet above the surface of the ground. The large chisel-like incisors of the rabbits will cut bushes up to the size of lead pencils as smoothly as if done by a knife, and they also serve to remove the bark from fallen branches and even the trunks of small trees when other food is not abundant. Sometimes whole thickets of willow and aspen

are denuded of bark as high as the rabbits can reach, and even some of the young forest trees are thus injured or killed. Except in years of unusual abundance the rabbits find an ample food supply in the buds and tender tips of the winter browse without doing much harm. They are usually plump and sometimes show considerable fat even during the coldest of winter weather.

Economic status.—In newly settled sections of wooded country where the snowshoe rabbits are abundant they sometimes do considerable harm in cutting the young trees and shrubbery in winter, and may take a small portion of the growing crops in summer. Their value as food and game animals, however, is sufficient to outweigh by far the little damage they occasionally do. In many parts of the country where once common, they have been practically exterminated from extensive areas by persistent hunting. There is great danger that, without reasonable protection in restricted areas of their range, such as that about Devils Lake and in the scattered timber patches along the Mouse River, and even in the brushy bottoms along the Missouri, they may be killed off to the point of extermination. Among all the rabbits of the State they are the most desirable as food and game and from their habit of keeping entirely within the brush they are less likely to do serious harm to crops. Except in years of extreme abundance, their seasonal protection with that of other game would seem a wise precaution. At any time when their numbers become too great the protection could be removed and they would soon be reduced by local and market hunters.

Lepus townsendii campanius Hollister

White-tailed Jack Rabbit

Warchu of the Arikaras, and *Ma^{n}sti^{n}ska* of the Dakotas Gilmore).

Lepus townsendii campanius Hollister, Proc. Biol. Soc. Washington, vol. 28, p. 70, 1915.

Type locality.—Plains of Saskatchewan, probably near Carlton House, Saskatchewan.

General characters.—A large, heavy-bodied jack rabbit with long ears and legs and large white tail. Color in summer, light buffy gray above, back of ears white with black tips; tail, large and usually pure white or with an obscure gray line down the top; underparts, except throat, white or grayish white. In full winter coat, usually pure white all over except black tips of ears and dark eyes, but sometimes with a buffy tinge on feet, face, and back. Average measurements of adults from North Dakota: Total length, 648 millimeters; tail, 108; hind foot, 154; ear (measured dry), 95; Seton (1909, vol. 1, p. 654) records specimens weighing from 6 to 12 pounds. H. V. Williams, of Grafton, gives the average weight of 12 specimens as 8 pounds, and the greatest weight as 14 pounds. A large old female shot near Medina in June weighed 7¼ pounds.

Distribution and habitat.—The big white-tailed jack rabbits are generally distributed over the plains and prairie region from New Mexico to Saskatchewan and from Iowa to the Continental Divide, including all of North Dakota except the forested areas, into which they do not penetrate to any great distance. There are specimens from Lidgerwood, Ludden, Forbes, Valley City, Lisbon, Napoleon, Dawson, Harrisburg, Devils Lake, Towner, Buford, Mandan, Medora, Grinnell, Cannon Ball, and Sentinel Butte. They have

been reported from almost every locality in the State where field work has been carried on, except in the wooded part of the Turtle Mountains; at Little Prairie, an open area in the midst of the forest, Eastgate says they are common. In the smaller strips of forest they often gather in winter storms to feed on the bushes and escape the blizzards, but usually they are found on the wide, open prairie. Generally they are not numerous, and only occasionally is one seen to spring from its grassy form and go bounding over the wide expanse. Their big tracks are conspicuous in the dusty trails and roads, and their well-worn trails can often be followed for a long distance through the grass. Their abundance can also be estimated from the numbers of large round flattened pellets found scattered over the prairie. Some years they become much more numerous than others, but never multiply into the great numbers of the southern black-tailed jack rabbits. They hold their own well as the country settles up and are as much at home in the grainfields as on the prairie.

General habits.—These jack rabbits are animals of the open country, where speed and protective coloration save them from their enemies. As they sit crouched low in their shallow forms, even in the short prairie grass, they are so nearly invisible as to be rarely seen until they move. Depending on their invisibility, they will often lie close until almost stepped upon, then spring into the air and bound away at full speed with a startling flash of white tail, legs, and ears. Usually, they run with long, high leaps, head and ears held high as if in play, tail cocked on one side, patting the ground lightly with their feet, and at first often appearing to limp or run on three legs. It is only when badly frightened or closely pursued that they get down to real speed and stretch out in low, long form, with ears laid back as they glide close over the surface of the ground.

From a passenger train the writer once watched an interesting race with one that a dog had chased across the prairie directly toward the middle of the train. As it turned parallel with the train it raced along for about a mile, straining every nerve, stretching long and low and occasionally making two or three long leaps, then stretching out again at its best speed. As nearly as could be estimated, the train was going at about 40 miles an hour and for at least two minutes the rabbit held its own. The dog had given up the chase and finally the rabbit turned back into the prairie and with a few long, high bounds went over the top of the nearest swell. With an automobile on good roads, the speed of these rabbits could be measured, but no opportunity has been presented to give it a fair test. It is probable that these animals are excelled in speed only by good greyhounds. In their white winter coats, on big, furry feet, they run over the top of the snow in perfect safety from all pursuers except those with wings.

As the snow becomes deep they burrow underneath and usually sit fully concealed in their snow tunnels, where they are safe from even the large hawks and eagles. In the shallow snow they will sit nose to the wind on the open prairie or in plowed fields, as invisible as a speck on the great white snowfield. Speaking of their winter habits, H. V. Williams, of Grafton, says:

Plowed fields are their favorite places in winter. One of their peculiar habits, which usually warns a hunter of their presence, is that of zigzagging before digging a form and lying down. It is a sure sign that the rabbit is not far away when the trail begins to zigzag or the tracks turn back over themselves; one will often follow down a furrow, then turn and backtrack for 30 or 40 yards and make a long leap to one side before lying down within a few yards of the trail. Then as the hunter follows the trail past them they will get up behind him and get a good start before being seen.

Breeding habits.—At Buford, Anthony took a female on May 31, 1910, which contained 5 full-haired fetuses. The number of young is usually given as 3 to 6. The mammae are arranged usually in 4 pairs, generally considered 1 pair inguinal, 2 pairs abdominal, and 1 pair pectoral. While nursing young there is a copious supply of milk and the young up to quarter grown are found with a mixture of curd and green vegetation in their stomachs, but by the time they are half grown they seem to be entirely independent, relying on their ears, eyes, and legs for protection. Apparently in the northern part of the range but one litter is raised in a year, and these are born in May or June and are practically full grown at the beginning of winter. Seton (1909, vol. 1, p. 664) gives an interesting account of two fetuses taken from a mother that had been shot. They were found to have their eyes open and to be very active, and when set on the ground they ran about so quickly as to be hard to catch. They were taken home and raised by spoon feeding and became perfectly tame and very playful pets, living until 3½ months old, when they were accidentally killed. The young are usually found in some shallow burrow or concealing cavity in the ground, and up to the time when they are half grown and able to distance most of their pursuers they often run to a badger hole and disappear in its depths. If no burrow is near they often run to the nearest brush or weed patch and squat close under the protecting cover, but even on the short-grass prairie they absolutely disappear from view when squatted flat with ears laid low and tail tucked in.

Food habits.—In summer the white-tailed jack rabbits feed largely on grass, growing grain, and the prairie plants. They are very fond of clover, alfalfa, and many garden vegetables, as well as the tender shoots of growing grain. In winter their food is largely buds and browse, including the tips, branches, and bark of a great variety of shrubs and small trees. Young fruit trees and berry bushes afford favorite winter food. Until the ground is buried in snow they find an abundance of food among the dry winter plants, and as the snow becomes deep they hunt for thickets or brush patches where buds and branches are always within easy reach. Often they gather around hay or straw stacks, or follow the roads for scattered straws, which have been dropped by passing teams.

Economic status.—Unlike the southern black-tailed jack rabbits, which are often excessively numerous and of comparatively little value for food or game, these big northern hares are generally considered valuable game animals. In North Dakota they are rarely so abundant as to do any serious mischief, and their toll in forage is largely compensated for by their furnishing good sport and wholesome meat during fall and early winter. In orchards, groves, and yards they sometimes cause considerable loss and annoyance by cutting off or eating the young trees and bushes, but in most cases this

can be prevented by shooting the spoilers or by encouraging hunting in the vicinity. At Grafton, in 1912, Williams reported that they were hunted for food and sold a great deal in the markets. In the Sheyenne River Valley, in 1912, Eastgate wrote that during the winter many were shot and sold to be shipped abroad. Some years they were shipped by hundreds to commission merchants in St. Paul, Minn. In winter great numbers find their way to the markets of eastern cities, where they sell at a good price. Locally also they have considerable importance as game, and from midsummer on, when other fresh meat is scarce and expensive, the half-grown young form many delicious meals on the farms and ranches. They seem to be holding their own over the State surprisingly well.

In covering a good deal of North Dakota in 1912, the writer found these rabbits fully as common as when he first crossed the State in 1887. Even near the larger places, as Fargo, Grand Forks, Devils Lake, Bismarck, and Williston, they were almost as common as in the less settled sections, but in 1919 they were noticeably scarce in the Red River Valley. In some places many are shot at night in the roads as they run in front of automobile lights. One man told of shooting 16 in front of his machine one night "just for fun." If this unsportsmanlike practice should become general, it might seriously diminish the numbers of these useful animals, but generally they need little protection other than their own alertness and speed.

In rare cases where they become overabundant as they did in 1923 and 1924 in western Hettinger County, their numbers are reduced by organized hunting parties. Lewis F. Crawford sent a photograph of 7,550 of these great white hares in one pile at New England, N. Dak., killed in December, 1924. They were hunted with guns, dogs, and automobiles over an area of 20 to 30 miles square, both in the daytime and by the light of the moon. If rightly used the food value of the rabbits is a safeguard against any overabundance of the species.

Order CARNIVORA: Flesh Eaters

Family FELIDAE: Cats

Felis hippolestes Merriam

Mountain Lion; Cougar; Panther

Inmu-tanka of the Dakotas (Gilmore); *Shunta-ha^{n}ska* of the Mandans (Will); *Itupa-ichtia* of the Hidatsas (Gilmore); *Wachtas* of the Arikaras (Gilmore).

Felis hippolestes Merriam, Proc. Biol. Soc. Washington, vol. 11, p. 219, 1897.

Type locality.—Wind River Mountains, Wyo.

General characters.—Largest of the mountain lions; body, long, light, and powerful; tail, long and slender; color, reddish brown, darkest along the back, and darkening at tip of tail to black; underparts, with areas of soiled white. Measurements of type specimen, adult male, taken from well-made skin: Total length, 2,600 millimeters; tail, 930, hind foot, 270; in feet and inches, approximately 8 feet 6 inches, 3 feet and 10.6 inches, respectively. A large male measured by Colonel Roosevelt in Colorado was 8 feet in total length and weighed 227 pounds; a large female was 6 feet 9 inches in total length and weighed 124 pounds.

Distribution and habitat.—Mountain lions undoubtedly ranged over all of North Dakota, as they have over practically all of the United States, but apparently they have always been scarce in this open prairie country. There seems to be no definite record for the State east of the Missouri River Valley. Even Alexander Henry, with his bands of trappers in the Red River country from 1800 to 1808, makes no mention of them. Maximilian (Wied, 1839–1841, Bd. 2, pp. 87, 302, 1841; Bd. 1, p. 395, 1839) in 1833 says in his journal, "Der panther (*Felis concolor*) ist jetzt am Missouri selten," and apparently he did not find any trace of them himself, although their skins were frequently mentioned among the Indians at Fort Clark and other places along the Missouri River. In one place he speaks of a Minnataree chief (Yellow Bear), who had a beautiful ornamented quiver made of panther skin. Again he speaks of a party of Crow Indians visiting Fort Clark on horseback, with beautiful panther skins for saddles. Farther west he found the Blackfeet Indians also using their skins for saddle cloths, but these were obtained from the Rocky Mountains. A high price was often paid for the skins, sometimes a good horse or even several horses, and seldom less than the equivalent of $60. This may in part account for the evident scarcity of the panthers along the Missouri River Valley, which was well occupied by tribes of hunting Indians.

Audubon, in 1843, on a trip up the Missouri River to Fort Union, does not mention them, but later one collected at Fort Buford, by A. Culbertson, was deposited in the National Museum. Roosevelt (1900a, p. 48), in 1883, at his ranch on the Little Missouri River, says: "The cougar is hardly ever seen round my ranch; but toward the mountains it is very destructive both to horses and to horned cattle."

At Cannon Ball, in 1916, Beede, who had lived among the Sioux Indians at that place until thoroughly familiar with their language and traditions, told the writer that the Indians say there have been no mountain lions in that region for many years. He says they showed him the spot in some of the buttes west of the town of Cannon Ball where an Indian boy was killed and eaten by one about 100 years ago. The boy had gone out in the buttes to fast and go through the test to become a brave. On the third night some of the young men who were watching for his return heard cries and in the morning they found only his bones that had been left by the big cat. The story is fresh and vivid in their history, which has been carefully kept for generation after generation ever since.

In 1889, W. B. Mershon (1925), in his hunting trips on the Little Missouri beyond Dickinson, reported mountain lions common and killing many deer, of which he saw the remains.

In 1913, Mr. Crawford, of Sentinel Butte, told the writer that there were still a few mountain lions in the Badlands region along the Little Missouri. In the same year Jewett, while in the Killdeer Mountains, was told by some of the old settlers that the animals once did considerable damage to stock in that section, but that they were then believed to be extinct. At Goodall, in McKenzie County, in 1915, Remington Kellogg was told that several were killed by Bill Black in 1895, and that in 1899 one had killed a colt of Mr.

Goodall's. In 1914, the writer saw a fine mounted specimen of mountain lion in the Leland Hotel, at Minot, and after making inquiries, wrote to the manager, Clarence H. Parker, then at San Antonio, Tex., asking for information in regard to its capture. The following reply was received from him:

The mountain lion which you write about I killed November 20, 1902, about 25 miles down the Missouri River from Williston on the south side of the river. I had killed lots of bobcats and some lynxes along the same grounds previous to the shooting of this lion. This is the only lion ever killed by anyone in the State to my knowledge. My father, who trapped the winter of 1887 on this same ground, says there were some grizzly and silver-tip bears, lots of bobcats and lynxes, but he never saw any sign of mountain lions in that country. The day previous to killing this lion I followed the tracks of three lions, and the next day shot this big fellow. He measured 9 feet 5½ inches,[21] his weight being about 143 pounds one week after he was killed. I did not see anything of the tracks of the other two for a few days after and then ran across them farther down the river. I followed them one day, but the animals kept in the thick cover and were hard to get at. That same winter an old trapper by the name of Yankee Robinson caught another lion and later a rancher trapped the young one. Yankee Robinson made a raft and floated down the Missouri to St. Louis, taking with him the two lions. He exhibited them at the World's Fair and afterwards sold them to a show company. The winter these lions were in this point the deer were scarce, and the following winter they were very plentiful. It has always been a question as to where these lions came from, but I figured they came over from the Little Missouri River, which is a very rough country about 50 miles south of the Missouri River. I was hunting in that country the winter of 1900 and saw a few lion tracks.

At Elbowoods in 1915 Kellogg was told of a pair of mountain lions seen at Sullys Lake in 1907, but they only staid there a short time. It is not improbable that a few may still lurk in the very rough Badlands country in the western part of the State, but it is more probable that the last record for the State has been made. Much interesting information is probably still available among the early settlers in regard to these big cats, and it is very desirable that more of it be placed on record before too late.

Lynx canadensis canadensis Kerr

Canada Lynx

Inmu-chota of the Dakotas (Gilmore); *Wach* of the Arikaras (Gilmore); *Sihtachache* of the Hidatsas (Maximilian).

Lynx canadensis Kerr, Anim. Kingdom, Mammalia, p. 157, 1792.

Type locality.—Eastern Canada.

General characters.—A large cat with long legs, large feet, short tail, tasseled ears, and crested cheeks. In winter, upper parts light hoary gray; underparts whitish with dark mottling on middle of belly; whole tip of tail, edges of ears, ear tassels, and part of cheek crests black. In summer, general color brownish gray more strongly marked with black. Readily distinguished from bobcats by the big feet, long legs, and solid black tip of tail. Owing to the long legs and long fur they look much larger than the bobcat, but often are not so heavy. A large individual measured by Preble near Fort Simpson, Mackenzie, was in total length 950 millimeters; tail, 100; hind foot, 250. A large one caught in Glacier Park, Mont., weighed 28 pounds.

[21] These measurements must have been taken from the skin, as the animal was not very large, judging by the weight and the appearance of the mounted specimen.

Their fur when prime is one of the most beautiful to be found—long, light, silky, and pale blue-gray of a peculiar frosted appearance. It is often used for capes and muffs, with the long flank hairs at the edge, where they rise and fall in beautiful undulations. Choice skins are always ranked among the valuable furs.

Distribution and habitat.—Some years the Canada lynx is common over the northern part of North Dakota and occasionally one is found wherever timber and brush offer cover and hunting grounds. The main range, however, lies in the Canadian Zone north of the border and south into the mountainous districts. From 1800 to 1804, Alexander Henry (1897, pp. 184, 198, 221, 245, 259) records in his journals, among other furs brought in by trapping parties in the Red River Valley country, 9 lynx skins from Reed River, 19 from Park River, 28 from Pembina River, 13 from Turtle River, 59 from the Hair Hills, 4 from Salt River, and 15 from the Grand Forks region. These undoubtedly included a few bobcats, but were all listed under the generic name "Lynx." Charles Cavileer in his "Story of '53," gives the highest number of lynx skins taken by the fur company in a good rabbit year as 4,000. In 1839 Maximilian (Wied, 1839–1841, Bd. 1, pp. 431, 432, 1839) reported 1,000 to 2,000 lynx skins, brought in to the fur trader at Fort Union (now Buford). These were listed separately from the bobcat skins, which were given as approximately the same number. In 1850, Mr. Culbertson collected a skin at Fort Union, later recorded in Baird's Mammals of North America. In the early eighties Roosevelt (1900c, pp. 173, 192) recorded lynxes from the Little Missouri country. Clarence H. Parker, of Minot, writes under date of March 13, 1914, that previous to 1902 he had killed many bobcats and some lynxes on the Missouri River bottoms below Williston, and that his father had trapped numbers of both on the same ground in 1887.

In 1878 they were reported by Doctor McChesney (1878, p. 201) at Fort Sisseton, just below the southeastern corner of the State. In 1909 they were said to be fairly common in the Turtle Mountains, and in 1912 Eastgate reported two killed near the boundary line, though he did not see the skins and so could not be sure whether they were Canada lynxes or bobcats. A mounted specimen in the agricultural college collection, at Fargo, was killed at Arrowwood Lake, May 26, 1907. At Devils Lake in 1916, Mrs. Falger told the writer of one that had been killed just south of the lake the previous winter. At Buford, in 1910, Anthony reported a few occasionally taken in winter, and at Sentinel Butte, in 1913, Mr. Crawford said that one was occasionally taken in that part of the country. In 1913 Jewett was told by a trapper living on Spring Creek, west of Oakdale, in the Killdeer Mountains, that he had caught four lynxes during the winter of 1912–13. In 1915 Sheldon obtained from E. F. Underhill, at Cannon Ball, a skin from one that had been caught on July 25 by an Indian, Jerome Elk, about 6 miles south of town. In 1915 Kellogg reported one killed at Lakota on July 25, 1915, by Fred Hensey and Charles Trounicek, and another seen in the timber near Larimore that year. At Grafton he was told of one killed by Frank Welch, 3 miles east of there, in 1909, and of one killed 8 miles west of the town in 1911. At Towner he heard that tracks were often seen

and that in 1914 a pair had been in the timber near there. He also obtained a general report of their having been known in the country south of Devils Lake, but without any definite record, and was also told of a few seen near Elbowoods. At Kenmare and Minot, in 1913, the writer was told that many had been captured from that part of the State in 1908 and 1909, apparently when wandering in search of new hunting fields. Trappers caught numbers of them and many were brought into the taxidermist shop to be mounted.

General habits.—Over a wide range in Boreal zones, Canada lynxes are stealthy forest hunters, keeping mainly within the shelter of timber and brush, where the snowshoe rabbits are most abundant and furnish their principal game. In the open country they may be considered accidental and wandering, and they are often seen and captured, while in their brushy haunts they are rarely seen except when taken in traps. In summer their dull-gray fur melts into the brushy shadows and in winter their frost-colored coats are almost as difficult to see on the shadowy surface of the snow as those of the white rabbits. Their big woolly-bottomed feet enable them to run over the surface of the snow almost as lightly as the snowshoe rabbits, and their big, round tracks are more often mistaken for those of the mountain lion than for those of their nearer relative, the bobcat.

In the far north the Canada lynx is one of the important fur animals, and large numbers are taken in traps and snares each season, although some years they are much more abundant than others. In North Dakota, on the thin edge of their range, they are not in sufficient numbers to be of much importance, and it is, perhaps, fortunate that they are not. Their serious inroads on game birds and mammals are more than suspected, although they are so stealthy that they are rarely caught in the act.

Lynx uinta Merriam

Northern Bobcat; Mountain Bobcat; Spotted Wild Cat

Itupa-púzi of the Hidatsas; *Mantóka* of the Mandans; *Bidábaho Pusika* of the Hidatsas (all, Gilmore).

Lynx uinta Merriam, Proc. Biol. Soc. Washington, vol. 15, p. 71, 1902.

Type locality.—Bridgers Pass, Carbon County, Wyo.

General characters.—More than twice the size of the common house cat, with short tail, tasseled ears, and crested cheeks, and readily distinguished from the Canada lynx by its smaller feet and legs and by the white tip of the tail. Upper parts yellowish gray, obscurely mottled, striped, or specked; most of underparts white, heavily spotted with black or brown or throat, belly and legs; back of ears with light gray patch, bordered by black, which runs into the black-tasseled tips; tail, white below and at the extreme tip, gray above with one to three black bars near the end. The type, a large old male, measured in total length 1,030 millimeters; tail, 165; hind foot, 200; and weighed 31 pounds. Few individuals, however, are so large.

Distribution and habitat.—In the western part of the State, along the Missouri River Valley and in the Badlands, the northern bobcats are fairly common, but good specimens are lacking to show positively which form is represented. A few mounted specimens seen at Williston and some skins at ranches, as well as specimens collected in eastern Montana, indicate the large, yellow-spotted *uinta* as the bobcat of this region. At Buford, in 1833, Maximilian

(Wied, 1839–1841, Bd. 1, pp. 431–432, 1839) recorded 1,000 to 2,000 skins of bobcats among the furs brought into the trading post in the course of a year. In 1910 Anthony was told by the trappers there that they were still a part of the yearly catch. At Williston, in 1913, the writer was told that there were a few, and the same year Jewett reported four caught by one trapper on Magpie Creek, a branch of the Little Missouri River, near where, in 1883, Roosevelt (1919, p. 106) recorded a raid on his chicken house by bobcats. On a trip down the Missouri River in 1915 Kellogg reported three killed at Goodall two years before by Frank Crane; he saw the skin of one which had been killed near Elbowoods and made into a rug, and was told of one that had been killed at Stanton five years before, and near Sather of one that had been seen a few years before. Sheldon and the writer obtained reports of northern bobcats being at Cannon Ball, but neither of them could get any specimens or definite records. One was killed at Parkin in 1915 and sold to some taxidermist, but the writer could not trace it the next year. On the North Dakota National Forest, about 25 miles south of Medora, in 1913, bobcat tracks were found common along the Little Missouri River and in the sandy trails of the Badlands gulches of the national forest. Two years later Sheldon found tracks fairly common on Deep Creek along the southern border of the forest, but was unable to obtain specimens. A record (Bailey, 1888, p. 432) obtained from the Turtle Mountains in 1887, is now considered doubtful, as many of the residents do not distinguish between the bobcat and the Canada lynx. The rough Badlands country and the brushy bottoms of the western part of the State furnish excellent hunting grounds, cover, and protection to these cats, which are rarely found in the open country of the prairie.

General habits.—Catlike, the bobcats are silent, stealthy hunters, always prowling in search of rabbits, ground squirrels, pocket gophers, mice, or any other small game that comes handy, pouncing upon it in the brush or giving chase when necessary. Unfortunately they do not confine their hunting to such small game, but include game birds, poultry, and the young and often adults of many of the species of large game. In places they become almost as destructive as the coyote to the herds of domestic sheep, killing not only lambs but adults freely, and undoubtedly taking many fawns and deer where they are to be obtained. Fortunately they are easily hunted with dogs and are quickly treed or run to cover, so that their numbers are readily controlled in a well-settled country. They are also easily caught in traps, but their fur is of relatively low value, although when prime it is full and soft and makes very light and warm coats and clothing. They are not likely to survive much longer in this open country nor to prove serious pests.

Lynx rufus rufus (Schreber)

Eastern Bobcat; Wild Cat

Felis rufa Schreber, Säugthiere, pl. 109b, 1777.

Type locality.—New York State.

General characters.—Slightly smaller than the Rocky Mountain form, darker, more uniformly gray, less strongly marked with spots and stripes. In summer rusty instead of yellowish gray. Measurements of large male from Greenbank, W. Va.: Total length, 915 millimeters; tail, 153; hind foot, 178.

In eastern North Dakota bobcats are scarce and the only specimen seen is one mounted in the Williams collection at Grafton, killed at Minto, January 11, 1908. It is an adult in full fresh winter coat, plain gray with little trace of spotting, and should certainly be referred to the eastern form. Other rather indefinite records of bobcats from Grand Forks County, Fargo, and Hankinson probably represent the same form, as may also those reported from Stump Lake, McHenry, and Towner.

Family CANIDAE; Dogs, Wolves, and Foxes

Canis mexicanus nubilus Say

Gray Wolf; Buffalo Wolf; Lobo; Loafer

Shu^{n}g-tokeca of the Dakotas (Gilmore); *Harrata* of the Mandans (Will); *Tshesha* of the Hidatsas (Matthews); *Stshirita-kusa* of the Arikaras (Gilmore).

Canis nubilus Say, Long's Exped. Rocky Mountains, vol. 1, p. 169, 1823.

Type locality.—Engineer Cantonment, near present town of Blair, Nebr.

General characters.—The size of a very large dog with heavier, more powerful teeth than any dog; ears, erect and pointed; mane, over shoulders, long, and capelike; tail, bushy with black tip; color normally light gray, produced by the black tips of the long hairs, through which the white under color is more or less conspicuous. The black and white varies in different individuals, in extreme cases, from entirely black to entirely white. Measurements of adult male: Total length 1,680 millimeters; tail, 480; hind foot, 320[22]; in inches 66, 18.9, 12.6, respectively; width of nose pad in adults, approximately 1¼ inches; width of heel pad of front foot, 1½ inches; greatest diameter of canine tooth at base, ½ inch; average weight of full-grown males approximately 100 pounds, but extremely large individuals as heavy as 150 pounds have been recorded; females average considerably lighter.

Distribution, habitat, and abundance.—The group of large wolves, which originally covered almost the whole of North America, contains a number of well-marked geographic forms, but until the present time the areas occupied by the different forms have not been fully worked out. The species which originally covered the whole of North Dakota and at present are represented in the western part of the State can undoubtedly be referred to typical *nubilus*, the large, light-colored, northern plains wolf. According to the records of early explorers wolves were extremely abundant over all of North Dakota, but after the disappearance of the buffalo they were poisoned and trapped in such great numbers that they rapidly disappeared from most of their old haunts. From 1800 to 1808 Alexander Henry (1897, pp. 184, 198, 221, 245, 259, 281, 422, 440) recorded in his journal the number of skins brought in each year by his trappers along the Red River Valley, from Pembina and the Pembina Hills to Grand Forks, among them being the following numbers of wolfskins: In 1801, 194; 1802, 190; 1803, 582; 1804, 275; 1805, 563; 1806, 843; 1807, 127; and 1808, 68. These figures undoubtedly include coyotes as well as wolves, as no distinction was made

[22] Measurements from a large black male collected by E. A. Preble at Fort Simpson, on the Mackenzie River, in 1903. An old pure-white female from the Missouri River, recorded by Maximilian in 1833, measured in total length 56.5 inches, tail 14.5 (17 to tip of hairs). A large male from near Arvada, Wyo., measured by H. P. Williams, was 67, 15, and 12 inches.

in his records, but apparently in the buffalo days the large wolves were more abundant than the coyotes. Wolves were frequently mentioned in his journal on his trips back and forth between trappers' camps and the stations over which he had supervision. On February 28, 1801, he (Henry, 1897, pp. 171, 90, 86, 89, 175, 133) says, "Wolves * * * are very numerous, feeding on the buffalo carcasses that lie in every direction. Wolves are numerous and insolent at mouth of Park River. Large droves of wolves seen. Wolves frequently seen and not much afraid—one shot within a few yards. Indians were 'digging young wolves out of their holes' on September 6." On April 9 he says, "one of the men found six young wolves in a hole in the ground; another brought in three young on the 7th, which were very tame and kept for the train." On November 2, 1800, at his winter quarters near where Grafton now stands, he wrote in his journal:

> Last night the wolves were very troublesome; they kept up a terrible howling about the fort, and even attempted to enter Maymiutch's tent. A large white one came boldly into the door and was advancing toward a young child, when he was shot dead. Some of them are very audacious. I have known them to follow people for several days, attempt to seize a person or a dog, and to be kept off only by firearms. It does not appear that hunger makes them so ferocious, as they have been known to pass carcasses of animals, which they might have eaten to their fill, but they would not touch flesh; their object seeming to be that of biting. The Canadians swear that these are mad wolves, and are much afraid of them.

On March 5, 1801, at Pembina, Henry (1897, pp. 194, 322) says: "A large wolf came into my tent three times, and always escaped a shot. Next day, while hunting, I found him dead about a mile from the fort; he was very lean and covered with scabs."

On his trip to the Missouri River and the Mandan villages in 1806, on the high bluffs east of the Missouri, opposite the mouth of the Knife River, Henry found deep pits which the Indians had dug for catching wolves and foxes. Some were 10 feet deep and 30 feet wide below, but only as wide as the path above and about 5 feet long. They were made in the trails where the wolves were in the habit of running and the opening was covered over with dry grass. Every morning, he says, these pits were found to contain some of the animals.

On October 20, 1804, Lewis and Clark (1893, pp. 174, 280) on their journey up the Missouri recorded great numbers of buffalo on the flats just below Bismarck with their usual attendants, "the wolves, which follow their movements and feed upon those which die by accident or which are too poor to keep pace with the herd." Later they saw the wolves pursue and catch a buffalo calf that was not able to keep up with the herd. In many places on their journey up the river they spoke of the abundance of wolves.

On June 23, 1811, Brackenridge (1816, pp. 114–115, 135) while near the spot where Mandan now stands wrote:

> Great numbers of wolves were now seen in every direction; we could hardly go 40 yards from the buffaloe, before a half a dozen would shew themselves. It was amusing to see them peeping over hillocks, while we pelted them with stones.

Of the dogs at the Arikara Indian village he said:

> The dogs, of which each family has 30 or 40, pretended to make a show of fierceness, but on the least threat, ran off. They are of different sizes and

colors. A number are fattened on purpose to eat, others are used for drawing their baggage. It is nothing more than the domesticated wolf.

In 1833 Maximilian (Wied, 1839–1841, Bd. 2, pp. 86, 55, 279, 1841) reported the varied wolf (*Canis variabilis*) very common along the whole of the upper Missouri, and said that it varied in color from wolf gray to pure white. Again, he says:

I obtained many wolves from the quite white to the perfectly gray common variety which the Indians sold for two rolls of tobacco apiece.

On the night of November 6, 1833, just below the mouth of the Little Missouri, while camped near the bank of the river, he wrote:

The night was dark and the loud howling of the wolves was our never-ceasing music.

On the previous night, he said:

Numerous tracks of animals of all kinds, elk, bears, and wolves were observed; wolves prowl around us at no great distance, and at 10 o'clock, when I had the watch, they came between our bright fire and the boat, which was only 40 paces distant, being attracted by the smell of meat. In winter these animals are nearly famished and extremely lean. They closely follow the herds of buffalo, and many sick, young, or weak animals become their easy prey; and when the hunters are abroad, there is a rich harvest for the wolves. They even bite and devour each other, yet they did not meddle with the dead wolves we left on the prairie; possibly they might not have been so ravenously hungry just then. They distinguish the report of a gun so well that they hasten to the spot almost immediately after the shot has been fired. The same is the case with the ravens, and the Indian hunters affirm that the wolves watch these birds in order to ascertain the direction in which the prey is to be found. If a poor animal has only been wounded, they are on the alert, and instantly pursue it and it inevitably becomes their prey. In cold winters they are often so bold that they come into the villages and approach the people's dwellings.

He (Wied, 1839–1841, Bd. 2, pp. 55, 86, 259, 261, 294, 1841) also spoke of the wolf pits in which the Indians were in the habit of trapping these animals. At Fort Clark, in November, 1833, he writes:

One of the Indians was afraid to proceed on this path because he suspected a wolf pit or trap might be in the way, but the patron, or chief, wishing to shame him went before and actually fell into such a pit with sharpened sticks at the bottom, by which he was killed.

Again, he says:

We had here an opportunity of seeing the wolf pits in which the Indians fixed sharp sticks and the hole is so covered with brushwood, hay or dry grass, that it can not be perceived.

In January, 1834, while he was wintering with the Mandans at Fort Clark, Maximilian tells us that during the extreme cold of winter a wolf attacked three Indian women, who fought it off with their hatchets. The Indian dogs, however, proved to be more troublesome and dangerous than the wolves. At Fort Clark, Maximilian (Wied, 1839–1841, Bd. 1, p. 396, 1839) found great numbers of dogs in the Mandan village on his arrival, January 18, 1833, and 500 or 600 in the Crow Camp of 70 tepees near by. These, he says, were wolflike, but of all colors, and it was with difficulty they were kept off by throwing stones.

In 1843 Audubon (1897, pp. 20, 24, 26, 159, 160) found the wolves still abundant about Fort Buford and along the Upper Missouri

River. He saw and heard many at various points along the river, both from the steamer's deck and from his camps and hunting trips on shore, and a number were shot on the way up the river. At Fort Clark on June 8, he wrote in his journal:

> Bell fired at a bird, and a large wolf immediately made its appearance. This is always the case in this country; when you shoot an animal and hide yourself, you may see, in less than half an hour from 10 to 30 of these hungry rascals around the carcass, and have fine fun shooting at them.

On June 10, he said:

> Two buffaloes were shot, and at the report of the guns, two wolves made their appearance.

Again he wrote:

> These animals are extremely abundant on the Missouri River and in adjacent country. Some days we saw from 12 to 25 wolves.

Just below the mouth of Cannonball River he reported eight wolves in one gang, four of them white. At Fort Union, where Audubon remained during the summer of 1843, the wolves were a daily source of interest not only on his hunting trips but at the fort, where they could be seen early in the morning and even during the daytime, prowling about or sneaking close around the buildings for any food that could be obtained. Many were shot, run down with horses, or caught in traps in the immediate vicinity of the trading post. He noted a great variety of colors among the wolves and it seems probable that they were more or less mixed with the wolflike dogs of the Indians and Canadian trappers.

In 1856, Lieut. G. K. Warren collected a large series of wolf skulls at Fort Union, which are now in the United States National Museum. This series includes some that evidently are not full-blooded wolf, as both the form of the skull and the doglike molar teeth indicate hybrid animals. Many stories have been current of the ferocity of these hybrid wolf-dogs, and it is not improbable that their tameness and lack of fear of man, even in Audubon's time, was in part due to their mixture with domestic animals. At the present time and for at least 30 years past, wolves have been among the most wary and rarely seen of our large carnivores. Where most abundant they are rarely seen, even by hunters and trappers, and can be caught in traps by only the most skilful trappers.

Elliott Coues (1875, p. 153), in his trip across the northern part of North Dakota in 1873, said that wolves did not appear to be numerous in summer, at least in that region, and Doctor Allen (1875, p. 37) reported them rare east of the Little Missouri River. In an old number of the Fargo Record, is found a note to the effect that in 1858 George W. Northrup, while trapping on the south side of Devils Lake, poisoned 700 wolves and obtained many beavers, otters, foxes, and minks. In some notes from Valley City, furnished by Morris J. Kernall, is one of John Hailand, who settled there in 1878. At that time he says timber wolves were seen occasionally, though they were not numerous. He saw one killed there that he thought must have weighed more than 100 pounds.

In the early eighties, Roosevelt (1900c, p. 66), on returning to the house at his ranch on the Little Missouri River when it had

been closed for many months, found in the dusty trails in the ravines, many tracks of the timber wolves. "Once or twice in the late evening we listened to their savage and melancholy howling." Even then the great numbers of wolves had gone with the buffalo either to the skin market or farther west. In 1894 Roosevelt sent the skulls of two old and four young wolves, killed 20 miles south of Medora, to the Biological Survey.

In 1887 the wolves were practically gone from most of the country across the State, and even at Fort Buford, which was then the terminus of the Great Northern Railway, they were very scarce. In 1910 Anthony was told that they were still found in the country south of the river, but no definite records were obtained. In 1913, at Minot, the writer was told that a few wolves were still to be found in that part of the country, and the same year Jewett reported them rare in the Killdeer Mountains, but all too plentiful in the Badlands section along the Little Missouri from Quinion to Medora, and he was told of several colts that had been killed by them during the summer. In the vicinity of the former North Dakota National Forest it was stated that the large wolves were then getting scarce but that a few years previously they had killed many calves. The same year at Wade, on the Cannonball River, Bell reported a few, although they had been pretty thoroughly trapped out by professional wolf trappers employed for the purpose by the stockmen's association. In 1915, Kellog reported one wolf that had been followed for three days by a trapper near Warwick, south of Devils Lake. At Elbowoods he saw the skin of one that had been killed on the Indian Reservation, where a drove of six were said to be still at large. Farther down, at Painted Woods, he saw two cross the river and a few tracks on the east side. At Cannon Ball, in 1916, the writer was told that a few large wolves were still in the country a little farther west, but that the great numbers of the animals had disappeared with the buffalo. Doctor Beede told the writer that the old Indians, in talking of hunting trips when the buffalo were still abundant, claim that three wolves would pull down and kill any buffalo, even an old bull.

On January 1, 1922, a large wolf was shot by Mr. Bennett near Harwood, about 10 miles north of Fargo, and the skin, which was said to be 7½ feet long, was tanned for a rug and kept by the hunter. The wolf had been tracked for two days by dogs and hunters from the vicinity of Breckenridge, Minn., but was shot on the North Dakota side of the river.

At the present time there are probably a few wolves left in the least-settled parts of the rough Badlands region west of the Missouri River, but it is to be hoped that a very few years will see the last of these destructive animals in this State.

General habits.—Few animals show greater intelligence and resourcefulness than wolves in adapting themselves to such conditions of climate and environment as will afford them a sufficient supply of food. From the Arctic barrens to the steaming swamps of Florida they have been at home wherever game was abundant, but nowhere more numerous than over the Plains in the days of the great buffalo herds. In habits they are hunters and rovers and often to a con-

siderable extent migratory, although in their home life they are domestic and as closely restricted to their home grounds as any carnivore could well be. The breeding dens, which in this prairie country usually consist of burrows in banks and sidehills, are the home centers from which the faithful parents make regular excursions for food until the young are old enough to leave the den and accompany them on hunting trips. Then they are freebooters until the next breeding season, when the adults generally endeavor again to occupy the old den or dig another in its vicinity. The fact that the old wolves pair for the breeding season is thoroughly proved, and there is much evidence to indicate that the pairing is for life or for as long as the two are able to keep together. While the young are small and as long as they remain in the den, the male is always on guard or foraging for food to bring home for its mate and young, and as soon as the young leave the den it leads the pack and apparently does much of the killing. The wolf pack usually consists of a family, the two adults, and 6 to 10 young of the year, but there are apparently authentic accounts of larger wolf packs where presumably two or more families have temporarily joined.

Breeding habits.—Wolves do not breed until 2 years old, but the family pack keeps together until about midwinter or later. The young are generally born in March, although there are records of pups late in February, and a few late litters are born in April. The young vary normally from 6 to 10, but there are records of 11, 12, and 13 in a den. At first they are dull black in color, but by the time they are a month old and begin to appear at the entrance of the den they have faded to a dull clay color or yellow gray. Usually they do not leave the den until July or August, when nearly half grown and able to accompany their parents on hunting trips and take care of themselves in case of emergency. A pack of growing, hungry young wolves in fall and early winter requires a large supply of meat which is obtainable only from large game or domestic stock.

Economic status.—Apparently a considerable time intervened between the destruction of the buffalo herds and the introduction of domestic cattle in sufficient abundance to provide an easy food supply for the wolves. This scarcity of food, together with the activity of those trapping and poisoning wolves for their skins, reduced the number of wolves and made the cattle industry possible over most of the open plains country. The last of the wolves, however, took up their residence in the roughest and least occupied sections, where they are extremely difficult to dislodge, and with their natural intelligence and long years' experience with man and his traps, guns, and poisons, they have become one of the most difficult animals to capture or destroy. In some sections of the country they had shown their ability actually to increase in the face of all human efforts and inventions for their destruction until the recent concerted efforts of Federal and State wolf hunters proved too much for them. One wolf was known to kill 125 head of cattle in 10 months, valued at the time at $5,000. In Custer County, of the adjoining State of South Dakota, one wolf killed $25,000 worth of cattle in seven years. Although it is probable that

the wolves can never be exterminated over much of the northern forest area of the continent, it has been clearly demonstrated that they can be practically eliminated from the open stock range of the Western States.

Canis latrans latrans Say

Northern Coyote; Brush Wolf

Mes-ta-chá-gan-es of the Ojibways (Seton)

Canis latrans Say, Long's Exped. Rocky Mountains, vol. 1, p. 168, 1823.

Type locality.—Engineer Cantonment, near Blair, Washington County, Nebr.

General characters.—Largest of the coyotes; ears, erect and pointed; conspicuous capelike mane over shoulders; fur, long and soft in winter, short and harsh in summer; color, light brownish-gray, darker and more fulvous in summer; underparts, whitish, tail tipped with black. Measurements of female from Elk River, Minn.: Total length, 1,219 millimeters; tail, 394; hind foot, 179; weight of adult male from Beemer, Nebr., 36 pounds; of one from Fort Dodge, Iowa, 40 pounds.

Distribution and habitat.—In the absence of specimens from the type region of *Canis latrans* it has been customary to refer to this original form of the group, the large brush wolves of Iowa, Wisconsin, and Minnesota. In 1897 Merriam made a study of the coyotes with the material then available, which was not sufficient to establish the matter of intergradation between *latrans* and *nebracensis* of the plains region farther west. The great quantity of material since collected seems to establish this connection, but the definite outlines of areas occupied by each form remains to be worked out in a comprehensive study of the group as a whole. Specimens from near Grand Forks and Grafton indicate that these brush wolves come into eastern North Dakota, but how far west they extend is not at present known. The wolf skins collected by Alexander Henry and his trappers along the Red River Valley from 1800 to 1808 probably included many of these large coyotes or brush wolves.

At Hankinson in 1912 there were said to be a few coyotes, but they were seen only at rare intervals. In the region about Fargo the same year they were said to be very scarce. At Wahpeton in 1915 Kellogg reported them as common, and was told of a litter of five dug out of a den 3½ miles south of town on May 30. At Larimore, in Grand Forks County, he reported them as fairly plentiful, and near Grand Forks he reported one killed during the previous winter and a bunch of six seen at one time; at Grafton a few killed each winter, and at Drayton, Pembina County, as not very common, but a few killed each winter. Near Grand Forks during the winter of 1918–19 they were reported as unusually common and destructive to stock. At Grafton H. V. Williams, in a letter of March 21, 1919, says that several were killed during the winter. In the Turtle Mountain region they have been reported as common by Williams and Eastgate, and while there is some doubt as to which form occurs there, in the absence of specimens the writer is inclined to consider them as probably the large northern form. Some of the residents describe them as a large coyote or small wolf and others says that they are small and pale, but the relative characters can not be reliably determined without actual specimens for comparison. A skull of a small female collected at Valley City by Morris J. Kernall in 1913 is apparently intermediate between *latrans* and *nebracensis*,

as it does not show decided characters of either. Coyotes are still found over practically all the State, but the specimens from the western part seem to be all referable to the smaller, paler *nebracensis*.

General habits.—These large coyotes generally inhabit a partly timbered, partly open country, but readily adapt themselves to either type where game or livestock furnish a satisfactory food supply. In habits they differ little from other species of coyotes except in adapting themselves more readily to forest conditions and in depending more on game and livestock for their food. They are most persistent in the destruction of sheep and calves, and have long rendered impracticable the keeping of small herds of sheep on farms over much of their range. Just how much they have had to do with the destruction of deer and other large game will never be known.

Canis latrans nebracensis Merriam

Plains Coyote; Prairie Wolf

(Pl. 18, fig. 1)

Mica or *Micaksica* of the Dakotas (Riggs and Williamson); Mĭkasi of the Omahas (Gilmore); *Sehéke* of the Mandans (Will); *Mótsa* of the Hidatsas (Matthews); *Stshirits pukatsh* of the Arikaras (Gilmore).

Canis pallidus Merriam, Proc. Biol. Soc. Washington, vol. 11, p. 24, 1897.
Canis nebracensis Merriam, Science, vol. 8 (n. s.), p. 782, 1898. (Substituted for *pallidus*, which was preoccupied.)

Type locality.—Johnstown, Brown County, Nebr.

General characters.—Slightly smaller than *latrans*, with lighter dentition and paler colors; upper parts, light buffy gray, back of ears buffy; tail with black tip; underparts whitish. Unfortunately there are no measurements or weights available from the type region, nor of any specimens that may be considered typical of this form. One measured by Kellogg at Fort Totten was as follows: Total length, 1,193 millimeters; tail, 380; hind foot, 205, but the specimen was not obtained. In distinguishing a coyote from a wolf, the nose, foot, and tooth measurements are always sufficient. In the coyote the nose pad measures approximately seven-eighths of an inch wide, the heel pad of front foot, 1 inch wide, and the greatest diameter of canine tooth at base, 0.3 inch.

Distribution and habitat.—At the present time plains coyotes are distributed over practically all of North Dakota and are especially common over the western half of the State. Apparently they have held their own and even increased since the destruction of game herds, for filling the country with domestic livestock and poultry gives them a food supply often more easily obtained than the original wild game. In the early days of trapping and exploration, little mention is made of coyotes, and apparently they were less common or less conspicuous than the large wolves. Alexander Henry, in the beginning of the eighteenth century, does not mention them, but possibly he did not discriminate between them and the larger wolves. Lewis and Clark, in 1805, rarely mentioned them on their trip up the Missouri River, while they frequently spoke of the wolves seen and killed. On April 24, 1805, at a point about 13 miles above the mouth of the Muddy River (1893, p. 280), they spoke of the hunters returning "with four deer, two elk, and some young wolves of the small kind." In 1833 Maximilian (Wied, 1839–

1841, Bd. 2, pp. 97, 98, 278, 307, 1841) frequently refers to them and gives the Indian names used by the Mandans, Minnetarees, Arikarees, Dakotas, and Blackfeet. He says, "The prairie wolf is numerous over the prairies and in winter comes occasionally into the Indian villages to pick up whatever he can in the way of refuse." Again, in December, he writes, "During the night we heard the barking of the prairie wolves (*Canis latrans* Say) which prowled about looking for any remains of provisions." On February 26, 1834, he notes, "The prairie wolves now prowl about in couples."

In 1843 Audubon (1897, p. 160), on his trip up the Missouri River to Fort Union, made little mention of coyotes, but reported one seen at Fort Union and one shot by Harris, on September 3, below the mouth of the Cannonball River. A series of skulls from the upper Missouri River in North Dakota, collected by F. V. Hayden in 1850, are still in the National Museum collection. Roosevelt (1900c, p. 63), at one of his hunting camps in the Little Missouri River country, in the eighties, enjoyed the "wild, mournful wailing of the coyotes. They were very plentiful round this camp; before sunrise and after sundown they called unceasingly." At Valley City, Major White told Morris J. Kernall that the coyotes were more abundant there in 1882 than in 1913, and John Hailand, who settled at Valley City in 1878, told him that they were then more numerous than in 1913. In 1887 coyotes were reported as common at many localities over the State, and in 1893 Doctor Fisher, in stopping off at various localities from Bismarck to Fargo, reported them more or less common at all places visited. In 1912 Eastgate reported them at Tolna, on the south side of Stump Lake, along the Sheyenne River, 30 miles north of Valley City, in the sand hills near Kathryn in Barnes County, and that a few were shot every winter near Lisbon, in Ransom County, where they did considerable damage to sheep and poultry.

In 1909 the writer found them common about Marmarth, in the southwestern corner of the State, and in 1912 was told that at Tolna one man had brought in 50 scalps during the winter for the bounty, and that a den of young had been found a year before near Stump Lake. At Kenmare, in 1913, they were said to be fairly common over that general region. At Minot, Mr. Booth said that they had been scarce in that vicinity until the sheep industry developed in 1890, when they became unusually numerous. Since the country has settled up, however, few sheep are kept and the coyotes are becoming comparatively scarce. At Crosby the writer was told that they were scarce, but that a man living there, hunting with a couple of wolf hounds, occasionally brought in one. At Williston and Buford, in the same year, they were said to be fairly common and a considerable number of tracks were seen. In the Killdeer Mountains, in 1913, Jewett reported them in numbers over the entire region, as also along the Little Missouri River south to Medora. He also found them common about Fort Clark, where they were heard barking nearly every evening in July, and their tracks were found in the mud along the river flats. At Mandan they were reported common, and a few skins were seen. At Glen Ullin, in July, Jewett heard them barking near the town. At Sentinel Butte he found them fairly numerous all over the region, but doing little damage on the farms, which were mainly devoted to raising grain. On June

5 he located a den containing young in a rocky slope on the side of Sentinel Butte, but was unable to get the animals, which were then well grown. On the former North Dakota National Forest, about 25 miles south of Medora, in 1913, coyotes were found abundant, as also along the Little Missouri River near there, where their tracks were seen and the animals heard barking and howling every night. At Wade, on the Cannonball River, in August, 1913, W. B. Bell reported them abundant.

In 1915, Sheldon reported them as fairly common at Cannon Ball, Dawson, and Ellendale, and Kellogg reported them at Tokio, on the Sullys Hill National Park, at Towner, Grinnell, and all the way down the Missouri River to Bismarck. At a point several miles above Shell Village he saw six at one time running up a steep slope of Badlands. Near Elbowoods he saw five one evening, and while camping heard them every evening at dusk on both sides of the river. At Elbowoods he saw one looking at him through the willows, and at Stanton found them hunting rabbits, which they dug from the burrows. Near Sather he reported them common and doing considerable damage by killing turkeys at the farms. At Cannon Ball, in 1916, Mr. Underhill said that they were common and had troubled him a good deal by killing his chickens at his farm on the river flats. At Devils Lake in June, 1916, the writer found coyotes common in the timber of Sullys Hill Park and all around the lake. Mrs. Falger told him that they howled every night around the dump heaps near the Chautauqua grounds, and their tracks were found everywhere on the sandy patches. On the south side of the lake they were common in and around the park, which was then being fenced.

General habits.—Unlike the large wolves, coyotes adapt themselves readily to conditions of civilization, and if a food supply is available they seem to thrive as well in a thickly settled country as on the open range. They are always ready to match their wits against dogs, traps, and guns, and usually have no trouble in holding their own and increasing if enough poultry, sheep, pigs, young stock, and dead animals can be found for food. They are not entirely dependent on such food, however, as they will get along comfortably on ground squirrels, pocket gophers, mice, rabbits, game birds, eggs, grasshoppers, and fruit. They are sly and to some extent foxlike in their habits, will come close to buildings at night, and usually are not permanently deterred by being chased away by dogs.

Breeding habits.—Coyotes are prolific breeders, usually producing five to nine young in a litter. They often live in close proximity to farms and ranches, raising their young successfully, unless hunted with unusual persistence by one familiar with their habits. A few miles south of Ellendale, in the spring of 1915, Sheldon reported nine young captured by a farmer. On May 12, 1913, an old coyote and nine pups with eyes not yet open, were taken from a den about 20 miles west of Valley City. The old one was killed and two of the pups were kept alive in the Valley City Normal School grounds, where they were seen when they were about half grown. Two of the young and the skull of the mother were saved for specimens by Morris J. Kernall.

The young are born in burrows or cavities among rocks or in the sides of Badlands buttes, where they find abundant safe retreats until old enough to venture out in pursuit of game under the leadership of their parents. At Parkin, a little way up the Cannonball River, in June, the writer found a family of nearly half-grown pups living in the brushy gulches on the side of one of the big buttes just east of town. While exploring the sides of the butte for chipmunks, the writer suspected the presence of young when one of the old coyotes began barking and howling in plain view at midday in the open valley. He soon found the tracks of the half-grown pups in one of the rocky gulches and saw where they had wallowed down the grass under the brush near the den. The anxious parents followed and would appear on first one side and then the other, at every turn doing their best to attract attention and lead away from the family.

During the latter part of summer and the fall, coyotes usually hunt in family parties, but by the beginning of winter they have mainly scattered out singly or in pairs. Unlike the wolves, they seem to begin breeding when 1 year old, and, late in January, when the mating season begins, they are usually found in pairs.

Economic status.—During the past coyotes have not reduced the number of injurious rodents sufficiently to protect the crops, and it has become necessary to resort to artificial means instead of depending upon coyotes as a natural aid. Hence their value in this respect may be overestimated. On the other hand, their destruction of livestock and game is in many localities so great as to make the raising of small herds of sheep impracticable, except where protected by wolf-proof fences, while the loss of other stock, poultry, and game which they destroy over the State, is very serious. In States like Montana, Wyoming, Colorado, and New Mexico, where stock raising is one of the most important industries, the annual loss from coyotes is estimated at hundreds of thousands of dollars each year. The bounty system has long ago proved worse than ineffective, but the present system of cooperation between the State and the Federal authorities in employing expert trappers promises satisfactory results. The full cooperation of residents throughout the coyote-infested regions is of the utmost importance in keeping down the numbers of the pests. The dens should be located and the young captured whenever possible. It is not probable that coyotes will ever be exterminated over the whole country, but their control over extensive areas can certainly be predicted.

Vulpes fulva regalis Merriam

Yellow-red Fox

(Pl. 17, fig. 1)

Ehchokuschi of the Hidatsas (Maximilian); *Hirútt-sa* of the Mandans (Maximilian); *Hirutse* (Will).

Vulpes regalis Merriam, Proc. Washington Acad. Sci., vol. 2, p. 672, 1900.

Type locality.—Elk River, Sherburne County, Minn.

General characters.—Slightly larger than the eastern red fox; slender and light, with erect, sharp ears, slender muzzle, and long tail. Winter fur, very long, full, and soft; tail, very large and fluffy; summer fur, short and

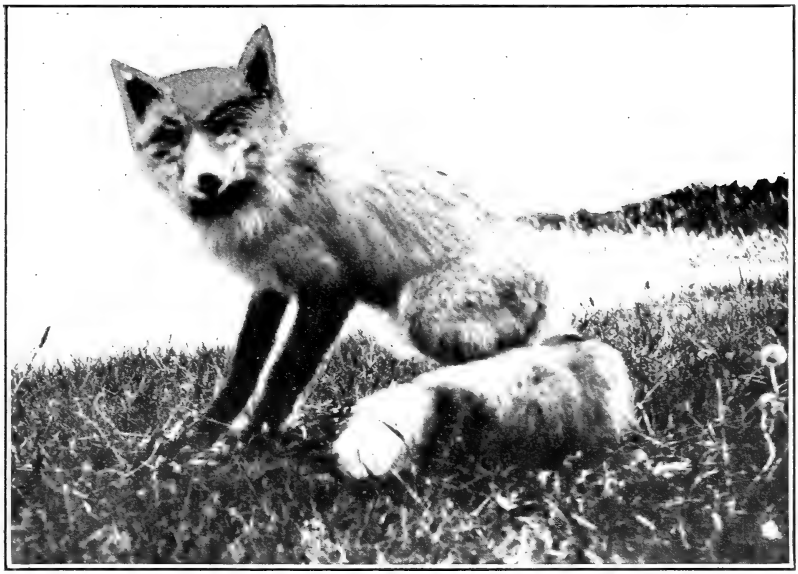

FIG. 1.—YELLOW-RED FOX (VULPES FULVA REGALIS)

Mounted in Agricultural College collection. Much reduced

FIG. 2.—BLACK-FOOTED FERRET (MUSTELA NIGRIPES)

Mounted specimen from Fort Rice. Much reduced

FIG. 3.—VARYING HARE, OR SNOWSHOE RABBIT (LEPUS AMERICANUS AMERICANUS)

Mounted specimen in winter coat. Much reduced

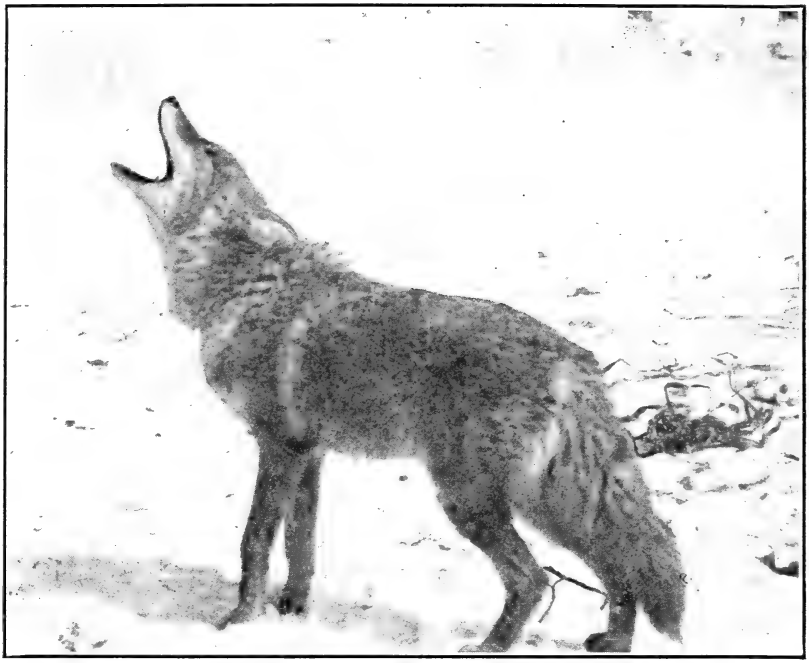

FIG. 1.—PLAINS COYOTE (CANIS LATRANS NEBRACENSIS)

A captive at Mandan

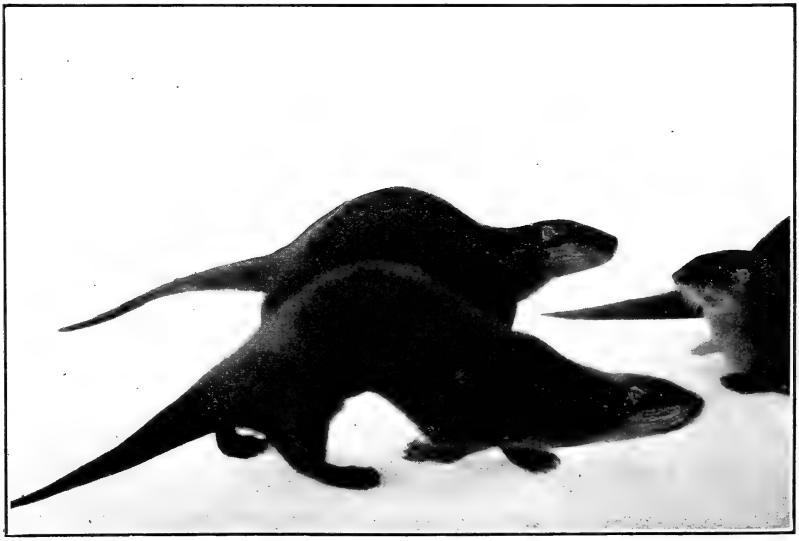

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FIG. 2.—OTTERS (LUTRA CANADENSIS CANADENSIS)

Captives in National Zoological Park, Washington, D. C.

thin; tail, slender. Color in winter, rich orange yellow, paler and more straw yellow over face, back, sides, and legs; underparts whitish, tip of tail always white, back of ears, feet, and ankles black. In summer coat darker, richer orange. Young blackish, soon fading to yellowish brown or yellowish gray, with tip of tail white. Measurements of type of species, adult male from Elk River, Minn.: Total length, 1,117 millimeters; tail, 420; hind foot, 170. Of adult female collected at Oakes, N. Dak.: Total length, 990 millimeters; tail, 381; hind foot, 165. Seton (1909, vol 2, p. 707) gives the weight of one taken at Carberry, Manitoba, as 10 pounds. The darker forms of this fox, called cross-fox, silver fox, and black fox, seem to be of rare occurrence in the prairie country, but they are merely different degrees of melanism occasionally found among red foxes, and are more common farther north and west.

Distribution and habitat.—The group of red foxes has not been sufficiently worked up to show the limits of range of the various forms, but all of the specimens available from North Dakota seem to be referable to the large yellow-red fox described from southern Minnesota, and apparently covering a great part of the northern Plains country. While probably never very numerous over the State, foxes were evidently much more so in the earlier trapping days than at present. In 1801 Alexander Henry (1897, pp. 184, 198, 221, 245, 259, 281, 422, 440) reported, among other furs taken in the Red River Valley, 82 red-fox skins from Reed River and 102 from Park River; in 1802, 20 from Grand Forks and 29 from the Hair Hills; 1803, 23 from Pembina River, 61 from Turtle River, and 78 from the Hair Hills; 1804, 8 from Grand Forks, 38 from Hair Hills, 4 from Park River, and 12 from Pembina River. In 1805 he reported 56 red, cross, and silver foxes from the Hair Hills, 91 from Salt River, and 31 from Pembina River; in 1806, 171 from Grand Forks, 256 from Pembina River; in 1807, 34 from Pembina River; in 1808, 2 from the Hair Hills, 6 from Grand Forks, and 28 from Pembina River. In 1833 Maximilian (Wied, 1839–1841, Bd. 1, pp. 431–432, 1839) stated that about 2,000 red-fox skins, 200 to 300 cross foxes, and 20 to 30 silver foxes were brought annually to the fur traders at Fort Union. On February 15, 1805, Lewis and Clark (1893, p. 235) mentioned a large red fox killed at their winter quarters among the Mandans at what is now Fort Clark.

Maximilian (Wied, 1839–1841, Bd. 2, pp. 86–87, 98, 1841), in 1833, while at Fort Clark, wrote in his journal: "The red fox (*Canis fulvus*) is very handsome and at the same time common, though by no means so numerous as the wolves." He compared many specimens and found them in general very similar, although "the fur dealers make a different species out of every slight variation." Generally they are lighter and brighter colored than the European fox and from their beautiful fur might well be called "goldfuchs." He further says: "The black or silver fox (*Canis argentatus*) is met with 60 or 70 miles farther north, but it is occasionally seen here, and its skin is highly prized, being sold for $60."

In 1856 F. V. Hayden (1875, p. 91) collected three skulls of these foxes from Fort Union, and reported the different varieties as cross, silver, and black, which he said were well known among the traders "and are much valued. A skin of the Silver variety . . . selling for $100."

At Valley City John Hailand told Morris J. Kernall that red foxes were numerous when he came there in 1878. In 1887 the writer was told that they were common about Devils Lake and on

the prairie near Bottineau. In 1912 Eastgate collected an old female near Oakes, and nine young, about a month old, were found in the den. The same year the writer was told that there were a good many red foxes about Hankinson, where they were considered one of the standard fur animals. At Fargo there were said to be still a few in that part of the valley, and at Valley City they were reported as common, many being caught in winter. At Stump Lake there were said to be a few, and in the Turtle Mountains they were reported common, but mainly on the surrounding prairie. At Kenmare in 1913 they were said to be rather scarce, although a few were caught in winter. At Minot Mr. Booth, the taxidermist, said that they had been numerous in the early nineties, but that the great increase in coyotes since sheep were brought into the country had apparently resulted in a corresponding decrease among the foxes. At Crosby in 1913 the writer was told that a few were to be found in the glacial hills to the south, but that they were rather scarce. South of Medora, on the Little Missouri River, they were said to be scarce, and there seemed to be some doubt of their being there at that time. From Grafton on April 17, 1914, Williams sent the skin of a fox pup a day old from a litter of five born in captivity; again in 1917 he sent seven young, only 4 days old; in 1919 he reported red foxes fairly common and several killed every winter in the vicinity. In 1915 Kellogg found them fairly common at Wahpeton and reported a few skins taken each year by hunters. A litter of three was dug out on the farm of J. Brandt, 7 miles west of town, on May 23. At Larimore, Kellogg reported a few red foxes, and stated that a number of skins were taken each year at Manvel. At Drayton, in Pembina County, he reported a number trapped each year and two tame young ones kept in captivity. At Fort Totten he was told that red foxes had been common in that region 30 years before, but were then scarce. At Towner no records were obtained, nor at Lostwood, on the Missouri River. At Fairmount in 1915 Sheldon reported them as abundant at one time, but of late years rarely seen, although occasionally one was trapped or shot by some of the farmers. In 1916 there were said to be still a few in the country about Cannon Ball.

General habits.—The yellow foxes typify all that is sly, cunning, and crafty, with a peculiar combination of timidity and boldness. They are skilful hunters, but by farmers are often looked upon as cunning thieves, because of their excessive fondness for poultry. To the fur trapper they are the acme of all that is difficult and inspiring in his craft. In keen senses, alertness, and intelligence they are excelled by few wild animals. For most of the year they are hunters, depending for subsistence on mice, ground squirrels, pocket gophers, rabbits, and birds, which they are usually able to capture in abundance. At times they find grasshoppers and other insects acceptable, and in the blueberry season they almost live upon these delicious berries. They also eat a great variety of other berries and fruit. Although the animals are mainly nocturnal, their catlike eyes are well adapted to both night and day, and on rare occasions a fox may be seen prowling over the prairies or meadows watching for mice or small game in broad daylight. Generally, however, during the day they remain in their burrows or curl up on a knoll where

they can see on all sides, and at night range far and wide in search of food.

Breeding habits.—The young are generally from five to nine in number, and are brought forth in the breeding burrows prepared by the parents, or sometimes in hollow logs or trees. Near Oakes, Eastgate saw nine young about a month old that had been dug out of their den on June 5, 1912. Williams reported five and seven young in the litters of his tame foxes at Grafton. Alexander Henry reports five young caught by one of his men at Park River, October 18, 1800, but these may not have been the full litter, as at that season they would be large enough to be separated. The young when first born are dull black, with a conspicuous white tip of the tail extending up from a half to three-quarters of an inch. Their eyes are said to open in eight or nine days, and by that time the black has begun to fade and the yellow-gray is appearing over the head. About the time they begin to run about, when three or four weeks old, they are usually of a dirty gray color, unless destined to represent the darker cross, silver, or black forms, in which case they retain the dark black and shoulder stripes of the cross fox or the entirely dusky fur of the future silver or black. In all cases, however, the white tip of the tail and the black posterior surface of the ears distinguish them from young coyotes, dogs, or kit foxes. Both parents are very attentive to the young, the male taking its full share in hunting and guarding the den. Apparently the young do not follow their parents in the hunt, even when well grown, as more than one fox track is rarely seen at a place in any season. Their methods of still hunting are more likely to be successful singly than in groups.

Economic status.—The destruction by these foxes of game, poultry, and lambs is often discounted by the value of their skins and the interest they offer in hunting and trapping. They are known to be very destructive to lambs, however, in Michigan doing great damage among them. Apparently their fur value is sufficient to keep their numbers down to a minimum, or they might otherwise prove a pest and a serious check on the abundance of many species of small game. Their value in fur farming has not yet been fully determined, but the best grades of silver and black are among the most remunerative of fur animals to be raised under domestication. Many reports, and even books, have been published on the subject of fox farming, and experiments along this line indicate that in the future much of our choicest fur will be that produced under domestication.

Vulpes velox hebes Merriam

Kit Fox; Prairie Fox; Swift

Ihoichka of the Hidatsas (Gilmore); *Ohcha* of the Mandans (Maximilian); *Soⁿgina* of the Dakotas (Gilmore); *Ciwaku* of the Arikaras (Gilmore).

Vulpes velox hebes Merriam, Proc. Biol. Soc. Washington, vol. 15, p. 73, 1902.

Type locality.—Calgary, Alberta, Canada.

General characters.—A very small fox with a rather short black-tipped tail, long, dense winter fur, and short, harsh summer hair. In winter the color is mainly dark buffy gray with orange sides, legs, and lower surface of tail, and light buffy belly. Tip of tail black and patches on sides of nose blackish.

In summer the upper parts are more reddish gray. The type, adult male, measures in the flesh, in total length, 844 millimeters; tail, 312; hind foot, 130. The weight, as given by Audubon (1851–1854, vol. 2, p. 14, 1851), is 8½ pounds. Seton (1909, vol. 2, p. 700) gives 4¼ pounds as the weight of an adult from Saskatchewan.

Distribution and habitat.—Apparently the kit foxes of the northern Plains at one time covered the whole of the prairies of North Dakota, but at present they are restricted to the western part of the State, and even there they have become very scarce. In 1800 they were one of the common fur animals of the Red River Valley. Alexander Henry (1897, pp. 184, 221, 245, 259), in his journal, recorded, among other skins taken by his trappers in the spring of 1801, 9 kit foxes from Reed River and 7 from the Park River; in 1803, 1 from the Turtle River and 23 from the Hair Hills; in 1804, 17 from the Hair Hills; and in 1805, 26 from Hair Hills and 31 from the Salt River. In "A Story of '53," which describes the fur-trading station at Walhalla, Charles Cavileer says 400 to 600 skins of kit foxes were obtained in a season, but none have been seen since the buffalo disappeared. In 1805, Lewis and Clark (1893, p. 271), on their journey up the Missouri River, spoke of the Assiniboine Indian camp, 25 miles above the mouth of the Little Missouri River, where the Indians were trading dried meat, grease, and skins of wolves and small foxes to British traders for liquor. In 1833, Maximilian (Wied, 1839–1841, Bd. 2, p. 51, 1841), while at Fort Clark, reported prairie foxes frequently seen. Just below the mouth of the White Earth River he speaks of finding traces of large bears and seeing the prairie fox come out of its burrow; and later he obtained specimens that were kept alive and furnished material for interesting study. Audubon (1851–1854, vol. 2, pp. 15–16, 1851) recorded them a little north of Fort Clark in 1843, and again at Fort Union, where specimens were obtained. He brought back a live one from Fort Clark to his home in New York. In 1862, F. V. Hayden (1862, p. 142) reported 50 to 100 caught every winter near each of the trading posts along the Missouri River.

There are a few specimens in the National Museum collection, taken by Culbertson in 1850 at Fort Union, and others taken by Coues in 1873 on the Souris River, where he reported them common. At Grafton, in 1915, Remington Kellogg was told that the last kit fox caught in that region had been taken by Olaf Dahal in 1876. At Minot, in 1909, the writer saw several skins at a taxidermist's shop, brought in to be mounted during the previous winter, and was told that there were still a few swifts in that region, but that they were so scarce that those caught were usually preserved as curiosities. A mounted specimen in the Williams collection at Grafton was taken near Williston, December 16, 1911. In 1913, a few mounted specimens and several skulls were examined in the collection of Mr. Allen, the taxidermist, at Mandan, who said that none had been brought in in recent years. At Sentinel Butte, Mr. Crawford said that kit foxes used to be common, but had become very scarce since the country had settled up. In 1915 Kellogg reported them as very scarce in the vicinity of Goodall in McKenzie County, where they had formerly been common. He said that they were very easily trapped, poisoned, or caught by dogs, so that they did not last long after the country became settled.

General habits.—At Fort Union (Buford), on October 16, 1833, Maximilian (Wied, 1839–1841, Bd. 2, p. 37, 1841) wrote in his journal:

> The little prairie fox is so hungry and therefore so tame that it often visits the environs of the fort, and we found these pretty little animals among the circles of turf which were left on the removal of the Indian tents. Here they remain in the daytime and at nightfall collect and look for the remains of provisions in the neighborhood of buildings. Our dogs frequently pursue them, but their extreme swiftness enables them to escape and to retreat to their burrows, where easily caught by setting snares.

On his return trip down the Missouri River to Fort Clark, in 1833, he (Wied, 1839–1841, Bd. 2, pp. 256–258, 1841) brought one of these little foxes with him as a pet and gave an interesting account of its habits. At one time, he says:

> During the night we were disturbed by great numbers of rats, and I placed my little tame prairie fox in the loft where the corn was kept and there he did excellent service. * * * This pretty and very tame little fox afforded us much amusement during the long winter evenings. He was nearly a year old but always glad to play with anyone. Would scratch or pat one on the clothing with his paw as he came quickly by and then make great bounds into the air as if he were pouncing upon a mouse or rat. He was very cunning and noticed everything and was delighted to be petted and stroked. He would often take some object in his mouth and shake and carry it about, dash away, hide it, look roguishly with head on one side, then come bounding back with all sorts of antics. We taught him to shake hands like a little dog, and he always offered his paw when he wished to be rubbed and petted. To rest he would roll up in a heap and cover his nose and face with his bushy tail. In cold weather he would get so close to the fire that he burned off much of his fur. He ate little, but drank often, though only a little at a time. He was very fond of rats and mice, and as with all such animals, caught them by the head. He usually chewed like a cat on one side of his mouth, using the sharp-edged molars, then licked his lips and usually one little paw. When no longer hungry he would bury the rest of his prey in the ground or in a corner, push it down with his nose, and cover it exactly as do others of the dog kind. His voice was a very loud bark, repeated three or four times in succession. It is very similar to that of the European fox, but louder and rougher. It has a wonderful ring to it, and one is astonished to hear such a loud voice from such a tiny animal.

Late in the fall (October 31) Maximilian (Wied, 1839–1841, Bd. 2, pp. 47–49, 1841) reported an abundance of buffaloberries, which after the frosts were very palatable. "With this fruit we refreshed our bears and my little fox, to which they offered an agreeable variety in their food." The wild grapes, however, he says were very poor and did not suit the taste of even the little fox.

In 1845, at Fort Union, Audubon (1897, pp. 116, 130), while riding over the prairie, saw a swift dart from a hole under the feet of Harris's horse. Harris gave chase and gained upon the beautiful animal with remarkable quickness, overtaking it and firing at it several times, but to no purpose as it doubled and cut about in such a manner that it escaped into a ravine. A few days later Harris succeeded in shooting one, which was saved for a specimen. At Fort Clark a captive kit fox was given to Audubon, (1851–1854, vol, 2, p. 16, 1851), who carried it back to his home near New York. It had been kept for some months in a loft without food other than the rats and mice which it caught there. In its new home it was fed on birds, squirrels, the flesh of other animals, and any kind of fresh meat, and grew fatter every day. This probably accounts for the weight of 8½ pounds, which seems much for this little

animal in its wild state. Seton's (1909, vol. 2, p. 700) weight of 4¼ pounds for an adult specimen from Saskatchewan seems nearer the probable average weight of wild individuals.

These dainty little foxes are among the most graceful and sprightly of native carnivores. They glide over the prairie as lightly and smoothly as passing shadows and are so quick in their motions as to have inspired fabulous stories of their speed. They are said to be tamed easily and to make interesting pets, but they are of relatively small value in the fur market.

Seton records several dens, in each of which a pair of kit foxes were found guarding five young. There is much to be learned in regard to their hunting, feeding, and breeding habits. As they are easily hunted, trapped, and poisoned, they are rapidly disappearing over a large part of their range and if doomed to extinction it is important that a closer study be made of their home life before it is too late.[23]

Family MUSTELIDAE: Weasels, Minks, Martens, Skunks, Badgers

Mustela longicauda longicauda Bonaparte

Long-tailed Weasel; Ermine

Ohsisa of the Hidatsas, and *Mahchpach-piraka* of the Mandans (Maximilian.)

Mustela longicauda Bonaparte, Charlesworth's Mag. Nat. Hist., vol. 2 (n. s.), p. 38, 1838.

Type locality.—Carlton House, Saskatchewan, Canada.

General characters.—One of the largest of our weasels, with slender body and long tail. In summer, upper parts, yellowish brown, darker on face, with tip of tail black; underparts and usually feet and toes, yellow, varying from rich buff to deep orange. In winter pure white, except for the black tip of tail and usually a light-yellowish wash or stain on the belly, hind legs, and tail. Measurements of an average-sized male from Crosby, N. Dak.: Total length, 445 millimeters; tail, 150; hind foot, 50; of an average female from Lostwood: 369, 121, and 40, respectively. A male from Treesbank, Manitoba, measured 457, 163, 49, and weighed 13 ounces.

The change from summer brown to winter white comes usually in November or with the first permanent snows. A male collected at Jamestown, November 1, and another at Castleton, November 3, 1892, are nearly white, with only a mixture of brown hairs over the back sufficient to produce a brownish gray. In the agricultural college collection at Fargo an adult male taken October 24, 1912, has the back, top of head, neck, and tail brown, and the sides and underparts, including the lower surface of tail, white, while an adult female taken November 2, 1912, is pure white, except for the black tip of the tail. A female taken at Valley City on November 13 is pure white with only a trace of sulphur yellow on the tail. Three specimens collected at Valley City, by Morris J. Kernall, on October 27, 1912, show three stages in the fall change; one has the back mostly brown, with sides, belly, and tail mostly white; another is mainly white, with a little brown on the back; and the third is in the full white winter coat. The spring change from white to brown comes approximately with the normal disappearance of the winter snow, but is not represented in the North Dakota series of specimens.

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[23] Gray fox (*Urocyon cinereoargenteus*) (Schreber). There is only one record for the State and this seems doubtful. In 1833, at Fort Clark, Maximilian (Wied, 1839–1841, Bd. 2, p. 86, 1841) wrote: "The gray fox (*Canis cinereo argenteus*) and the cross fox (*Canis decussatus*) are likewise found here." This record seems very questionable, as no other report of their occurrence is to be found so far north in the prairie country. It seems probable that Maximilian confused the silver-gray fox of the genus *Vulpes* with this species, or merely applied the wrong name to the silver-gray. Perhaps the note refers to furs traded by the natives at Fort Clark, but really brought from points farther south. The northern edge of the Black Hills in South Dakota is the nearest point at which gray foxes are known to occur.

Distribution and habitat.—The long-tailed weasels cover the northern Plains country and are the most common of the weasels over practically all of North Dakota. They are common all over the prairie part of the State, and the forest of the Turtle Mountains region is sufficiently open to attract them. They are prairie dwellers, ranging over the wide open expanse of country and making their homes in the burrows of the numerous rodents on which they prey.

General habits.—These large weasels may often be seen over the prairie, running rapidly from one to another of the ground squirrels' burrows, and when alarmed taking refuge in the burrow nearest at hand. In 1833 Maximilian found their skins among those much prized by the chiefs of the Indian tribes along the upper Missouri River, but in those days they seemed not to have been included among the marketable furs of the white trappers. In 1887 the writer took specimens of this weasel at Devils Lake and Bottineau in traps set for pocket gophers and ground squirrels, and again while at Devils Lake in 1914 was surprised to see one thrust its head out from under a board sidewalk where crowds of people gather to take the electric car for the lake. In 1892 Loring collected specimens at Castleton, Valley City, Larimore, and Jamestown, taking most of them in traps set in the burrows of pocket gophers. In 1909, while riding over the prairie near Lemon, in the southwestern part of the State, the writer saw one running from one burrow to another of the 13-lined ground squirrels. The squirrels were greatly excited and were calling shrilly back and forth over the surrounding prairie, evidently passing along the word of great danger. At Buford, in 1910, Anthony reported the weasels quite common, some of them making themselves at home among the ranch buildings for several days. At Lisbon, in 1912, Eastgate reported them fairly common, but rarely seen. During the summer, living where the pocket gophers and ground squirrels are thickest, they destroy large numbers of these rodents, rarely entering poultry yards or killing chickens. Many are trapped during the winter. At Valley City, in 1912, one of these weasels came close to the writer in its pursuit of ground squirrels, running quickly from one burrow to another. On seeing him it stood erect, tall, and straight, as a snake will often raise its head to look over the top of the grass. It then ran into a badger hole, but, full of curiosity, soon reappeared and raised its head and neck in full view to watch. It was needed for a specimen, and the writer hoped to find out what it was eating, but its stomach was empty. At Crosby, in the northwestern corner of the State, while driving over the prairie, a large weasel was seen running from burrow to burrow, while the ground squirrels from far and near were uttering shrill whistles in a panic of fright. To obtain it for a specimen, it was only necessary to frighten it down a burrow and then wait a moment until it reappeared and raised its head and neck from the grass for inspection.

As usual, its stomach and intestines were entirely empty, in spite of the fact that it was evidently engaged in killing squirrels. In 1915, Sheldon collected a very large, dark-colored male near Oakes, in Dickey County, and reported the weasels fairly common throughout that part of the State. The same year Kellogg reported them

common all across the central part of the State, and down the Missouri River Valley from Goodall to Bismarck.

At Hankinson and Wahpeton it was said that a good many weasels were caught each winter for fur, and at Grand Forks Kellogg reported many brought in to the fur market, where they sold for $1.25 each. He also reported considerable numbers of them taken for fur at Drayton, Towner, and other points along his route across the State. In the Turtle Mountains the writer was told that weasels were considered by the trappers as one of the important fur animals. At Wade Bell reported them fairly common and was told that one trapper had caught 46 during the previous winter.

Breeding habits.—Of the breeding habits of these weasels there seems to be little definitely known. At Manvel, Grand Forks County, Kellogg was told of a litter of 11 young found by William Brown, but this seems a large number for any weasel to have at one time. Apparently they do not multiply very rapidly, as their abundance seems never to increase beyond a few scattered individuals found over the country.

Food habits.—The actual determination of the food of weasels is difficult, as examination of stomach contents rarely shows a trace of any food and generally the whole intestinal tract seems to be empty. The weasels when seen are usually chasing ground squirrels or putting their heads out of the burrows of squirrels or pocket gophers, which they enter freely, and where they find the occupants helpless against their attacks. From their well-known habit of killing many more animals than they can eat and the ease with which they can capture the ground squirrels and pocket gophers, it is evident that they are killing for the sheer lust of it as well as for a little blood, which they take from each individual and which is quickly digested.

In places where a weasel remains for some time, the ground squirrels and pocket gophers usually disappear, but generally the weasels are great wanderers, covering new hunting grounds every day.

In winter, when the burrows are filled with snow, the weasel tracks show that mice are the principal game sought. Open spaces under logs and brush or fallen grass are entered through the snow and often the tracks reappear on the surface a considerable distance away. In soft snow the weasels often force their way down to the surface of the ground and plow tunnels through the snow, evidently in pursuit of mice and small game.

If game is not to be found in sufficient abundance, they will feed on any frozen meat or old carcass that is available, and on rare occasions they find their way into henhouses and sometimes do serious mischief before they are discovered and checked. It is not improbable that they kill some wild birds and possibly eat the eggs, but there is little evidence of their doing so in a country where ground squirrels, pocket gophers, and mice are abundant.

Economic status.—Ordinarily many weasels are caught in traps set for other fur-bearing animals such as minks, martens, and foxes, but where these large weasels occur in considerable numbers and bring a good price, the trappers seem to devote their attention especially to catching them. This is easily done, as they are entirely unsuspicious and are easily attracted by bait of fur or feathers

scattered around or above the trap. It seems a great mistake, however, in a region of numerous rodent pests to destroy the greatest enemy of such animals. Even if it is possible to destroy by artificial means all of the ground squirrels and pocket gophers over a considerable extent of country, the mice and smaller rodents still remain in abundance, and if their increase goes unchecked serious losses of crops are sure to follow.

The occasional mischief done by weasels in the poultry yard can usually be prevented by a little care in making the buildings tight and secure by wire mesh. The value of weasel fur, which is sold as "ermine," is in most cases far less than the economic value of the animals as rodent destroyers.

Mustela cicognanii cicognanii Bonaparte

Bonaparte Weasel; Short-tailed Weasel

Mach-schipka of the Mandans (Maximilian).

M[*ustela*] *cigognanii* [sic] Bonaparte, Charlesworth's Mag. Nat. Hist., vol. 2 (n. s.), p. 37, Jan., 1838.

Type locality.—Northeastern North America.

General characters.—A medium-sized weasel with moderately short tail. In summer, upper parts light brown; underparts white, usually tinged on belly with sulphur yellow; winter coat, pure white or slightly tinged on belly, hind legs, and tail with sulphur yellow; tip of tail, always black for about an inch at end. Measurements of large adult male, from Walhalla: Total length, 338 millimeters; tail, 98, hind foot, 44. Weight, 6 ounces. Female much smaller, one from New York State measures 260, 72, and 31 millimeters, respectively.

Distribution and habitat.—A specimen of the Bonaparte, or short-tailed, weasel from North Dakota was collected by H. V. Williams at Stump Lake on May 6, 1913. Another specimen examined in the collection of the biological laboratory at Devils Lake in 1914 was taken near there by Eastgate. A specimen listed under *richardsoni* in the catalogue of the Field Museum from Minot is undoubtedly also this species (Elliot, 1907, p. 449). In 1833, Maximilian (Wied, 1839–1841, Folio, Tab. 13), at the Mandan villages, had a drawing made by his artist, Carl Bodmer, of one of the Mandan chiefs, Mato-Tope, dressed in full regalia and wearing many skins of both large and small species of white weasels with black-tipped tails. In December, 1912, Eastgate, on a trip from Bottineau to St. Johns, along the edge of the Turtle Mountains, reported both the large and small weasels very common and says: "I was never out of sight of their tracks in the soft snow and saw many skins of the larger kinds with the trappers' furs. The trappers did not bother to skin the small weasels."

General habits.—The writer's experience with these weasels has been mainly in Minnesota, where in the early eighties they were common and often came about the buildings in winter during the time of deep snow, and got into mink traps set along the streams and lake shores. Their tracks were found everywhere, but mostly in the woods or along fence rows and through thickets. On the meadows they would run from one haystack to another, or along the creek banks, where they would find or make openings to the surface of the ground under fallen grass or reeds. Here they were

always hunting mice and the small animals that remained active under the snow during the winter. In places where the weasels were most abundant the mice always became noticeably scarce before spring, and when the snow disappeared the mouse crop seemed always to be at its lowest ebb.

In the early pioneer days of log barns and rough buildings these weasels would occasionally make their homes in the barns and outbuildings for a time during the deep snows, and remain as long as there were rats and mice for them to feed upon. Occasionally they would get into the poultry houses and clean out the mice without doing any damage to the poultry, and when the mice were gone they would leave the building and go to the woods or find other hunting fields. There are, however, many authentic reports of their destroying large numbers of chickens and apparently killing them for sport as well as for food. Generally, however, the larger weasels are much more destructive to poultry where it is unprotected. The small size of these weasels, especially of the females, seems to limit their prey largely to mice and small rodents, and the number killed by one of these tireless, bloodthirsty little animals during the course of a year must be enormous.

Economic status.—The snowy white skins of these weasels in winter make some of the choicest ermine, but their small size fortunately limits their value, and many of those caught in traps set for minks, martens, and other animals are not even saved by the trappers. Their value as mice and rodent destroyers seems far to outweigh their fur value and greatly to overbalance the relatively small amount of damage done to poultry and game. In most parts of the country it would seem advisable to protect the weasels, although they are generally hardy animals, well able to protect themselves unless the price of their skins runs high enough to induce trappers to make special efforts to get them.

Mustela rixosa rixosa (Bangs)

Least Weasel

Hitu^{n}ka-sa^{n} (white mouse) of the Dakotas (Gilmore)

Putorius rixosus Bangs, Proc. Biol. Soc. Washington, vol. 10, p. 21, 1896.

Type locality.—Osler, Saskatchewan, Canada.

General characters.—Smallest of all native weasels, full-grown individuals measuring about 6 or 8 inches in length. The tail is very short, without black tip at any time. In summer the upper parts are dark brown, underparts, white; in winter the whole animal is pure white. An adult male from Grafton, N. Dak., measured in the flesh: Total length, 202 millimeters; tail, 39; hind foot, 25. A smaller male from Bowdon measured 155, 34, and 21 millimeters; and an adult female from Alaska, 165, 18, 21 millimeters, respectively.

Distribution and habitat.—The tiny least weasel occupies the Boreal Zones of much of the northern part of the continent. There is one specimen in the Biological Survey collection from North Dakota, taken by H. V. Williams at Grafton, October 24, 1913. Another specimen in the Williams collection was examined by Remington Kellogg in June, 1915. Kellogg also reported a specimen in the collection of the State university, taken at Fort Totten, July 21, 1913, and he was told that the species is trapped occasionally in the timber around Devils Lake. At Manvel, Grand Forks County,

he was told by trappers that a very small weasel was occasionally caught, but was not saved, as its fur had no value. At Fort Buford Anthony reported a small weasel that might be of this species. At Tolna, near Stump Lake, Eastgate reported the species as "said to occur." At Bowdon M. C. H. Murie took an adult male in brown summer fur July 27, 1918.

In 1833 Maximilian (Wied, 1839–1841, Bd. 2, p. 98, 1841) collected a specimen which was evidently of this species at Fort Clark, but unfortunately it was lost on the return journey. His measurements of 6½ inches for total length, 1¼ inches for tail, and 7½ lines for hind foot, and his statement that in winter it becomes "gänzlich weiss" seem to identify it beyond question. Apparently these little weasels are very scarce even in the midst of their range, and it is not surprising that so few have been taken in North Dakota on its extreme border.

General habits.—Apparently least weasels are strictly mouse hunters, and their small size enables them to follow the runways and underground burrows of almost any mouse. The specimens taken by collectors are usually caught in mouse traps. They are such inconspicuous animals, either in the dark-brown summer coat or pure-white winter coat, that it is not surprising that they pass unnoticed; but the fact that with all the trapping for the different small rodents few of these weasels have been found seems unquestionable evidence of their rarity. Occasionally fine tracks are seen in the snow that may have been made by this species, but these probably in many cases may be attributed to the very small females of the short-tailed weasel. In habits they do not differ from other weasels, except as limited by their diminutive size.

Economic status.—Although too small to do any serious harm to poultry or to be of any value for fur, these little animals certainly serve as a valuable check on the increase of mice. Studies in southern Manitoba by Stuart Criddle (1926) have demonstrated their effectiveness in controlling the colonies of *Microtus minor*, and they are undoubtedly equally beneficial in other parts of their range, and with other species of mice. If they could be domesticated, it seems probable that they might be of value in destroying mice around buildings, and that poultry and other animals would be safe from them. If a family of young could be obtained for breeding purposes, it might be well worth while to test their usefulness.

Mustela nigripes (Audubon and Bachman)
Black-footed ferret

(Pl. 17, fig. 2)

Etopta sapa of the Yankton Sioux; *Nazi* of the Mandans; *Tahu akukahak napish* of the Hidatsas (all, Gilmore).

Putorius nigripes Audubon and Bachman, Quadr. North Amer., vol. 2, p. 297, 1851.

Type locality.—Fort Laramie, Wyo.

General characters.—A large, heavy-bodied weasel with rather large ears, short tail, and short fur. Color, creamy yellow with a wash of brown over

middle of back and top of head; feet, legs, tip of tail, and mask across face and around eyes, blackish. An adult male measured by Osgood, total length, 529 millimeters; tail, 130; hind foot, 65; and adult female from Quinion, measured by Jewett, 510, 128, and 61, respectively.

Distribution and habitat.—The black-footed ferret, like the black-tailed prairie dog, has a wide range over the Plains country from Texas to Alberta. A few have been taken in western North Dakota, west and south of the Missouri River. In 1910, the late Howard Eaton told Cary of a ferret skin which he had bought at a Crow Indian fair, and said to have come from the Little Missouri River near Medora, where he has since reported them near his old ranch. In 1912 one was snared by some Indians near Fort Rice and given to H. C. Fish, curator of the Historical Society Museum, at Bismarck, and later was given to Bell for the agricultural college collection at Fargo. On June 20, 1913, Jewett collected a fine adult female near Quinion between the Killdeer Mountains and Medora. Describing the incident, he writes:

> While driving along the road through a large prairie-dog town about 2 o'clock in the afternoon, I saw a ferret's head disappear into a prairie dog's burrow only a few yards distant from the horses' feet. I jumped out of the wagon without stopping the team and almost immediately the head of the ferret reappeared and I shot it. It proved to be an adult female, evidently with young, as the mammae contained milk. I had been told by old settlers that there were no ferrets in this region, and when I showed the specimen to several no one knew what it was, so they are evidently quite rare in this part of the State.

In 1915, at Stanton, Kellogg saw a mounted specimen in a taxidermist's shop, which was said to have been killed near there.

General habits.—At his ranch on the Little Missouri River in the eighties, Roosevelt (1900c, pp. 85–86) writes of the ferret:

> It makes its home in burrows, and by preference goes abroad at dawn and dusk, but sometimes even at midday. It is as blood-thirsty as the mink itself, and its life is one long ramble for prey, gophers, prairie dogs, sage rabbits, jack rabbits, snakes, and every kind of ground bird furnishing its food. I have known one to fairly depopulate a prairie-dog town, it being the arch foe of these little rodents, because of its insatiable blood lust and its capacity to follow them into their burrows. Once I found the bloody body and broken legs of a poor prairie hen which a ferret had evidently surprised on her nest. Another time one of my men was eye-witness to a more remarkable instance of the little animal's blood-thirsty ferocity. He was riding the range, and being attracted by a slight commotion in a clump of grass, he turned his horse thither to look, and to his astonishment found an antelope fawn at the last gasp, but still feebly struggling, in the grasp of a ferret, which had throttled it and was sucking its blood with hideous greediness. He avenged the murdered innocent by a dexterous blow with the knotted end of his lariat.

Most of the records of the black-footed ferret throughout its range are from prairie-dog towns, where ferrets are almost invariably found running from burrow to burrow or taking refuge in the underground retreats. Evidently their principal prey consists of prairie dogs, although so far as is known they have never been seen actually catching and killing one. While apparently very useful in destroying prairie dogs, they are so rare that little impression is made upon the population of extensive prairie-dog towns. With the abundance of easily procured food it seems strange that they should remain so scarce. It is possible, however, that this very abundance has in some way pauperized the species until reproduction is restricted.

As in other weasels, the mammae are arranged in 3 pairs well back, 2 of these pairs close together in the inguinal region, and 1 pair a little farther out on the posterior part of the abdomen. Apparently nothing is known of the breeding habits or of the number of young at a birth.

Lutreola vison letifera (Hollister)
Mink

Dokshiⁿca of the Dakotas (Riggs and Williamson); *Daktsuà* of the Hidatsas (Matthews), *Naksua* (Gilmore); *Monika suntike* of the Mandans (Will), *Mini-gasundek* (Gilmore); *Eruch* of the Arikaras (Gilmore).

Mustela vison letifera Hollister, Proc. U. S. Nat. Mus., vol. 44, p. 475, 1913.

Type locality.—Elk River, Minn.

General characters.—Size, medium, not so dark as the average of minks from farther north. In prime early-winter fur the color is a rich dark brown, darkening to blackish on the tail, with usually a white patch on chin, throat, or breast. Later in the winter and in spring the color fades out to a paler brown and in summer the short, harsh fur is yellowish brown. Measurements of large adult male from Lake Irwin, North Dakota: Total length, 697 millimeters; tail, 230; hind foot, 81. Of adult female from same place, 561, 178, and 67. Weights of the two, 3 pounds 12 ounces, and 2 pounds 5 ounces, respectively.

Distribution and habitat.—Until the minks have been thoroughly revised the limits of range of the different forms will necessarily remain somewhat in doubt. There are so few specimens from North Dakota that it is not possible to say whether more than one form is represented in the State, nor to determine the extent of the range of *letifera*. It is quite probable that specimens from the northern part of the State could be referred to the larger, darker *lacustris* described by Preble from Manitoba, Canada. In the Biological Survey collection there is a female collected at Stanton, on October 6, 1915, and an immature male from Fargo, taken December 27, 1918. In the National Museum collection are four skulls taken by Coues on the Souris River in 1873, and there is a specimen in the agricultural college collection at Fargo, taken on Apple Creek, near Bismarck, in 1914.

Although never numerous, minks seem to have been fairly common along most of the streams in the State. In 1801, Alexander Henry (1897, pp. 184, 198, 221, 245, 259, 281, 422, 440) reported 68 skins from Reed River and 29 from Park River; in 1802, 6 skins taken at Grand Forks; in 1803, 39 taken on the Pembina River, 3 on the Turtle River and 8 in the Hair Hills; 1804, 13 at Grand Forks, 2 in the Hair Hills, and 2 on Pembina River; 1805, 14 in the Hair Hills, 5 on Salt River, and 44 on Pembina River; 1806, 35 at Grand Forks, and 141 on Pembina River; 1807, 21 on Pembina River; and in 1808, 7 in the Hair Hills, 18 at Grand Forks, and 63 on Pembina River. At Fort Union, in 1833, Maximilian (Wied, 1839–41, Bd. 1, pp. 431, 432, 1839) reported a few thousand mink skins brought in by the trappers each year. In 1873 Coues (1877, p. 175) reported many minks taken on the Mouse River. In 1887 they were reported

common at Harwood, Grand Forks, Pembina, Devils Lake, and in the Turtle Mountains.

In 1912 the writer was told that a good many were caught around the lakes in the vicinity of Hankinson each winter and that in the Turtle Mountains they were considered the most important fur animal of the region. At Stump Lake and along the Sheyenne River, Eastgate reported them as occurring in limited numbers, and at Kathryn, in Barnes County, he reported six caught by one trapper during the winter of 1912. At Lisbon, Ransom County, he reported them as rather rare, but found on every river and creek, and on many of the deeper sloughs and lakes. At Fairmount, in 1915, Sheldon reported them as becoming rare, although a few were trapped each winter along the Bois de Sioux River. At Wahpeton a few were said to be caught along the river each year. At Larimore and Manvel, in Grand Forks County, Kellogg reported quite a number trapped each year. At Grafton he reported them fairly common along Park River, where many were trapped in winter, and at Drayton, in Pembina County, a good many trapped by the half-breeds in winter. At Devils Lake he says they were not very common, but a few were taken each year, and at Towner he saw the tracks of one on the banks of Mouse River and learned that a few were trapped in winter. At Goodall he reported them quite common along the creeks and river, and near Elbowoods an Indian had caught six on Shell Creek during the preceding winter. At Stanton he took one specimen on Knife River and along the river near Sather and Wogansport he saw a few tracks, but considered the animals rather scarce. At Bismarck, in 1914, the writer caught one in a beaver trap set on Apple Creek, and at Wade, on the Cannonball River, in 1913, Bell reported them as fairly common. In 1919, Murie reported them in fair numbers along the Red River near Fargo and a few on the James River and near Bowdon, and the writer found tracks along the Heart River near Mandan, in the Pembina Hills, and along the Red River near Grand Forks. Wherever there are streams or extensive lakes, minks seem to be holding their own fairly well over the State and will probably never be entirely exterminated even by persistent trapping and a rather high value on their skins. The days of the professional trapper seem nearly at an end, and if the minks have been able to withstand his skill for more than a hundred years they will doubtless persist for a long time with only local trappers to contend with.

General habits.—Minks are semiaquatic animals, usually found near streams, where they do much of their hunting for small game, both in the water and on the banks. They are great hunters, with some of the bloodthirsty ferocity of the weasel, always eager to kill whatever they claim as game. Eastgate reports digging out a mink den at Sweetwater Lake, where he found 9 full-grown muskrats, 4 ducks, 5 coots, several smaller birds, some mice, and one small jack rabbit, that had been killed and brought in for food. This was undoubtedly a breeding den, as it is only during the breeding season that the mink remains in one locality long enough to bring in such stores of food. For most of the year minks are wanderers over somewhat extended hunting grounds. In winter, when their habits can best be observed by watching their tracks, the same mink usually

makes its round every few days with the varying regularity of a free lance. An abundance of safe retreats are found in the hollow banks of streams and lakes, often in muskrat burrows or houses, the owners of which have been killed or driven out in terror of their lives. A hollow tree or log is often used as a refuge or resting place.

Minks climb trees readily when hard pressed by dogs and on several occasions while hunting raccoons the writer has shaken a mink out of the topmost branches of a tree for the waiting dogs below. Even then the dogs are not sure of their game, as the mink is weasel-like in its quickness at dodging and avoiding enemies. But if cornered, minks never refuse a fight with anything that comes their way and often terrify a dog by their savage screams as with lightninglike motions they fasten their keen teeth into his nose or lips. Their pungent odor, from an amber-colored liquid carried like that of the skunk in two glandular sacs surrounding the anus, is used as a method of defense, and though quite different from that of the skunk it is equally offensive to man or beast.

Breeding habits.—The five or six young are usually born in May and zealously cared for in the den by the mother mink until old enough to follow her on her hunting trips. Before the trapping season begins in early winter they are practically full grown. The male has no part in the family affairs after the brief mating season, and as soon as the young are large enough to capture their prey the family disperses, and each is thereafter a solitary hunter.

Food habits.—The natural food of minks consists mainly of rodents, birds, fish, and crustaceans. Among the rodents the muskrat is one of the favorites, and empty muskrat houses with a small round hole in one side usually indicate a family that has been destroyed by a mink. Sometimes a small pond will be entirely depopulated of muskrats before the mink leaves the vicinity, but in larger bodies of water the muskrats appear to escape to other houses or burrows and do not return until the mink has departed. Meadow mice apparently furnish considerable food for minks. Rats and rabbits are also captured for food, and wild ducks and other waterfowl, small birds, game, and poultry are equally acceptable. In places small fish furnish a large part of the food of minks, which often capture fish as large or larger than themselves. Crawfish and other crustaceans are greatly sought wherever they can be found and in many places form the principal food, as shown by the scattered droppings along the trails or about the dens. Frogs are eaten, but are evidently not a favorite food. At times dead animals, and especially frozen carcasses, are eaten when other food is not available, but live game that they can kill for themselves seems always to be preferred to all else. In captivity they will eat bread or cereals soaked in milk and many table scraps, but only when fresh meat and blood are not to be had.

Economic status.—Locally the minks have been known to do considerable damage to poultry. At Willows, N. Dak., in December, 1886, David H. Herman wrote to the Biological Survey that a mink killed all of his hens one night and the next night spent its time trying to climb up the sides of the house to get at those hung up from the previous night's kill; the third night it came back and killed the rooster, the only remaining bird of the flock, and was

found breakfasting on it in the morning. One of Mr. Herman's neighbors also lost 51 fowls in one night, the mink being killed with a stick in the henhouse the following morning. In 1912 Eastgate reported minks at Lisbon as doing some damage to poultry during fall and winter. So serious is this occasional damage that near streams or lakes it is generally necessary to protect poultry houses with some kind of mink-proof structure.

The destruction of game, and especially waterfowl, is probably far more serious than is generally supposed, but the guilt is not easily divided between minks, weasels, skunks, and foxes. On the other hand, considerable credit is due the minks for destruction of rats, mice, and other troublesome rodents. Their fur value usually assures them protection during the season when fur is not prime. In the absence of statistics of annual fur values it seems safe to assume that minks alone contribute many thousands of dollars a year to the local trappers over the State. Although minks are easier to trap than foxes, the boy who can catch his half dozen in a season without devoting undue time to his trap line can take considerable satisfaction in his skill.

Sufficient information has not been obtained to determine the practicability of domesticating minks, but with proper handling they have in some instances proved successful on a small scale. Considerable has been written on their management in captivity, but further tests are necessary to show that they can be produced economically.

Martes americana americana (Turton)

Marten; Pine Marten; American Sable

[*Mustela*] *americanus* Turton, Linnaeus, Syst. Nat., vol. 1, p. 60, 1806.

Type locality.—Eastern North America.

General characters.—About the same size as the mink, with longer legs, larger ears, longer and softer fur, and more bushy tail. Color usually lighter, more yellowish brown than the mink, varying from dull orange to dark chestnut; throat usually light yellow to deep orange. Measurements of adult male from Montana: Total length, 615 millimeters; tail, 200, hind foot, 93; of adult female, 565, 180, and 83, respectively.

Distribution and habitat.—At present there are probably no martens in North Dakota, but in 1801 Alexander Henry (1897, pp. 184, 198, 245, 259, 281, 422, 440) recorded among others taken, 26 marten skins from Reed River and 36 from Park River; in 1802 he reported 13 from the Hair Hills; 1803, 9 from Pembina River, 26 from the Turtle River, and 47 from the Hair Hills; 1804, 21 from Grand Forks, 3 from the Hair Hills, 1 from Park River, and 5 from the Pembina River; 1805, 6 from the Hair Hills and 3 from the Pembina River; 1806, 4 from Grand Forks and 271 from Pembina River; 1807, 75 from Pembina River; 1808, 2 from the Hair Hills, 6 from Grand Forks, and 69 from Pembina River. In his "Story of '53" regarding the fur trade at Walhalla, Charles Cavileer says 700 martens were taken one winter.

In 1833 Maximilian (Wied, 1839–1841, Bd. 1, pp. 431–432, 1839) gave a list of the approximate number of furs bought at Fort Union during the year, and among these, marten skins numbered 500 or 600. These, however, were undoubtedly brought down the river from wooded country farther north and west. Apparently martens

were originally fairly common in the timbered sections of northeastern North Dakota, but the beauty and value of their fur caused the early destruction of the species in that part of the State.

General habits.—Martens are timber-loving animals and are rarely found away from forests or the vicinity of trees. They are not only Boreal in range, but largely arboreal in habits, seeking much of their prey under cover of brush and trees and pursuing squirrels and chipmunks up tree trunks and among the branches. They are rarely found along streams, but range at large through the woods, where their winter tracks may be distinguished from those of the mink by larger feet and longer reach. There is nothing recorded of their food habits in this region, but in other parts of the country their natural food consists largely of mice, squirrels, rabbits, and birds; they are also known to eat berries, insects, and a variety of animal and vegetable foods.

Economic status.—It is not probable that martens, even with careful protection, would ever return to restock the limited forest areas of North Dakota, but in captivity they give some promise of becoming of practical value for fur farming. In the northern part of the State, especially the forest area of the Turtle Mountains and Pembina Hills, their fur should become dense and fine, as the Boreal climate represents their original habitat. If the experiments being carried on in raising martens prove successful, North Dakota should be found well adapted to the industry.

Martes pennanti pennanti (Erxleben)

Fisher; Pekan; Black Cat

[*Mustela*] *pennanti* Erxleben, Syst. Regni Anim., p. 470, 1777.

Type locality.—Eastern Canada.

General characters.—About twice the size of the marten, with relatively long legs, long tail, and coarse fur. Colors, blackish with a grizzled cape over top of head, neck, and shoulders. A large male measured in total length 1,020 millimeters; tail, 400; hind foot, 143; a female, 835, 343, and 115, respectively.

Distribution and habitat.—Fishers belong to the Boreal Zone forests of the northern part of the continent, and in the early trapping days reached into northeastern North Dakota. On September 26, 1800, Alexander Henry (1897, pp. 103, 122, 184, 198, 221, 245, 259, 281, 422, 440) reported one seen at the mouth of the Park River, and on October 19 wrote in his journal at the same locality that some fishers were brought in daily by the trappers. In the spring of 1801 he recorded 108 fisher skins from the Reed River and 70 from the Park River; in 1802, 23 from Grand Forks and 57 from the Hair Hills; 1803, 69 from the Pembina River, 98 from the Turtle River, and 111 from the Hair Hills; 1804, 36 from Grand Forks, 30 from the Hair Hills, 16 from the Park River, and 21 from the Pembina River; 1805, 74 from the Hair Hills, 14 from the Salt River, and 25 from the Pembina River; 1806, 59 from Grand Forks and 140 from the Pembina River; 1807, 78 from the Pembina River; 1808, 46 from the Hair Hills, 14 from Grand Forks, and 29 from the Pembina River. Apparently the animals were not uncommon then, as the number of skins usually ran higher than that of mink and marten and many of the other fur bearers that were being

taken. In 1853 Charles Cavileer, at Walhalla, reported 400 fisher skins a year as not an unusual number obtained by the fur company of which he was agent, but many of them doubtless came from beyond the borders of the State.

In 1833 Maximilian (Wied, 1839–1841, Bd. 1, pp. 431–432, 1839), in listing the approximate number of skins annually brought in to Fort Union (now Buford), gives the fisher as 500 to 600. Some of these may have come from the Turtle Mountains, Souris, and the Mouse River country, but probably more of them were brought down the Missouri and Yellowstone from farther west. At the present time there are certainly no fishers within the State and there seem to be no authentic records of their occurrence since the early trapping days.

General habits.—Fishers, like martens, are mainly forest-dwelling animals, seeking their prey of small mammals, rabbits, squirrels, and birds among the trees and brush and wandering at large over the woodland areas. They are expert climbers and pursue and capture squirrels in the treetops. The common name applied to them is an evident misnomer, as they are not known to catch fish or to frequent streams or bodies of water. The names "black cat" and "pekan" are also used for them, but less commonly than that of "fisher."

Economic status.—The fur of the fisher, although hidden by long, coarse hairs, is full, soft, and durable, and the general effect of prime skins made into wearing apparel is very pleasing. They are counted among the more valuable furs, and have always brought a high price in the fur market. For this reason the animals have disappeared or become scarce over much of their original range, but are still taken in some numbers in northwestern United States, Alaska, and Canada.

Gulo luscus (Linnaeus)

Wolverene; Glutton; "Indian Devil"

Eh-tupah of the Hidatsas, *Mató-ka* of the Mandans (Maximilian).

[*Ursus*] *luscus* Linnaeus, Syst. Nat., ed. 12, t. 1, p. 71, 1766.

Type locality.—Hudson Bay.

General characters.—A heavily built little animal with short ears, short legs, and short, bushy tail. Fur soft and light, covered with long coarse overhairs. Color dark brown, or blackish, with a yellow gray band along sides and across rump, and more or less gray over top of head and shoulders; throat, breast, and sometimes belly usually with irregular white spots. A very large male from Alaska, collected by Charles Sheldon, measured in total length, 1,070 millimeters; tail, 218; hind foot, 190; and weighed 36 pounds; an adult female from northern Mackenzie, measured by Preble, 920, 200, and 175 millimeters, respectively.

Distribution and habitat.—The wolverenes are Boreal animals extending across the northern part of the country and southward into the high mountain region. In North Dakota they apparently occupied at least the northeastern part of the State in the early trapping days and possibly the northweastern part. In 1801 Alexander Henry (1897, pp. 184, 198, 221, 245, 259, 281) reported, among other skins taken by his trappers, 2 wolverenes from the Reed River and 3 from the Park River; in 1802, he reported 3 from the Hair Hills; 1803,

4 from the Pembina River; 1804, 3 from Grand Forks, 1 from the Park River, and 2 from the Pembina River; in 1805, 1 from the Hair Hills and 5 from the Pembina River; in 1806, 1 from Grand Forks and 10 from the Pembina River. They were not mentioned by Maximilian among the skins brought in at Fort Buford in 1833, but in 1842 Harris included them in his list of mammals of the upper Missouri territory from Fort Leavenworth to Fort Union. A specimen brought from Fort Union by Mr. Culbertson in 1850, for the National Museum collection, probably, as Baird (1857, p. 182) says, was brought to Fort Union from some of the posts toward the Rocky Mountains. The fact that both the Minnetaree and Mandan Indians have names for this animal is suggestive of its occasional occurrence in the upper Missouri region of North Dakota. Howard Eaton wrote, under date of June 19, 1919, that while he never saw one during his residence in the Little Missouri country in the seventies, a hunter named Henry Bennett told him of poisoning one at the mouth of Cherry Creek, near the Killdeer Mountains. Apparently there are no recent records of occurrence in the State.

General habits.—Wolverenes are found mainly within timbered sections of the country, but are great wanderers and at times may strike out over open country in search of new hunting grounds. They are omnivorous hunters and scavengers and have the reputation of being gorging gluttons, a fact which has given them one of their common names. Although valuable as fur animals, they are in bad repute with the trappers from their habit of robbing traps and breaking into caches of food and supplies.

They are said to have from two to four young, and like most of the family they have three pairs of mammae arranged close together on the posterior part of the abdomen. Their underfur is soft and lax, of a gray-brown color, mainly obscured by the long, glossy outer hairs, which in prime skins have a well-spaced and pleasing effect aside from the beautiful and striking pattern of coloration. Prime skins usually bring a high price in the fur market, partly no doubt from their rarity, but mainly from their intrinsic beauty and durable quality.

Lutra canadensis canadensis (Schreber)

Otter

(Pl. 18, fig. 2)

Ptaⁿ of the Dakotas (Riggs and Williamson); *Pehtakè* of the Mandans (Will); *Midapóka* of the Hidatsas (Matthews); *Citapat* of the Arikaras (Gilmore).

Mustela lutra canadensis Schreber, Säugthiere, pl. 126b [1778].

Type locality.—Eastern Canada.

General characters.—Body, long and slender; tail, tapering and muscular; legs, short; feet, webbed; ears, small; fur, dense and glossy. General color, rich dark brown slightly lighter below and with grayish brown on throat and cheeks. Measurements of adult male from Canada: Total length, 1,220 millimeters; tail, 482; hind foot, not given (Audubon, 1851–1854, vol. 2, p. 4, 1851); in inches, 48, 19, respectively; of female, 1,150, 463, and 137 millimeters, respectively. Judging from a medium-sized female from Idaho which weighed 19 pounds, the weight of a large male may be estimated at 25 pounds.

Distribution and habitat.—A few otters are still found along all the principal streams in North Dakota and around some of the larger lakes. Although never very abundant, they were evidently much more so in the early trapping days than at present. Owing to their peculiar habits and disposition they hold their own better than many of the more common fur bearers and will undoubtedly remain for generations a part of the North Dakota fauna. In 1801–1808 Alexander Henry (1897, pp. 184, 198, 221, 245, 259, 281, 422, 440) reported 60 otter skins from Reed River, 49 from Park River, 117 from Grand Forks, 24 from the Hair Hills, 322 from Pembina River, 34 from Turtle River, and 12 from Salt River. In 1833 Maximilian (Wied, 1839–1841, Bd. 1, pp. 431–432, 1839) reported 200 to 300 skins brought in annually at Fort Union, and he frequently speaks of the use of otter skins or otter tails for decorations among the Indians. Henry (1897, p. 85) speaks of shooting four otters from the canoes in one day near the mouth of Park River on his way up the Red River, and evidently they were in considerable abundance in the Red River Valley at that time. Lewis and Clark (1893, pp. 175, 272), on October 21, 1804, obtained an otter near the mouth of Heart River, and another was seen and shot at about 30 miles above the mouth of the Little Missouri River on April 14, 1805.

A skull from Fort Berthold in the United States National Museum collection was mentioned by Doctors Allen and Coues, but seems to be no longer in the museum. Audubon (1851–1854, vol. 2, p. 11, 1851), on his trip up the Missouri River in 1843, says: "We did not capture any otters during our journey up the Missouri to the Yellow Stone River, but observed traces of them in the small water courses in that direction." In 1913 John Hailand told Morris J. Kernall that there were still a good many otters at Valley City when he settled there in 1878. In 1887 the writer found otter tracks along the northern shore of Devils Lake, and in the Turtle Mountains was told that the animals were still fairly common. In 1912 he could get only indefinite reports of their occurrence in the Turtle Mountains, but a more ideal country for them could hardly be imagined than this region of numerous lakes and streams well stocked with fish. In 1910 Anthony reported a few otters still caught along the Missouri River near Buford, and in 1912 Eastgate reported them from the Sheyenne River, 3 miles south of Tolna. In 1915 Kellogg reported one seen at the mouth of Antelope Creek near Goodall by Jess Widsome two years previously, and at Elbowoods a pair recently seen on a lake at the headwaters of Shell Creek, where they had been common a few years before.

General habits.—Otters are largely aquatic in habits, traveling with great ease and speed on or underneath the surface of the water, where much of their food is captured. On land they are slow and awkward except when they "toboggan" over the country on soft snow with considerable speed and evident pleasure. On dry land they are rarely found away from the shores of streams or lakes, but on deep melting snow they often make long journeys from one stream or lake to another, progressing rapidly in short jumps and long slides on their glossy bellies. They are powerful animals and savage fighters. Few dogs can handle one on land and they will quickly dispose of any dog that they can get into the water. They are

intelligent and, unlike the weasel tribe, have pleasant dispositions and are said to make affectionate and interesting pets. They have few enemies except man, and as more than ordinary trapping skill is required to catch them, they are able to maintain themselves and remain scattered throughout the settled parts of the country in spite of a high price on their beautiful fur.

Breeding habits.—The young are usually two to four in number and while small are kept in burrows along the banks. Later they follow the mother on hunting trips until nearly full grown, when they scatter out and each one becomes thereafter a solitary hunter.

Food habits.—Apparently the greater part of the food of otters consists of fish, which they pursue and catch in the water. They are rarely found along streams and lakes where fish are not plentiful, but evidently a great part of the fish taken are of the smaller and slower species or the sick or crippled individuals, which fall an easy prey. Crawfish and frogs are also eaten, and it is probable that many waterfowl are captured under favorable conditions. In winter otters travel long distances under the ice, through which they cut holes to the surface when they wish to come out. They are usually in good condition and often covered with a layer of fat like a white blanket under the skin, which serves to protect them from the cold and renders them very difficult to skin for fur.

Economic status.—Otter is one of the more valuable and most beautiful of our native furs. It is very durable, especially in the unplucked form, with the glossy overhairs protecting the dense, silky underfur. Although the price is relatively low for actual value, usually ranging from $10 to $25 for prime skins, it is sufficient to tempt the fur farmer to experiment with raising otters in captivity. As the habits of the animals are becoming better known it is found to be possible to breed them in captivity, and several broods of young have been raised in zoological parks. Further experiments and intensive study will be necessary before otters can be recommended for the production of fur in captivity.

Mephitis hudsonica Richardson

Northern Skunk

Maⁿka of the Dakotas (Williamson); *Suⁿkte* of the Mandans (Will); *Choka* of the Hidatsas (Matthews); *Hohga* (Gilmore); *Nichwit* of the Arikaras (Gilmore).

Mephitis americana var. *hudsonica* Richardson, Fauna Boreali-Americana, pt. 1, p. 55, 1829.

Type locality.—Plains of the Saskatchewan.

General characters.—Low, heavy-bodied, bushy-tailed animals with plantigrade feet, naked soles, and long digging claws. The most striking peculiarity consists of the pair of anal scent glands, which secrete a yellow fluid with a powerful odor. This northernmost and largest form of the genus *Mephitis* has a very long and bushy tail; the color is glossy black with a white stripe between the eyes and a white triangle on the back of the neck connecting across the shoulders with two broad white stripes along the sides of the back and tail; upper base, lower surface, and tip of tail usually black or washed with black over the surface. The relative amount of black and white varies greatly in different individuals. An adult male from Cannon Ball measures in total length, 710 millimeters; tail, 300; hind foot, 80; a female from Towner measures 780, 273, and 91, respectively. Weight of a large adult from the Yellowstone Park, 8½ pounds. (Seton, 1909, vol. 2. p. 968.)

Distribution and hatitat.—The large northern skunks range over most of the northern Plains country and extend south in the mountains to New Mexico. They are found over practically all of North Dakota, ranging alike over the prairie and into the open forest, but are most abundant along the brushy borders of streams and lakes and in the thickets of the gulches. They are much trapped and their abundance varies constantly, but they quickly increase where trapping is relaxed for a short time. So unsuspicious and easily caught are they that by persistent effort any amateur can get most of them in his vicinity. None were reported by the fur trappers of the early pioneer days, evidently because skunk fur was not then considered marketable. Hence no companion can be made of their past or present abundance. In 1878, when John Hailand came to Valley City, skunks were numerous. In 1887, the writer found them common at Pembina, Devils Lake, in the Turtle Mountains, and at Fort Buford. In 1909 D. D. Streeter reported them at Medora, and in 1910 Anthony reported a few at Fort Buford. In 1912 Eastgate reported them at Stump Lake, Valley City, Lisbon, Kathryn, and Bottineau. One trapper near Bottineau had 77 skins and another at Lisbon claimed to have taken 178 during the previous winter. The same year the writer found skunks fairly common in the country about Fargo, Stump Lake, Valley City, and in the Turtle Mountains, where they were said to be one of the principal fur-bearing animals caught in both fall and spring. In 1913 he was told there were a few about Kenmare and along the Mouse River farther west. At Fort Clark, Jewett reported them rather scarce, although a few tracks were seen on the river bottoms near there. In the Badlands, 25 miles south of Medora, a few tracks were found. In 1915 Sheldon reported them as common about Fairmount, Oakes, Dawson, and Cannon Ball across the southern part of the State, and Kellogg reported them common at Wahpeton, Larimore, Manvel, Grafton, Drayton, south of Devils Lake, Towner, Grinnell, and along the Missouri River at Lostwood, Elbowoods, Goodall, Stanton, and Sather. At many of these localities they were regarded as the principal fur-bearing animals taken by the trappers, and at Drayton, in Pembina County, Kellogg says that with the mink and muskrat they form the means of support for a large number of persons during the winter months.

General habits.—Owing to their confidence in their peculiar defensive powers, skunks appear fearless and independent. As a matter of fact they have no other recourse, as their short legs bar escape and their rather weak bodies are unfitted for combat. When met in the path or in the bushes or grass they usually stand their ground, stamp their feet, and with erect and bristling tail make themselves as conspicuous as possible, on the assumption that they will be given plenty of room. Generally their right of way is undisputed, but if closely pressed they about face or throw the body forward and with a quick contraction of the muscular bands surrounding the scent gland force the amber-colored fluid through one or both of the nipplelike ducts to a distance of 10 to 15 feet. The spray is often so fine as to be unnoticed, except by the powerful odor, which at once fills the air and almost stifles one in close proximity. So far as possible, the animals avoid getting the fluid on themselves, and

when undisturbed they usually have little, if any, trace of the odor. Even when caught in traps they rarely discharge their scent unless approached or clumsily handled when killed. If shot so as to break the spinal column or if struck a sharp blow with a club just back of the shoulders, the posterior muscles are paralyzed so that the scent will not be discharged and the animals may be skinned with no unpleasantness.

Skunks generally make their homes in burrows, which they dig in banks or brush patches, or even occasionally in the open. They are mainly nocturnal, but usually leave their dens early in the evening and are often seen abroad before dark and after daylight. They are great hunters, and notwithstanding their short legs often travel long distances in search of food. In fall they become very fat, and usually with the first snows enter the burrows that have been prepared for winter use and curl up for the winter's sleep of four or five months. Generally they are out before the last snows are gone in March, and often their tracks are found in the soft, wet snow in spring. Much of the winter's fat is carried over and is needed for the spring mating season or until the supply of insects and other summer food becomes available.

Breeding habits.—A female taken by Sheldon on May 11, 1915, at Fairmount, contained 4 well-developed embryos showing perfectly the characteristic white stripes. This was evidently the first litter of a young breeding animal, as usually the number of young is 6 to 10. Nine skunks which Kellogg reported dug out of one burrow, near Wahpeton, in the winter of 1915, probably represented a family that had not been broken up—the mother skunk and 8 young. The mammae in breeding females are usually arranged in 7 pairs, 2 pairs of inguinal, three of abdominal, and 2 of pectoral, or in 2 long rows of 7 each, rather evenly spaced along each side of the ventral region.

Food habits.—Apparently the largest part of the food of skunks consists of grasshoppers, beetles, crickets, and other insects and insect larvae, which they catch in the grass or dig up from underground or under decayed vegetation or rotten logs. Their stomachs are large and are usually found well filled with material that is easily identifiable. They eat some mice, especially the young of mice and other rodents which they dig out of the nests. To what extent they feed on young and old ground squirrels in North Dakota has not been well determined, but undoubtedly they get some of these among other rodents. They are fond of eggs and the stomach of one taken by Sheldon at Fairmount on May 11 contained egg-shells of prairie chickens, as well as remains of five young meadow mice. Eastgate says they are destructive to young chickens during early summer, and to prairie chickens, sharp-tailed grouse, and wild ducks during the breeding season. Along the borders of the Sweetwater Lakes in June, 1916, skunks were found unusually numerous and in the evenings they were often met galloping along the trails at the edge of the lake or climbing about through the reeds and tules where the ducks were nesting, evidently searching for nests containing eggs or young birds. The fact that many of the old ducks had small broods of young and others none may have been attributable to these nest robbers, although minks and other animals may have been in part

responsible. The regular breeding grounds of ducks and other water birds should be protected from skunks and such animals by very thorough trapping during the fur season and, if necessary, during the breeding season of the birds.

Economic status.—Skunks are one of the most valuable, because one of the most abundant, of the fur-bearing animals in North Dakota. There are no statistics as to the number taken in the State, but the total number of skunk skins sold in London in 1911 was more than 2,000,000. The average price at that time was $2 each. In 1921, 824,599 skunk skins were dressed by one association, which handles about 90 per cent of the fur dressed in America. The recent average price of raw skins in New York City was $3. This gives only an incomplete record of the skunk fur crop, of which North Dakota furnishes her full share.

In many sections, however, the fur of skunks is not their greatest value, as their insect and rodent-destroying habits render them extremely useful adjuncts to agriculture. An overabundance of skunks would not be advantageous in most localities, and in certain areas their numbers should be restricted as much as possible. Their abundance should be well controlled by suitable trapping laws with provision for local modifications. Many of the States have a close season protecting skunks, except when the fur is prime, during late fall, winter, and early spring. There is little danger of their extermination even locally, but their numbers could often be so controlled as greatly to increase their value for fur and other purposes.

For fur farming, skunks have been thoroughly tested and in many cases successfully raised in confinement, but the low value of their fur prevents any large returns from the industry. Farmers' Bulletin 587, of the United States Department of Agriculture (Lantz, 1914), gives much practical information on the breeding of skunks for fur.

Taxidea taxus taxus (Schreber)

Badger

(Pl. 15, fig. 2)

Choka of the Dakotas (Riggs and Williamson); *Maté* of the Mandans (Will); *Amaka* of the Hidatsas (Matthews), *Awagá* (Gilmore); *Sunuh-katuh* (flat porcupine) of the Arikaras (Gilmore).

Ursus taxus Schreber, Säugthiere, Theil. 3, p. 520, 1778.

Type locality.—"Labrador and Hudson Bay" (probably really from Manitoba or Saskatchewan).

General characters.—A heavy-bodied, low, wide, powerfully built animal of the weasel family, with short, muscular neck, short ears, short legs, and short tail; fur, long and light, especially on the sides, which heightens the effect of the wide body. Color of upper parts buffy or brownish gray, top of head and nose blackish with white stripe from nose to back of neck, white markings on cheeks connected with white or creamy throat; underparts, plain buff or soiled whitish; feet and legs, black. Measurements of adult male from Oakes: Total length, 788 millimeters; tail 133; hind foot 120. Of female from Lidgerwood, 730, 150, and 114, respectively. Weight of male from Wisconsin, 23 pounds 6 ounces. (Jackson, 1908, p. 28.)

Distribution and habitat.—Badgers range over most of the western United States and from southern Mexico to Saskatchewan, and several well-marked forms are recognized. Those ranging over the whole of North Dakota may undoubtedly be referred to the original species. Apparently there is no considerable area in North Dakota where they are not occasionally found. Although most abundant over the prairies, they penetrate into open forested country and even in the Turtle Mountains are found occasionally throughout the more or less scattered timber. Over the prairie country their greatest abundance usually coincides with the abundance of ground squirrels, which form their principal prey. In the more thickly settled parts of the State they are disappearing, as they are practically defenseless and easily destroyed by man unless they can escape into convenient underground burrows. As the time will doubtless come when these useful animals will be very scarce, it seems worth while to give detailed record of their present distribution.

In 1887 the writer found them common at Harwood, Grand Forks, Pembina, Devils Lake, Bottineau, Rugby Junction, and Fort Buford. In 1892 Loring reported them common about Sherbrooke and Jamestown. In 1909, they were found fairly common both in and around the Turtle Mountains. In 1910 Anthony reported a few burrows around Fort Buford, but the badgers were more abundant on the other side of the Missouri River. In 1912 they were more or less common at Hankinson, Fargo, Valley City, and Stump Lake, and a few in the Turtle Mountains; and Eastgate reported them about Stump Lake, Kathryn, and Lisbon. In 1913 the writer found them common at Kenmare, Crosby, and on the Dakota National Forest, south of Medora. Jewett reported a few along the Little Missouri River from Medora to Quinion and many of their burrows in the country about Sentinel Butte. In 1915 Sheldon found them fairly common across the southern part of the State at Fairmount, Lidgerwood, and Oakes. In the same year it was said that there were still a few near Wahpeton, and Kellogg saw the remains of one in the road near Larimore. At Manvel, in Grand Forks County, he reported a number of burrows found in almost any field where the badgers had been digging out ground squirrels. Near Grafton he reported one killed on the Munson farm. At Drayton, in Pembina County, he found where one had been working on the farm where he staid, but it had recently disappeared. Along the south side of Devils Lake he found a number of places where the badgers had been working, but saw none of the animals. At Towner he collected a specimen and reported the animals quite numerous and doing some damage to the roads as well as killing a great many ground squirrels. In one place he counted 18 burrows within a radius of 20 feet. At Grinnell, on the Missouri River, he reported two badgers seen and at Lostwood he considered them fairly numerous, judging by the number of burrows. At Elbowoods, farther down the river, he was told that they were plentiful, and at Goodall quite a few were found. At Stanton he reported them as fairly plentiful over the prairie and one occasionally found on the river bottoms. From Washburn to Bismarck he was told that they were occasionally found. At the Sweetwater Lakes in 1916, Mrs. Bailey saw three alive and one that had been killed.

General habits.—Badgers are preeminently burrowing animals, and they depend on their claws not only for unearthing a large part of their game, but also for the construction of both their summer and winter homes. They seem to prefer open country, where they can see to considerable distances and either escape the approaching enemy by retreating to some near-by burrow or, if necessary, by quickly digging a hole in the ground deep enough to protect all but their vicious jaws, which few animals care to approach. Within a few minutes they will sink their burrows until they are out of sight and then pack the earth behind them as they continue to tunnel through the ground to greater depths. A person on foot can easily overtake one as it lopes away on its short legs, but if unarmed or without even a stick or stone, the tables are quickly turned, and he has to run his best to escape having his legs severely bitten. With a camera one can usually obtain good pictures by chasing a badger until it turns and then backing about over the prairie as it comes on in animated pursuit. Occasionally one is seen lying in the sun on the mound in front of the burrow from which it has unearthed a ground squirrel, or loping across the road in its short, floppy gait. Dogs usually pursue, but keep well out of reach of the savage jaws of the badger, and there are very few dogs that do not get the worst of an encounter with one of these strong-jawed, thick-hided animals. In summer the badgers spend most of their time and energy in digging out the various rodents on which they feed, and even after the ground squirrels have denned up for winter continue to unearth and feed upon them for a month or six weeks, until the ground begins to freeze, when they seek their own winter quarters and, well ensconced in deep burrows, curl up for a long sleep. At this time of year they are always fat and covered with a heavy coat of long fur. From the middle of October to the middle of March they are rarely seen above ground, but with the melting of snow they appear and, still fat and with a still heavier coat of fur, start out on their hunting and mating expeditions.

Breeding habits.—Surprisingly little is known of the breeding habits of badgers. The young are apparently brought forth and kept within the burrows until well grown, as few persons have seen a badger outside less than half grown. The mammae are usually in 4 pairs, 2 pairs of inguinal and 2 of abdominal, and the young are usually four in number. Near Stump Lake, on July 23, 1912, a family of four not fully grown young were found in the prairie grass. They were followed to the nearest burrow, where the last of the four was struggling to get inside. It was caught by the tail and then by both hind legs and given a wide swing over the prairie grass to a considerable distance from the burrow. With the camera the writer followed around, teasing and keeping it engaged while taking as many photographs as were wished before it was allowed to return to the burrow where its brothers and sisters had disappeared.

Food habits.—In North Dakota the favorite food of the badger seems to be the Richardson ground squirrel, and where the squirrels are most abundant so also are the badgers. Other ground squirrels are dug out and eaten wherever found, as also are pocket gophers, prairie dogs, mice, and other burrowing rodents. Occasionally

badgers will feed on some old carcass, and usually they will take any kind of meat with which traps are baited. On rare occasions one will dig under a chicken coop and kill some of the poultry, but this happens so rarely and is so easily prevented as to be of little economic importance.

Economic status.—In North Dakota, as in other parts of the country, badgers are generally killed on sight by the residents on the pretext that they catch poultry, kill lambs, and are a danger to horses, which sometimes step in their burrows and, if running, possibly break their legs or injure their riders; or that they make burrows in roads, causing serious bumps to passing automobiles. All of these claims have some foundation in fact, but they are generally over-emphasized to warrant the wanton destruction of a conspicuous and rather ferocious little carnivore that is not swift or skilful enough to protect itself.

On the other hand, the badger spends almost all of its time digging out and devouring the most injurious rodent pests of the region, thus saving a large quantity of grain and other crops from destruction. It is unquestionably one of the least harmful and most completely beneficial of the native mammals in the State, and even when the ground squirrels are poisoned and under good control there will still be ample employment for the badgers in digging out pocket gophers, mice, and other small rodents which must be held in check to prevent serious loss to crops.

Only recently have badger skins come into general use as fur. While very durable, warm, and when in prime condition, rather attractive, they are certainly worth more to the State when worn by the badger than when made into robes, coats, or muffs. In some States the value of the badger is recognized and the animal is protected by law, but a protection through popular sentiment based on a full knowledge of its useful habits would be much more effective than a legal statute not well enforced.

Family PROCYONIDAE: Raccoons

Procyon lotor lotor (Linnaeus)

Raccoon; "Coon"

Wica of the Dakotas (Williamson); *Mikâ* of the Omahas (Gilmore); *Isat* of the Arikaras (Gilmore); *Shunte-pusa* of the Mandans (Gilmore); *Sida-buzhe* of the Hidatsas (Gilmore); *Asebun* of the Ojibways (Wilson).

[*Ursus*] *lotor* Linnaeus, Syst. Nat., ed. 10, t. 1, p. 48, 1758.

Type locality.—Eastern United States.

General characters.—A thick-set, furry little animal with pointed nose, prominent ears, round, furry tail, long naked soles, and strong curved claws. Color, yellowish or silvery gray, with light gray ears, face, and feet; gray more or less darkened with black-tipped hairs over the back; a black mask across face, black spots back of ears, and five black rings around tail; long woolly underfur light brown. Measurements of a large male taken near

Fargo, by Murie: Total length, 880 millimeters; tail, 265; hind foot, 125. Weight, 24 pounds. A large and very fat male at Elk River, Minn., weighed 30½ pounds.

Distribution and habitat.—In the early trapping days raccoons were abundant in the Red River Valley and apparently scarce in the western part of the State. On September 16, 1800, Alexander Henry (1897, pp. 88, 90, 112, 122, 136, 155, 171) on a canoe trip along Red River, tells us in his journal that his "people saw many raccoons in the course of the day, and shot four." On October 5, at the mouth of the Park River, his party caught 5, and on October 6, 3, and on October 18, 20. After that he records some brought in daily by the trappers; many of them were very fat, and when stripped of the fat and roasted made excellent eating. On November 7, he wrote: "My men took great numbers of fat raccoons in their traps;" and on November 18, no more taken, as they had all denned up for the winter. At Park River, on November 30, he reports seven raccoons taken from one hollow tree where they were evidently hibernating. On March 5, 1801, he says: "The snow is gone and raccoons begin to come out in the daytime." During the trapping seasons from 1800 to 1809, he (Henry, 1897, pp. 184, 198, 221, 245, 259, 281, 440) reported among others, 37 raccoon skins taken at Red River, 163 at Park River, 144 at Grand Forks, 57 in the Hair Hills, 158 on the Pembina River, 63 on the Turtle River, and 15 on the Salt River. Apparently they were one of the commonest fur-bearing animals of that region.

In 1887 the writer found them common near Fargo and at Devils Lake, and in 1895 Loring reported them common at Portland, where he saw skins of some that had been taken in that vicinity. In 1912, in the Turtle Mountains, a resident trapper said that he knew of only three instances of raccoons having been taken in the hills and he considered them decidedly rare. The same year Eastgate reported three killed just north of Dion Lake on November 27. Eastgate also reported a few on the Sheyenne River, south of Stump Lake, and was told that they were formerly common at Lisbon, but that of late years they had become very rare, only three or four skins being brought in each winter. In 1913, a few coons were reported along the Mouse River, east of Kenmare; and at Minot, Mr. Booth, the taxidermist, said that there were still a few at that time, but that they used to be very common when he first came there in the early eighties. On the Missouri River no mention is made of raccoons by Lewis and Clark, Maximilian, or Audubon, while Hayden (1875, p. 92) in his report on the upper Missouri region for 1855, 1856, and 1857, reports them abundant at Council Bluffs; but the highest point on the Missouri River at which he observed them was about the mouth of the Niobrara River. The fact that Maximilian found a name for them among the Minnetaree Indians on the Upper Missouri would indicate that they were not entirely absent from the region at that time. At Fort Clark in 1913 Jewett reported fresh tracks in muddy places along the Missouri River. In 1914 the writer found tracks along Apple Creek, just east of Bismarck, where the animals had been feeding on crawfish and mussels along the creek.

In 1915, raccoons were found common along the river at Wahpeton, where many of the old hollow trees were well scratched up by their claws, and where there were great numbers of frogs in the marshes and an abundance of acorns, all of which offered a feast for them. In the same year Kellogg reported them at Grafton, where he saw three very large dark skins in the Williams collection. At Drayton, in Pembina County, he reported one occasionally captured, and around Devils Lake he found them common in the woods. At Grinnell, on the Missouri River, he reported a few caught, and at Goodall, he saw tracks along the river and was told that two had been taken by trappers two years before. At Elbowoods he saw a few tracks along the river, and near Sather he followed their tracks from the river to a cornfield, where they had been eating the corn and had destroyed entirely two rows. On his way from Washburn down the river to Bismarck he reported a few in the wooded sections of the river bottoms and was told of two trappers who had sold 75 skins taken around Chanta Peta Creek, south of Bismarck. In 1919, Mr. Allen, a taxidermist at Mandan, said that there had always been a few raccoons along the rivers there and one was brought in to be mounted the year before. No records were obtained from the Little Missouri country and the areas west of the immediate Missouri valley.

General habits.—In general habits, as well as to a slight extent in appearance, the raccoons resemble the bears. They are very intelligent and resourceful animals, adapting themselves to almost any environment where food is abundant and the climate not too severe. They are excellent climbers and usually make their homes in hollow trees or logs, but in the absence of such protection they often occupy caves and hollow spaces in banks or cliffs, where they find dark retreats for the daytime and safe dens for their long winter sleep. They are mostly nocturnal in habits, but on rare occasions will come out in the daytime when disturbed or move from one place to another in search of mates in the breeding seasons.

Although not very swift runners, they can usually outdistance a man, but are quickly overtaken by dogs, which are often used in hunting them at night. When pursued, if no hollow tree or rocky retreats are within range, they usually seek protection by climbing up the nearest tree. They are savage fighters and will generally get the best of a dog of approximately their own size.

In fall they become very fat, and soon after the first snows fall enter their dens for hibernation and remain until the early spring thaws rouse them to renewed activity.

Breeding habits.—Audubon (1851–1854, vol. 2, p. 77, 1851) gives a number of young of the raccoon as four to six, generally brought forth in May. The mammae are usually arranged in two pairs of abdominal and two pairs of pectoral. The young are kept well secreted in hollow trees or caverns and are rarely seen until about half grown, when they begin to follow their mother in search of food. In fall they are still in family parties and if so fortunate as to escape the dogs and trappers until November, they enter hibernation together, the mother evidently selecting a suitable hollow for

their winter's sleep. In spring the males are out with the first few warm days, making long journeys from tree to tree in search of mates. Occasionally in early spring a male and female are found together in a hollow tree or hollow log, but for the rest of the year the animals are mainly solitary, except for the mother and young.

Food habits.—In tastes raccoons are highly omnivorous, accepting almost any food in the way of fish, flesh, or fowl, fruit, nuts, or corn. In this northern country they feed in summer very largely on crawfish, mussels, frogs, and fish, and on such birds, eggs, or small mammals as they can find or catch. They are especially fond of ripe blueberries, serviceberries, and any kind of sweet fruit. In fall they usually fatten on acorns where these are obtainable, and the northern limits of their range are almost coincident with the northern limits of oaks. Often at this season their large stomachs contain nothing but the finely masticated pulp of acorn meats and a few shells, and the fattening properties of these rich nuts seem not to be lessened by their bitter and astringent flavor. They are also very fond of unripe corn, and at night will make long trips to cornfields, where they pull down the ears and strip them of their milky kernels. Once started on the green corn, they usually continue to feast on it from the early milky stages until it has become fully ripe.

Economic status.—On rare occasions raccoons find their way into poultry yards or houses at night and kill some of the fowls or rob the nests of eggs. It is probable also that they destroy eggs and young of game and other birds occasionally, but there is little mischief that can be proved against them. Their raids on cornfields are often of considerable extent, but usually the animals are discovered and captured by a night hunt with dogs before they have done serious damage.

On the other hand, their value as one of the standard fur-bearing animals is usually sufficient far to outweigh the losses from their occasional depredations. Their fur is thick, warm, and light, and the skins, while light, are very strong and durable and specially well adapted for overcoats, robes, caps, and driving gloves. The fur is also used for women's capes and muffs, and when plucked is a fair imitation of plucked beaver fur, although longer and less dense. It is usually one of the rather low-priced furs, but gives good value in warmth and wear.

Many people are very fond of the flesh of raccoons, and when fattened on acorns or beechnuts in the north the meat is of good flavor and wholesome. The fat makes a thin oil that is much prized for use on leather. In the pioneer days it was the principal oil for domestic purposes and even for machinery in the frontier settlements. Generally the raccoon is considered a valuable fur and game animal and its depredations are easily overlooked. Many of the skins are of little value because taken early in the fall before they have become heavily furred and prime. The young do not get their full growth before entering hibernation in fall, and only a very short season should be allowed for trapping before they den up for the winter. In North Dakota an open season from November 15 to March 15 would probably insure prime fur.

Family URSIDAE: Bears

Ursus americanus americanus Pallas

Black Bear; Cinnamon Bear

Wasabè of the Omahas (Gilmore); *Wachank-shica* of the Dakotas (Williamson); *Konuch-katit* of the Arikara (Gilmore), *Watú*—tame bear; *Haschida* of the Hidatsas (Maximilian); *Ischídda* of the Mandans (Maximilian).

Ursus americanus Pallas, Spicilegia Zool., fasc. 14, p. 5, 1780.

Type locality.—Eastern North America.

General characters.—A heavily built, powerfully muscled animal, not half so clumsy as it looks when fat and in long fur. Eyes, small and not very keen sighted, but the ears prominent and as sensitive to sound as the nose is keen to scent. Tail, short; feet, rather large and plantigrade with naked soles; front and hind claws, short, curved, and sharp for climbing. Color, mainly black, with usually a yellow-brown muzzle and occasionally a white spot on the breast or throat. Occasionally these bears are entirely brown, normally of a cinnamon color, but varying from yellow-brown to dark brown. Measurements of adult male, from Montana: Total length 1,680 millimeters; tail, 105; hind foot, 275; in feet and inches, 5.5 feet, 4.1 inches, 10.8 inches, respectively. In Minnesota, where probably the same form occurs, the weight is estimated usually at about 300 pounds for a fully adult male. One killed by A. H. Wilcox (1907, p. 100), at Detroit, Minn., weighed 299 pounds. Seton (1909, vol. 2, p. 1052) gives the weight of a large male killed near Winnipeg, Manitoba, as 265 pounds.

Distribution and habitat.—In the early days black bears evidently ranged over practically all of North Dakota, but were most abundant along the Red River Valley, in the Turtle Mountains, Pembina Hills, and on the wooded streams of the eastern part of the State. There are a few records of them for the Missouri Valley, but apparently they were never common over the open prairie country or in the Badlands farther west. Their greatest abundance seems to have been in the Red River Valley, where from 1800 to 1808 Alexander Henry (1897, pp. 184–440) records them in such numbers as have rarely been known in any part of the country. In September, 1800, near the mouth of Park River, he reported 4 bears killed on the 14th, 6 on the 15th, 1 on the 16th, 2 on the 20th, 3 on the 24th, 1 on the 25th, and 1 on the 26th of the month, and 40 skins taken by one party of trappers. For the next eight years he reported, among the fur bearers taken in the Red River Valley, 52 black and 20 brown bears on the Reed River, 148 black and 25 brown on the Park River, 64 black and 3 brown at Grand Forks, 131 black and 26 brown from the Hair Hills, 302 black and 75 brown on the Pembina River, 28 black and 12 brown on the Turtle River, and 18 black and 2 brown on the Salt River, making in all 906 bears from this region. At the mouth of the Park River, on September 22, 1800, Henry (1897, p. 101–102) says in his journal:

> Bears make prodigious ravages in the brush and willows; the plum trees are torn to pieces, and every tree that bears fruit has shared the same fate; the tops of the oaks are also very roughly handled, broken, and torn down, to get the acorns. The havoc they commit is astonishing; their dung lies about in the woods as plentiful as that of the buffalo in the meadow.

Over the rest of the State the records are few and scattered. Along the Missouri River bears were not mentioned by most of the

early explorers, although Audubon (1897, p. 133), in 1843, reported the killing of a black bear on the White Earth River, about 60 miles from its mouth, where he says a few are occasionally shot. In 1878, McChesney (1878, p. 202), from Fort Sisseton, S. Dak., just below the southeastern corner of North Dakota, reported them as once very common, but not seen of late years within 50 or 60 miles of the post. At Valley City, J. S. Weiser gave Morris J. Kernall a record of a black bear found near there in 1878. In 1887, there were said to be still a few black bears in the Devils Lake timbered areas, and in the Turtle Mountains they were said to be common. A few were also said to occur in the country about Fort Buford, but not on authority that seems very reliable. At Wade, on the Cannonball River in 1913, W. B. Bell reported black bears seen by Mr. Wade, who had lived there for 41 years. At the mouth of the Cannonball, in 1916, the writer was told that a few black bears had been found along the river bottoms up to comparatively recent times. Beede, who had lived among the Sioux Indians there, said that the Indians did not hunt them unless in dire need of food, as the bears were to them semisacred. When one was killed, he says, a bit of its skin was left on a bush or tree as an offering to the spirit world.

At the present time there are a few black bears in the Turtle Mountains and Pembina Hills, where one is occasionally killed, and in the Red River Valley one may sometimes wander in from the heavy woods of northern Minnesota. At Grafton, Kellogg reported two killed by Andrew Monsebroten, five miles west of the town, in 1884; two young bears killed by Arthur Blomquist, in 1910, about six miles north of Drayton on the Minnesota side of the river; and another killed in Pembina County, in 1894, by Jim Spanglo, "the latest record I could get for the county." At Devils Lake, in 1916, Mr. Palmer told of a small brown bear killed near the lake only two years previously. It had been seen in several localities and evidently had wandered from the Turtle Mountains.

General habits.—The black bears are timber-loving species, depending largely on the cover of thickets, swamps, and dense forests for protection, and to some extent also upon the trees for food and winter quarters. They are great wanderers, however, and do not hesitate to strike across wide stretches of open country when in search of a new supply of food, or when driven out of their regular haunts by hunters. Usually, however, their wanderings are along the lines of streams and wooded or brushy patches, where both food and cover are to be found.

Food habits.—Few animals are more nearly omnivorous than the black bears, and as they are hearty eaters a great quantity of food is required to satisfy them, especially in fall, when they are preparing for their long winter sleep. Acorns, berries, and fruit form a great part of their food in this northern country, but they readily accept any meat or carcass that can be found, such insects as can be procured from ant hills, rotten logs, or overturned stones, and many plants and roots and much succulent vegetation. In summer they gorge themselves on blueberries and serviceberries, the abundant sweet fruit of which seems to appeal strongly to their appetites. In fall, wherever oaks are to be found, bears search for the acorns and gather them, first from the treetops by draw-

ing in and breaking the branches until every acorn can be reached, often making the top of the tree look like an eagle's nest before they have finished with it. Later, as the ripe acorns fall to the ground, they gather them up and eat them to the exclusion of almost every other food. These puckery but rich little nuts rapidly supply the heavy coating of fat necessary for carrying the bears comfortably through the long, cold winter hibernation.

Hibernation.—In 1800, Alexander Henry (1897, pp. 157, 252–253, 87, 135, 136, 117) wrote in his journals that "bears den in hollow trees along the Red River, but in the Hair Hills on higher ground in holes in the banks. They are hunted by the Indians in the trees." On November 13, 1804, at Pembina, he writes, "My tame bear is making a hole to take up his winter quarters in." On September 6, 1800, he says, "one bear killed up a tree." In another place he records one bear killed November 5 and 10 skins brought in from the Hair Hills, November 6; and on May 1 following, he records 37 bear skins brought in from Grand Forks (p. 177). These dates, however, do not indicate reliable records of the beginning and end of hibernation, as apparently the Indians were in the habit of killing the bears in their winter dens. Usually the bears in northern Minnesota den up with the first heavy fall of snow and cold weather early in November, reappearing with the first warm days late in March or early in April. Their fur is not prime until about the time of hibernation and usually is in the best condition when they come out of their dens in spring. A large number of the skins taken are in almost worthless condition because the bears were killed too early in fall or too late in spring.

Economic status.—Over much of the country black bears are now considered one of the valuable game animals and given protection as such in the game laws. In a forested area like the Turtle Mountains it would seem well worth while to protect them until past danger of extinction. With the abundance of wild land, forest, and lakes, and ample food in the berries and acorns, there is little probability of their doing any serious mischief to crops or livestock in that region.

Ursus horribilis horribilis Ord

Grizzly Bear; Big Plains Grizzly; Silvertip

Mato or *Mato-chota* of the Dakotas (Gilmore); *Mato* of the Mandans (Maximilian); *Mato unknapininde* of the Mandans (Will); *Lachpitzi* of the Hidatsas (Maximilian); *Kúnuch* of the Arikaras (Maximilian), *Konuch-tarawis* (Gilmore).

Ursus horribilis Ord, Guthrie's Geogr., 2d Amer. ed., vol. 2, pp. 291, 300, 1815. (Reprint by S. N. Rhoads, 1894.)

Type locality.—Missouri River above the mouth of Poplar River, northeastern Montana.

General characters.—Size, very large; skull, long and massive with very heavy molar and canine teeth; front claws, long and only moderately curved. Fur, long and loose with well-marked mane or crest over "hump" of shoulder. Color, variable from light yellow to dark brown, the lightest individuals even called white by Lewis and Clark and other writers familiar with them. Audubon (1851–1854, vol. 3, p. 149, 1854) says: "We have skins in our pos-

session collected on the Upper Missouri, some of which are nearly white, while others are nearly of a rufous tint, and one that was killed by our party, of which we also have the skin, was a dark brown one."[24] Maximilian (Wied, 1839–1841, Bd. 1, pp. 490, 493, 1839) writes: An old bear and two cubs were killed. The mother was "a pale yellowish color; one of the cubs, which was brought on board alive, was whitish about the head and neck and brownish gray on body; the other was dark brown." Another killed on July 18 was reported as dark brown, with new hair of light gray with yellow tips already appearing; another killed farther up the river on July 21, 1833, was at first supposed to be a black bear, but when shot proved to be dark brown, and as Maximilian suggests, may have been another species of grizzly.

Measurements of a small male collected by Maximilian (Wied., 1839–1841, Bd. 1, p. 488, 1839) and supposed to be about 3 years old were: Tip of nose to tip of tail, 6 feet 2 inches 2 lines. A large one measured by Lewis and Clark (1893, p. 298) in northeastern Montana, apparently the type of the species, measured from tip of nose to extremity of hind foot, 8 feet 7½ inches, length of front claws, 4⅜ inches. A still larger one killed by the party was said to measure 9 feet from tip of nose to tip of tail, with front claws 6¼ inches in length. Skull of large male: Basal length, 351 millimeters; zygomatic breadth, 247; in inches 13.8 and 9.6, respectively. (Merriam, 1918, p. 19.) There seem to be no reliable weights for the adults of this Plains grizzly available, but Lewis and Clark (1893, p. 298) estimated the weight of a large one as 500 or 600 pounds.[25]

Distribution, habitat, and general habits.—At the coming of the white man these large grizzlies were apparently common over practically all of North Dakota. In 1800 Alexander Henry (1897, pp. 121, 145, 184, 245, 259, 281, 440), while in the Red River Valley, wrote in his journal:

> Grizzly bears are not numerous along Red River, but more abundant in the Hair Hills. At Lac du Diable [Devils Lake], which is about 30 leagues W., they are very common—I am told as common as the black bear [*Ursus americanus*] is here, and very malicious. Near that lake runs a principal branch of Schian [Sheyenne River], which is partially wooded. On the banks of this river I am informed they are also very numerous, and seldom molested by the hunters, it being the frontier of the Sioux, where none can hunt in safety; so there they breed and multiply in security.

Again, in speaking of the Sheyenne River, he says: "Grizzly bears are to be seen in droves." On his return from a trip to the Sheyenne River to his winter quarters at the mouth of the Park River, near where Grafton now stands, he records:

> During my absence the hunter had killed a large grizzly bear [*Ursus horribilis*] about a mile from the fort. He had seen two males and a female, but the latter escaped. My people having cooked and eaten some of the flesh were taken very ill, and most of them threw it up. This bear had been wounded in the fore leg some time before by an arrow, the iron head of which stuck fast in the bone, and was beginning to rust.

During the first trapping season 1800–1801, his men obtained four grizzly-bear skins at the Reed River and two at the Park River. In 1804 he reports one grizzly bear from the Park River and in 1805, four from the Hair Hills, four from the Salt River, and two from the Pembina River, and in 1806, three from the Pembina River. Meanwhile of the 113 skins of brown bears recorded, it is very prob-

[24] Possibly two species.

[25] The type specimen of *Ursus horribilis* collected by Lewis and Clark is lost, but a fine old male skull from near the type locality in eastern Montana, gives reliable characters of the species. There is still one skull of a 3-year-old male from Fort Buford in the National Museum collection, taken by J. P. Kimball, in 1868. This is the only specimen representing the species from North Dakota and we can only assume that the grizzlies extending across the State were all the same. Old skulls from any part of the State would be of great interest and value as contributions to the National Museum collection.

able that some were of the grizzly group. Henry (1897, pp. 422, 221) also reported one grizzly-bear skin in the catch from the Sandhill River, Minn., in 1807, and one from Portage la Prairie, Manitoba.

On their way up the Missouri River in 1804, Lewis and Clark (1893, pp. 157, 174, 251, 274, 288–289, 298) often referred to the white, yellow, and gray bears. On Fox Island, S. Dak., they saw the tracks of a "large white [grizzly] bear." On October 20, while camped an the river bottom just below where Bismarck now stands, they say: "We also wounded a white bear, and saw some fresh tracks of those animals, which are twice as large as the track of a man." From Mandan they sent back, among other skins, those of the "yellow bear." The following spring, on the way up the river after wintering at the Mandan villages, they saw one black and two white bears about 30 miles above the Little Missouri, and observed tracks along the river at other places. Near the junction of the Yellowstone with the Missouri River, on April 29, 1805, Captain Lewis, who was on shore with one of the hunters about 8 o'clock, met two white bears. He writes:

> Of the strength and ferocity of this animal the Indians had given us dreadful accounts. They never attack him but in parties of six or eight persons, and even then are often defeated with a loss of one or more of their party. Having no weapons but bows and arrows, and the bad guns with which the traders supply them, they are obliged to approach very near to the bear; as no wound except through the head or heart is mortal, they frequently fall a sacrifice if they miss their aim. He rather attacks than avoids a man, and such is the terror which he has inspired, that the Indians who go in quest of him paint themselves and perform all the superstitious rites customary when they make war on a neighboring nation. Hitherto those bears we had seen did not appear desirous of encountering us; but although to a skillful rifleman the danger is very much diminished, yet the white bear is still a terrible animal. On approaching these two, both Captain Lewis and the hunter fired, and each wounded a bear. One of them made his escape; the other turned upon Captain Lewis and pursued him 70 or 80 yards, but being badly wounded the bear could not run so fast as to prevent him from reloading his piece, which he again aimed at him, and a third shot from the hunter brought him to the ground. He was a male, not quite full grown, and weighed about 300 pounds. The legs are somewhat longer than those of the black bear, and the talons and tusks much larger and longer. . . . Its color is a yellowish-brown; the eyes are small, black, and piercing; the front of the fore legs near the feet is usually black, and the fur is finer, thicker, and deeper than that of the black bear. Added to which, it is a more furious animal, and very remarkable for the wounds which it will bear without dying."

A few days later, May 5, Captain Clark and one of the hunters killed a large grizzly, said to weigh 500 or 600 pounds, and to measure 8 feet 7½ inches, from the tip of the nose to the extremity of the hind foot. His front claws measured 4⅜ inches, and his color was of a reddish or bay brown. This specimen, with measurements and description, formed the principal basis of Ord's later description and name of the species; neither skin nor skull can now be found.

In 1833, Maximilian (Wied, 1839–1841, Bd. 1, pp. 419–420, 1839) notes in his journal on June 22: Near the great bend of the Missouri (just above the mouth of the Little Missouri River), a large grizzly seen on the prairie on the north bank of the river, and "soon after two others were seen, one whitish, the other of a dark color." From this place on, in their journey up the river, the gray bears become

more and more common. Above the mouth of the Knife River at the village of the Minnetarees, many of the Indians wore the large, valuable necklaces made of long bears' claws, and their handsomely painted buffalo robes were fastened around the waist by a girdle. A few days later Maximilian met a chief of the Assiniboines wearing a necklace of bears' claws, blue glass beads in his ears, and a red flannel shirt. At Fort Union he (Wied, 1839–1841, Bd. 2, pp. 39, 302, 213, 215, 1841) mentions several distinguished men of the Assiniboines who arrived at the post on October 20, among whom was one Mantó-Uitkatt (The Mad Bear). At the village of the Minnetaree Indians, about 30 miles above Fort Clark, he found an old chief, Lachpitzi-Sihrisch (The Yellow Bear), of whom he has much to say later. At the Knife River he gives the name of another Minnetaree chief as Lachpitzi-Wáh-Kikihrisch (The Bear Hunter). Mato-Tope (Four Bears) was one of the most famous of the Mandan chiefs and a staunch friend of Maximilian. His son was named Mato Berocka (Male Bear). In the folio of plates accompanying Maximilian's Reise in das Innere Nord-America, many of the Indians shown are chiefs or famous hunters wearing grizzly-claw necklaces, among them Sioux, Mandan, Minnetaree, and Crow, who had won the right to wear these trophies of the hunt. In Plate 36 of the folio, Maximilian (Wied, 1839–1841, Folio, pl. 36) shows his hunters attacking two grizzly bears as described in the text of his journal. On July 18 he (Wied, 1839–1841, Bd. 1, pp. 487–489, 1839) says:

> The hunters had seen several bears and on the 18th they saw two bears running about on a sand bar in the river. One of these was shot and when mortally wounded rolled over, uttering fearful cries. It was a male about 3 years old and not of the largest size, but was 6 feet 2 inches and 2 lines from tip of nose to tip of tail, and from tail to tip of hairs, 8 inches. His color was dark brown with the points of the hair of a rusty color, but new hair already appearing which was lighter gray with yellow tips. This bear is known to be a very dangerous beast of prey and is willingly avoided by the hunters. . . . It is certain that many white men and Indians have been torn to pieces by these dangerous animals, especially in former times, when they were very numerous and lived to a great age.

At Fort Clark, where he spent the winter with the Mandan Indians, he (Wied, 1839–1841, Bd. 2, p. 85, 1841) says:

> The grizzly bear approaches to within 4 miles of the fort because the Indians, who do not like to hunt them, leave them undisturbed. They are, however, very fond of the flesh of the young bear and the claws are much valued by them for the manufacture of their necklaces.

On returning down the river in October, Maximilian (Wied, 1839–1841, Bd. 2, pp. 47–49, 1841) brought with him, among other live animals, some young bears in cages. Near the mouth of the Muddy River, on October 31, he found along the shores an abundance of buffaloberries, which were fed to the caged bears and proved an agreeable variety in their food. Since no game had been killed for several days, the live animals, which would not eat salt pork, were half famished, and the bears especially made an incessant growling, which was in every respect highly disagreeable. The next day an elk was shot and he says: "The lamentations of my hungry animals were put a stop to." Generally, however, the bears were found feeding on buffalo carcasses, which were often plentifully distributed in the quicksand or along the river banks by floods and breaking ice.

Apparently the Missouri River Valley with its great abundance and variety of large game, wild fruit, and berries, bulbs, tubers, roots, and underground beans, was a paradise for those bears before the days of the rifle.

In regard to the breeding habits of the grizzlies, Maximilian (Wied, 1839–1841, Bd. 1, p. 510, 1839) says that only 2 or 3 young are generally raised, but 2 to 4 were sometimes recorded and some of the Indians even claimed that one group of 8 young had been found, but this he considered an exaggeration.

In 1843, Audubon (1897, pp. 155–156, 41, 51, 64, 75, 86, 117, 122, 146) on his trip up the river to Fort Union, found the grizzly bears apparently as common as had Maximilian and Lewis and Clark over the same ground 10 and 39 years earlier. Just above Bismarck he found many of their tracks, and near the mouth of the Little Missouri, on August 22, he and his companions killed one and saved it for a specimen. They had seen many tracks the previous day and on the following day saw another bear. In the vicinity of Fort Union he found many tracks around the three conical hills called the Mammalles. On June 19 a grizzly bear was seen just across the river, on June 22 another near there, and others were seen on June 27, July 5, 13, 27, and 30, and August 12, which gives some idea of their abundance at that time. Audubon describes a man at Fort Union who had been attacked by a grizzly in the Black Hills; his face was badly mutilated, one eye had been torn out, and his arm and side were literally torn to pieces, but he lived for years afterward. There are many accounts of bears attacking both Indians and whites, and often without provocation. Audubon (1851–1854, vol. 3, pp. 145–146, 1854) records an attempt to kill an old bear and capture her two young, discovered near the shore from one of the steamers of the American Fur Co. The old bear was wounded and charged the hunters with such fury that they dropped their guns, jumped into the river, and hurriedly made their way back to the steamer. He relates another incident of an attendant at Fort Union picking peas in the garden when he suddenly discovered a large grizzly gathering peas at the other end of the row. He dropped his bucket and fled, and when the hunters arrived they found the bear eating peas out of the bucket. He paid no attention to them as they approached and was shot dead.

In 1856, F. V. Hayden collected specimens of the grizzly bear near Fort Clark and a skeleton at Fort Union.

At Devils Lake, in 1916, Frank Palmer, who had lived in North Dakota since 1867, told the writer that he had never known of any grizzly bears east of the Missouri River Valley. He said that the Sioux in their own language called some hills near old Fort Ransom, in Ransom County, where the Sheyenne River turns north, "The Bears' Den." Some of the Indians from near Devils Lake used to go down there and hunt buffalo and Mr. Palmer was with them on one of these trips when he learned the name of these hills. In 1867, he says there were many grizzly bears on the river bottoms about Fort Buford, and also above and below there, and farther west in Montana. While carrying mail from Fort Buford west he often saw them along the Missouri River bottoms, and they would not always get out of his way.

In the Killdeer Mountains, in 1913, Jewett was told by the old settlers that grizzly bears were formerly common over all the country east and north of the Little Missouri River. Frank Donoyer, a veteran buffalo hunter, told of killing several of these bears in the Killdeer Mountains between 1864 and 1870. Dave Warren, assisted by a boy, killed two grizzlies in a gulch near Oakdale in the fall of 1897.

From his ranch on the Little Missouri, Roosevelt (1900, pp. 55–56) writes:

> In the spring and early summer of 1888, the bears killed no cattle near my ranch; but in the late summer and early fall of that year a big bear, which we well knew by its tracks, suddenly took to cattle-killing. This was a brute which had its headquarters on some very large brush bottoms a dozen miles below my ranch house, and which ranged to and fro across the broken country flanking the river on each side. It began just before berry time, but continued its career of destruction long after the wild plums and even buffalo berries had ripened.

Again, he tells of bears attacking his cattle, killing white-tailed deer, attacking one of his cowboys, and killing an Indian near his ranch, and of numerous instances of bears killed under thrilling circumstances during his ranching days on the Little Missouri.

In 1887, when the writer visited Fort Buford, there were still a few grizzly bears in the river bottoms in that vicinity, but they were growing scarce. In a letter dated March 30, 1914, Clarence H. Packer, of Minot, states that his father trapped along the river bottoms, 25 miles south of Williston, in 1887, and at that time there were some grizzly or silvertip bears there.

In 1889 William B. Mershon (1923, 1925), on a hunting trip along the Little Missouri, reported bear tracks everywhere, the sand bars literally tracked up by them, some of enormous size. He measured one track that was 8 by 14 inches.

At the present time there is certainly not a grizzly bear left in the State of North Dakota, and it is doubtful if there is anywhere a living representative of this original species of the grizzly group that was first given a scientific name and status in literature. Its destruction, however, was more inevitable than was that of the buffalo or the other large game animals of the Plains, because, aside from its commercial value and its appeal to the most vigorous sportsmen as a worthy antagonist among large game, its presence in an agricultural and stock-raising region could not be tolerated. Like some of the savage tribes with which it was associated, it has in passing left behind a thrilling record of savage bravery of surpassing interest to red-blooded Americans.

Ursus absarokus Merriam

Absaroka Grizzly

Ursus absarokus Merriam, Proc. Biol. Soc. Washington, vol. 27, p. 181, 1914.

Type locality.—Near head of Little Bighorn River, northern end of Bighorn Mountains, Mont.

General characters.—Large, but smaller than *Ursus horribilis*, with much smaller molar teeth. Color from skin of head and neck only, "Muzzle pale brown, changing to grizzled dark brown on head and face; a large patch of dark brown free from grizzling on side of face extending from eye to angle of jaw; chin and gular region dark brown (except anterior part of

chin, which has not yet molted the pale old coat); top and sides of neck and doubtless body also, strongly grizzled." (Merriam, 1918, p. 93.) Measurements of skull of adult male: Basal length, 322 millimeters; zygomatic breadth, 218; in inches, 12.7 and 8.6, respectively.

Distribution and habitat.—Doctor Merriam (1918, p. 93) gives the range of this grizzly as "Laramie and Bighorn Mountains, eastern Wyoming, Black Hills region, South Dakota, and northward along Little Missouri to Missouri and Yellowstone Rivers." He says it appears to be a mountain species, while *horribilis* apparently was a Plains species.

The only North Dakota specimen consists of a skull with accompanying skin of head and neck presented to Doctor Merriam for the National Museum collection by Howard Eaton, of Wolf, Wyo. This bear was killed by Mr. Eaton on October 27, 1880, at the mouth of Bear Creek, which empties into the Little Missouri River from the east, opposite Bullion Butte. Apparently its range overlapped that of the Plains grizzly to some extent, which may account for the supposed discrepancy in color of that species. Evidently this was a darker, browner bear than *Ursus horribilis*.

Order INSECTIVORA: Insect-eating Mammals

Family TALPIDAE: Moles

Scalopus aquaticus (machrinoides?) Jackson
Missouri Valley Mole

(Pl. 19, fig. 1)

Scalopus aquaticus machrinoides Jackson, Proc. Biol. Soc. Washington, vol. 27, p. 19, 1914.

Type locality.—Manhattan, Kans.

General characters.—Rather large for the common mole; a compact little animal with beaklike naked nose, no functional eyes, minute ears, large spadelike front feet with five rigid claws, small hind feet, short, nearly naked tail, and dense plushlike fur of a brassy brown color. Measurements of average adults: Total length, 172 millimeters; tail, 30; hind foot, 22.2.

Distribution and habitat.—The northernmost form of the common mole of the eastern United States ranges from Arkansas up through Missouri, Iowa, and Minnesota to Elk River, and has been reported from Ottertail County, near Fergus Falls, and from Crookston. There is no definite record for North Dakota, but at Hankinson, in the southeastern corner of the State, some of the residents reported that mole ridges had been seen on the sandy soil in that region. Doctor Bell and the writer were unable to find any trace of moles or ridges, however, and but for their close proximity along the eastern border of the State, little weight should be given to the report. Until specimens are actually obtained from the State this must be considered as a hypothetical species and the identity of the form occurring there doubtful. The characteristic ridges along the surface of the ground, pushed up by these moles in extending their tunnels, are so unmistakable and so well known to those who have lived where they are abundant, that the presence of moles is easily recognized. It is often difficult to obtain specimens, as the moles are not easily trapped. Once discovered in the act of pushing

up their ridges, however, they are easily caught by simply pressing down the earth back of them and then quickly scraping them out with hands, feet, or shovel. It is hoped that if the species does occur in North Dakota, specimens may be obtained to add this interesting and very useful little animal definitely to the list of the mammals of the State.

Condylura cristata (Linnaeus)

Star-nosed Mole

(Pl. 19, fig. 2)

[*Sorex*] *cristatus* Linnaeus Syst. Nat., ed. 10, t. 1, p. 53, 1758.

Type locality.—Eastern Pennsylvania.

General characters.—Starlike disk of sensitive filaments on tip of nose, and no visible eyes or external ears; front feet wide, flat, and spadelike, but not so large as those of the common mole; hind feet, slender; tail, large and slightly hairy, usually swollen toward the base. Color, black or dusky, nearly uniform all over. Measurements of average specimens: Total length, 202 millimeters; tail, 78; hind foot, 28.

Distribution and habitat.—The star-nosed moles are wide-ranging, Canadian and Transition Zone animals of eastern Canada and the northeastern United States, reaching their previously known western limit of range in central Minnesota and southeastern Manitoba. Seton (1909, vol. 2, p. 1137) records them from the vicinity of Winnipeg, on the authority of W. R. Hine, who assured him "that specimens have been brought to his taxidermist shop in Winnipeg; unfortunately, they were not kept." This record from Winnipeg on the north and report of occurrence at Fort Ripley, central Minnesota, mark a close approach to the State line on the east. The animals undoubtedly occur in the Red River Valley and Turtle Mountain country. At Towner, in 1915, Kellogg was told by James Lymburner of an animal answering the description of the star-nosed mole, which had on several occasions been found in his meadow. One was taken to the house and kept in a glass jar for a while as a curiosity, but no specimens were saved. Mr. Lymburner described it as having a long, pointed nose with a ring of soft, fleshy, finger-like projections. Its body was 2 or 3 inches long and its color a bluish black, which would indicate an immature animal. Kellogg says that several other persons described the same animal, but although traps were placed all over the meadow where the moles had been seen, none were caught. This seems to be the only available record for the State of this very useful little insectivorous animal, and while it adds the species tentatively to the State list, it only increases the importance of procuring specimens to substantiate the report.

Family SORICIDAE: Shrews

Sorex cinereus haydeni Baird

Hayden Masked Shrew

(Pl. 20)

Sorex haydeni Baird, Mamm. North Amer., p. 29, 1857.

Type locality.—Fort Union (now Buford), N. Dak.

General characters.—A tiny shrew with slender pointed nose, minute eyes, concealed ears, and slender tail about half as long as its body and three

B565AM

FIG. 1.—COMMON MOLE (SCALOPUS AQUATICUS MACHRINOIDES)

Photograph of fresh specimen. Half natural size

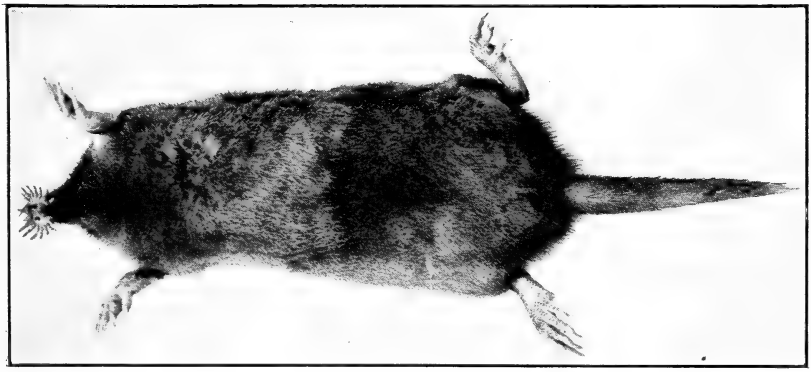

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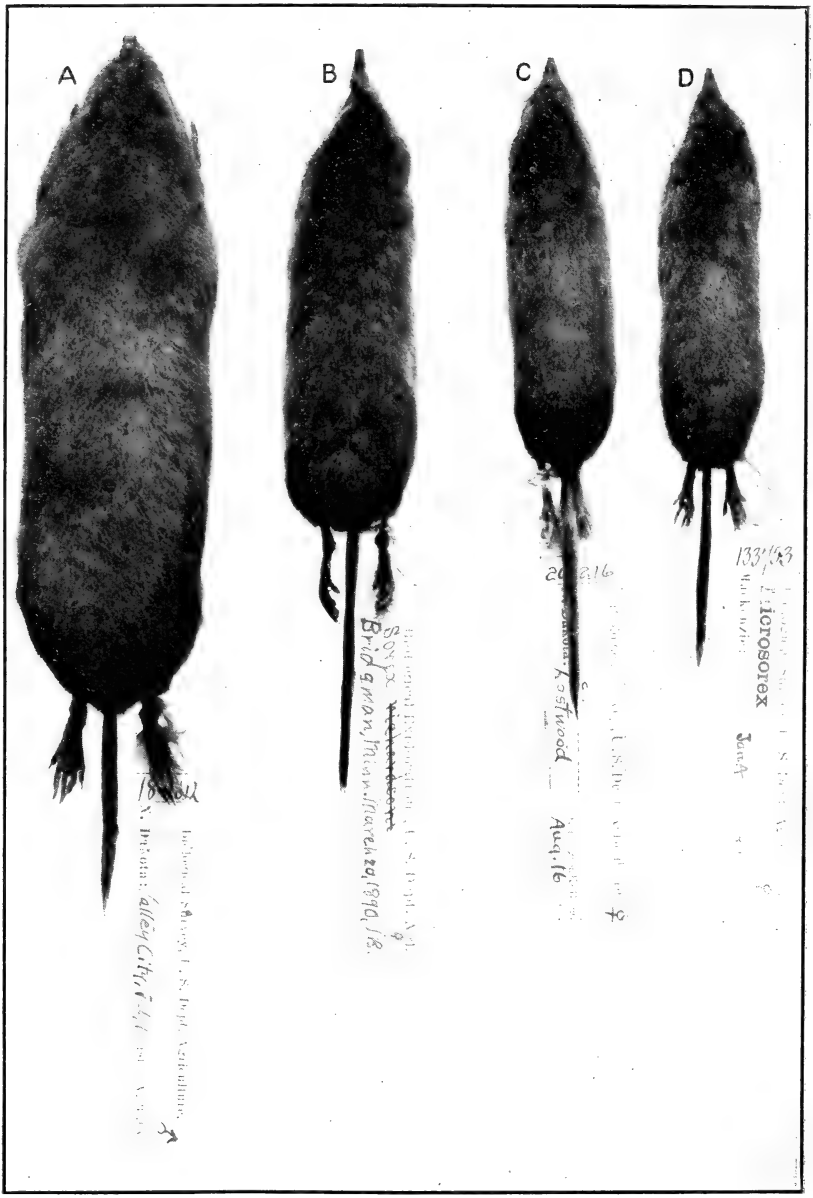
FIG. 2.—STAR-NOSED MOLE (CONDYLURA CRISTATA)

Photograph of fresh specimen. Half natural size



SKINS OF FOUR SHREWS

(A) Short-tailed shrew (*Blarina brevicauda brevicauda*); (B) Richardson shrew (*Sorex arcticus*); (C) Hayden shrew (*Sorex cinereus haydeni*); (D) Pigmy shrew (*Microsorex hoyi*). About natural size

times as long as its hind foot. Fur, soft and fine; color of upper parts, sepia brown, underparts, ashy gray. Measurements of an average adult, from Kenmare: Total length, 95 millimeters; tail, 33; hind foot, 11. An adult female at Walhalla measured 98, 38, and 12 millimeters, respectively, and weighed 3.6 grams; two others each weighed 3.3 grams.

Distribution and habitat.—The Hayden masked shrew is a barely recognizable prairie form of the wide-ranging species *cinereus* (formerly known as *personatus*) which with its various subspecies covers most of the northern part of the continent. The subspecies *haydeni* covers North and South Dakota and the prairie country of most of the surrounding States and Provinces. In North Dakota there are specimens from Buford, from near Williston and Lostwood, and from Kenmare, Bottineau, Birchwood, Walhalla, Grand Forks, Portland, Fairmount, Blackmer, Oakes, Steele, Cannon Ball, and Selfridge, all in the National Museum collection. There is one from Minot in the Field Museum collection, and specimens from Fargo and Grafton in the agricultural college collection, at Fargo. Although rarely seen, they occupy practically every meadow, brush patch, and grove, and are found under rich vegetation almost anywhere on the prairie.

General habits.—These little masked shrews live on or under the surface of the ground, mainly under the cover of old leaves, grass, and fallen vegetation, where they make endless runways and tiny tunnels over and through the surface of the mellow soil, keeping almost as completely hidden from view as do moles and pocket gophers. Their long, flexible, sensitive noses apparently take the place of eyes in their dark tunnels and burrows, for their eyes have become mere specks, with apparently very limited range of vision. On rare occasions a shrew is uncovered in turning over a board or log or in loading hay that has stood long on the meadows. More often one is found dead in some trail where killed by a cat, weasel, or little owl, and found too musky for food.

On soft snow in winter their tiny double lines of tracks are frequently seen, and often little ridges the size of one's finger show where they have plowed tunnels close under the surface of the snow for passageways from place to place. When caught alive in the hands they struggle and fight with surprising strength and vigor, although their tiny teeth can do no harm and their vain struggles are like those of some vigorous insect.

The little that is known of their habits comes mainly from trapping them either in their own little runways or burrows or catching them in traps set for meadow mice, whose larger runways they habitually follow. They are usually caught in small traps baited with fresh meat, bacon, or fat pork, and set under logs and in open places scooped out under the leaves and grass. Traps set for meadow mice and baited with rolled oats also catch them, either because they accidentally run against the trigger or in some cases apparently because they stop to feed on the bait.

Food habits.—The principal part of their food, as shown by the stomach contents consists of insects, earthworms, and the small animal life found over the surface of the ground. They ravenously devour any kind of fresh meat, whether it be a meadow mouse or woods mouse, or one of their own kind, found in a trap, or a bit of bird meat or beef placed on the trap trigger to attract them,

and in winter they will gather in numbers if a piece of frozen meat, lard, or tallow is left under a log for them to gnaw. They undoubtedly catch many of the small rodents, and especially the young, for food, as they are capable of killing animals larger than themselves. They apparently never accumulate any fat and are active throughout the year, evidently finding an abundance of frozen insects and other food along their tunnels on or below the surface of the ground.

Breeding habits.—Very little is known of the breeding habits of shrews, but Stuart Criddle, of Treesbank, Manitoba, sent to the Biological Survey for identification eight half-grown young of this shrew taken on October 14, 1924. They were found dead in a grass nest under a sheaf of brome grass, and near them the head of a partly eaten shrew, probably their mother. So little is known of the habits of shrews that such scraps of information are important.

Economic status.—Fortunately these bloodthirsty little animals are not large enough to do any damage to game or domestic poultry. In camps, cabins, and cellars in the wilderness they often gather in winter and become as numerous as some of the wild mice, and in some cases do slight damage by gnawing and soiling meat left within their reach. Any damage along this line, however, is so insignificant as to be negligible, while their constant destruction of insects and probably also their destruction of many small rodents, mark them as beneficial animals. There is still much to be learned of their habits and of the actual species of animals which furnish the bulk of their food.

Sorex merriami Dobson

Merriam Shrew

Sorex merriami Dobson, Monogr. Insectivora, pt. 3, fasc. 1, pl. 23, fig. 6, 1890.

Type locality.—Little Bighorn River, about 1½ miles above Fort Custer, Mont.

General characters.—About the same size as *haydeni*, but readily distinguished by buffy-gray upper parts and white underparts, feet, and lower half of tail. The skull characters show that it belongs to a very distinct group, but external characters are sufficient for easy recognition. Measurements of type specimen, preserved in alcohol: Total length, 90 millimeters; tail, 36; hind foot, 11.

Distribution and habitat.—The Merriam shrew is known only from the type specimen collected near Fort Custer, Mont., in 1884, by Major Bendire, and an imperfect specimen picked up by Jewett near Medora, on June 30, 1913. The latter was found on top of a dry Badlands butte, where evidently it had been caught by a hawk or a weasel and the head eaten off. Fortunately the skin was saved and the white underparts and the sharply bicolor tail served to identify it as this species. Apparently it is closely associated with the Badlands country and additional specimen will undoubtedly be taken in this semiarid region when more naturalists are on the lookout for rare species. Although a great deal of collecting of small mammals has been done in that general region, the scarcity of these shrews may be only apparent and due to some peculiarity of habits not yet learned by naturalists. Specimens should not only be saved, but any clue to their habits recorded, so that some light as to whether they are really scarce or merely escape observation may be obtained.

Sorex arcticus Kerr

Richardson Shrew; Black-backed Shrew; Saddle-backed Shrew

(Pl. 20)

Sorex arcticus Kerr, Animal Kingdom, p. 206, 1792.

Type locality.—Severn Settlement, mouth of Severn River, Ontario, Canada.
General characters.—Size, rather large; tail, of medium length; nose, long and pointed; eyes, minute; ears, concealed. In winter, whole back dark brown or black sharply contrasted with buffy brown sides and gray-brown belly. In summer back dull brown but still strongly contrasted with lighter sides and underparts. Measurements of average specimens: Total length, 112 millimeters; tail, 40; hind foot, 14.

Distribution and habitat.—A specimen of the black-backed shrew, now in the National Museum collection, was taken at Pembina by Charles Cavileer in 1855, and another by Robert Kennicott in 1861. One was taken at Fort Sisseton, just below the southeastern corner of the State, in 1877, by C. E. McChesney. Eastgate took one at Stump Lake in 1912, the writer took one at Kenmare in 1913, and Kellogg one at Fort Totten and another at Lostwood in 1915. There is one specimen in the Morris J. Kernall collection, taken at Valley City in 1912, and Kellogg reports one in the H. V. Williams collection taken at Grafton in 1915. This carries the range of the species diagonally over the northeastern half of the State.

It is a wide-ranging species, extending from the Mackenzie, through the Canadian Zone forests, to northern Michigan, Wisconsin, and Minnesota. In North Dakota the records are mainly from forested valleys, marshes, or lake shores. At Grafton, Williams reported catching these shrews on the edge of a marsh near town. Near the east end of Stump Lake Eastgate took one in some cold spring marshes, and at Kenmare the writer caught one in a trap set for meadow mice in a runway under the grass at the lower end of the Upper Riviere des Lacs, not far from cold gulches occupied by aspens and snowshoe rabbits. Usually there is a trace of Canadian Zone conditions where they are found.

General habits.—Like most of the shrews, these more conspicuous saddle-backs are known mainly from specimens taken in traps set for small rodents under fallen grass in the meadows or under leaves and dense vegetation or old logs in the woods. Cold, damp places seem to be their favorite haunts in the southern part of their range, where the conditions of Boreal habitat are most nearly approached. These shrews are readily caught in traps baited with meat and set across the runways which they follow, but the few specimens taken indicate that they are by no means a common animal in this region. In food, habits, and habitat they seem not to differ from most of the other small shrews.

Neosorex palustris (Richardson)

Water Shrew; Marsh Shrew

Sorex palustris Richardson, Zool. Journ., vol. 3, p. 517, 1828.

Type locality.—Marshy places from Hudson Bay to the Rocky Mountains.
General characters.—Largest of the long-tailed shrews in the region, with tail about as long as body, hind feet, large and fringed for swimming; nose, long and pointed; eyes, minute, and ears hidden in the fur. Upper parts, vel-

vety black, with sometimes a trace of brownish or gray; underparts, silvery white, often clouded with gray or smoky. Measurements: Total length, 160 millimeters; tail, 70; hind foot, 20.

Distribution and habitat.—Specimens of water shrews collected at Fort Sisseton, just below the southeastern corner of North Dakota, and from Winnipeg, would imply that this species has a general distribution along the Red River Valley and in eastern North Dakota, although no specimens are at present available from the State. They belong to a wide-ranging group of species occupying the Canadian Zone practically across the continent from Nova Scotia to Alaska, but generally associated with the marshes of the forest region. The Fort Sisseton record is apparently the only outlying prairie locality for the species.

General habits.—Although named for the marshes where they are usually found, these shrews are more than palustrine in habits. As their structure indicates, they are expert swimmers and apparently spend much of their time and obtain much of their food in the water. At Elk River, Minn., where the writer collected them from 1884 to 1887, they were generally taken along the banks of the creek which flowed through the meadow. Traps set at little burrows under fallen grass on the creek banks, just above the edge of the water, would occasionally contain one of these shrews, and in winter a few were taken under the ice when the water had fallen and left an air space between two layers of ice. In no locality has the writer ever found them common, or in numbers sufficient to yield more than an occasional specimen among the many other shrews and meadow mice taken in the trap line. In the spring of 1886 a neighbor brought one that he had caught while it was swimming about in a small pond of snow water. He said it darted about through the water like a fish and when under the surface seemed coated with silver and even more fishlike. The stomachs and intestines of those taken are usually found to contain particles of insects and small animals so well masticated that the species are not easily recognized. Of the breeding and other habits little is known.

Microsorex hoyi hoyi (Baird)

Pigmy Shrew

(Pl. 20)

Sorex hoyi Baird, Mamm. North Amer., p. 32, 1857.

Type locality.—Racine, Wis.

General characters.—Smallest of all North Dakota shrews and until a slightly smaller and closely related species was discovered and described by Preble in 1910, from near Washington, D. C., it was credited with being the smallest mammal in North America. In general proportions it approaches *merriami* and *haydeni*, but averages a little smaller than either. Upper parts, sepia brown; underparts, ash gray; tail, somewhat bicolor, brown above, whitish below. Measurements of specimens from Elk River, Minn.: Total length, 81.7 millimeters; tail, 30.7; hind foot, 10.7; weight, 2.9 grams.

Distribution and habitat.—The pigmy shrew, with its several recognized forms, apparently fills the Canadian Zone across the northern part of the continent, but specimens are few and from widely scattered localities. The one record for North Dakota is based on a specimen found dead in a road on the north side of Devils

Lake in 1887. Unfortunately it was in such condition that only the skull could be saved; but it proves to be *Microsorex* instead of *Sorex personatus*, as given in the writer's report for 1887. With all the collecting since done in the State, it seems remarkable that no others have been taken. The nearest localities outside of the State from which specimens are recorded are the Red River Settlement (Winnipeg), Manitoba; and Elk River, Minn.

General habits.—Of the habits of these little shrews practically nothing is known except that they are caught in traps with other species in woods, clearings, or meadows. In Ontario, Miller (1897, p. 37) recorded them as invariably found in dry clearings and gardens.

Blarina brevicauda brevicauda (Say)

Short-tailed Shrew; Mole Shrew

(Pl. 20)

Sorex brevicaudus Say, Long's Exped. Rocky Mountains, vol. 1, p. 164, 1823.

Type locality.—West bank of the Missouri River, near Blair, Nebr.

General characters.—A large heavy-bodied shrew with the usual small eyes, sharp nose, concealed ears, and short tail. The fur is short, soft, and velvety, varying in color from glossy plumbeous to almost black, with underparts but slightly paler than the upper parts. The color is unmarked and almost uniform over the body. Measurements of adult male, from Wahpeton: Total length, 137 millimeters; tail, 30; hind foot, 17; of a female from same place: Total length, 136; tail, 28; hind foot, 16; measurement of a large male from Walhalla: 127, 25, and 19 millimeters, respectively; weight, 23 grams.

Distribution and habitat.—There are specimens of the short-tailed shrew from Wahpeton, Fairmount, Oakes, Valley City, Portland, Fargo, Harwood, Grafton, Pembina, Walhalla, Turtle Mountains, Sweetwater Lakes, and Fort Berthold. From a wide range over the Transition and Upper Austral Zones of the northeastern United States and eastern Canada, these large shrews reach their northwestern limit of range in North Dakota, extending commonly as far west along the stream and lake valleys as the eastern timber reaches. Over the open prairie and the drier western part of the State they seem not to occur, although an alcoholic specimen in the National Museum is supposed to have been taken in 1856 by F. V. Hayden, at Fort Berthold, on the Missouri River. At Wahpeton they were very common and a number were caught in traps set in meadow-mouse runways along the river and slough banks. At Hankinson the writer caught one in a patch of dense grass under a fence, but it was so badly damaged that it was not saved for a specimen. At Fairmount, Sheldon found them common along the river banks, where a number of specimens were taken. At Oakes he reported them as fairly abundant along the James River, where they were found in the damp soil along the banks of the stream and also in patches of snowberry bushes. At Larimore, in Grand Forks County, Kellogg reported them, but did not collect specimens; at Manvel he also reported them as found about old strawstacks; at Drayton, in Pembina County, he was told by the farmers that during harvest they were often seen under shocks of grain. In the Turtle Mountains, near Fish Lake, in Roulette County, the writer caught two in the woods, one in a damp place on low ground and another under an old

log near the lake shore. At the Sweetwater Lakes two specimens were taken in a dry marsh in the woods back of the lake shore, where they were living in the meadow-mouse runways under heavy fallen grass. At Portland Loring caught seven under logs and stumps in the woods.

General habits.—Most of our specimens were taken in mouse traps baited with small pieces of meat or set in runways where bait was not necessary. The shrews eat many of the mice caught in traps and often leave only a piece of skin and a few bones to show what the trap had caught. In such cases they soon return and are almost certain to get into the trap when it has been reset. They are savage little brutes and very strong and muscular for their size. When caught in small box traps or cans sunk in the ground, they are usually found dead after a few hours, apparently because they are unable to live without an almost constant supply of food. They are caught as readily in the daytime as at night, and at Wahpeton Kellogg watched one digging a burrow in the ground about noon. Usually, however, they are not seen except as caught in traps or uncovered in moving logs or hay or grain that has been lying long on the ground. They burrow through the mellow soil and make runways between the fallen grass and leaves and the surface of the ground. Usually they are in moist, rich places where insect life is abundant, and where they have an ample supply of food while well concealed from enemies whose eyes are keener than theirs.

Breeding habits.—Little is known of the breeding habits of these shrews, but an interesting note was obtained by Sheldon at Fairmount, where on old female, which contained nine embryos, was taken May 28. Immature specimens are often caught in traps, but the very young have rarely been found and little is known of the nest or home conditions.

Food habits.—Their principal food consists of insects, earthworms, mollusks, and the various forms of animal life found on or near the surface of the ground, but these shrews are always eager for any kind of fresh meat. They devour many more desirable species of small mammals caught in traps where their runways are located. The number caught in traps set for meadow mice suggests that they deliberately follow the mouse runways for the purpose of capturing their prey. Even if not able to catch and overpower the full-grown meadow mice, which are nearly twice their size, they will certainly catch, kill, and eat many of the young and immature individuals. Their stomachs and intestines are usually well filled with food, but are never found distended, as are those of rodents, especially mice, after hearty feeding. They are never fat and are active throughout the year, in winter evidently getting their food on or under the surface of the ground, although occasionally coming to the surface of the snow and making long lines of their peculiar little double rows of tracks. They burrow in and out of the snow at will and in midwinter are easily lured to a food supply of frozen meat placed under logs, hay, or fallen vegetation on the surface of the ground. When once in the habit of coming to a food supply they are easily caught in considerable numbers.

Economic status.—There are no injurious habits of any consequence chargeable to these shrews, although they often come into

cellars and storage places on the farm, and if meat or milk is left within their reach will gnaw and soil the meat and eat the cream around the edges of the milk pans. Conditions where they can do such mischief are, however, rare and unnecessary. Their destruction of insects and great numbers of worms and other small animals inhabiting the richest soils goes on continuously throughout the year and their destruction of small, injurious rodents is undoubtedly of great benefit to agriculture. While many of our small mammals must be considered enemies and destroyed in every possible way, fortunately some, as the shrews, may be classed as wholly beneficial and their presence welcomed on the farm. Of all the small mammals, perhaps the shrews with their voracious and often cannibalistic natures are least lovable, but they can all be accepted as very useful allies.

Order CHIROPTERA: Winged Mammals

Family VESPERTILIONIDAE: Common Bats

Nycteris cinerea (Beauvois)

Hoary Bat; Great Gray Bat

(Pl. 21, fig. 1)

Vespertilio cinereus Beauvois, Catal. Peale's Mus. [Philadelphia], p. 15, 1796.

Type locality.—Philadelphia, Pa.

General characters.—Teeth, 32; size, large; spread of wings, about 16 inches; ears, short and rounded with black naked rims; top of feet and tail membranes, furry; fur, full and soft; color, yellowish brown, frosted with white above and below; throat and wing linings, buffy. Measurements of adult male, from North Dakota specimen: Total length, 130 millimeters; tail, 60; hind foot, 13; forearm, 51.

Distribution and habitat.—From a wide Boreal range across the northern part of the continent and southward in the mountains, and a winter migratory range to the southern border of the United States, the big hoary, or gray, bats cover at one time or another all of North Dakota. They are undoubtedly far more common than the few scattered records seem to imply, as their nocturnal habits conceal them from common observation. In 1833, at Fort Clark on the Missouri River, Maximilian (Wied, 1839–1841, Bd. 1, pp. 403–404, 1839) collected an adult female, which he described in much detail as to the color and measurements. About 1861, F. V. Hayden (1875, p. 95) collected a specimen at Fort Union (now Buford) and reported them as found "all over the United States east of the Rocky Mountains." In 1887 the writer recognized one of these bats on the wing at Pembina, August 3, and saw several about the woods on the north side of Devils Lake, August 6, but obtained no specimens. A specimen from Minot, N. Dak., was recorded in the catalogue of the Field Museum. (Elliot, 1907, p. 514.) A specimen collected June 20, 1913, was sent to the Biological Survey for identification by Daniel Freeman, of the agricultural college at Fargo, and in 1914, Bell and the writer shot four specimens in the little forest area between the lakes on the Hankinson farm near Hankinson. At Wahpeton, in 1915, the boys described a large gray bat which they had found hanging in the leaves of a tree, which was undoubtedly this species. At

Grafton, Kellogg found one dead in a cow path, but it had been so trampled by cattle as to be worthless for a specimen. At Towner he reported two seen one evening and perfectly identified by their large size, but before he could get his gun they had disappeared.

General habits.—These great gray bats are powerful and rapid fliers; they usually appear rather late in the dusk of evening and are rarely noticed except by bat hunters. During the day they hang head downward in clusters of leaves, usually at the ends of branches of trees. This habit restricts them to the forested areas or to country about ranches, where they can find sufficient foliage for roosting sites. At the Hankinson ranch, where the fine old elms, oaks, ashes, basswoods, and boxelders form heavy foliage and deep shade, they were found to be one of the common species. As they darted swiftly across the narrow spaces between the trees, the collectors had much trouble in shooting four specimens among the considerable number of smaller bats taken during the twilight. Their large size, however, made it possible to obtain all of those killed, while many of the smaller bats were lost in the grass and weeds. Some of these specimens were evidently young of the year, but practically full grown, and probably were born in this particular grove, although strong enough to have flown from a considerable distance. These bats are migratory, and as the cold weather approaches and insect life becomes scarce they move southward at least to the southern border of the United States and probably beyond for the winter season. Their breeding range has not been well worked out, but apparently they breed mainly in the cooler zones of the Northern States, Canada, and the high mountain areas.

Food habits.—Little is known of the food habits of the hoary bats except that they are insectivorous and capture their prey on the wing in swift zigzag flight, most baffling to the collector. At times they seem to be gleaning among the branches of the trees and at other times they circle high over the forest, apparently snapping up the insects that swarm far overhead.

Breeding habits.—The specimen collected at Fort Clark by Maximilian on June 12, 1833, was an adult female containing two large well-developed embryos, which he describes as quite naked, with wings folded over their noses. The specimen from the agricultural college was a female taken June 20, 1913, which contained two large embryos, now also preserved in alcohol. Other specimens have been recorded containing two embryos, and mother bats have been shot while flying about in the evening with two young clinging to their sides. There are two mammae close together on each side of the breast, located in a subaxillary position, and when the mother hangs head downward in the foliage they are just above the two fur-lined cradles formed by the hollows of her folded wings. Apparently the young cling to the body of the mother during her flight and are thus always with her until old enough to use their own wings. The young are surprisingly large at birth and it seems probable that they grow rapidly and do not long burden the parent. If born after June 20 and practically full grown by July 22, their growth and development must be very rapid.

Economic status.—Besides being in every way harmless and unobjectionable, these bats are, through their insectivorous habits, of un-

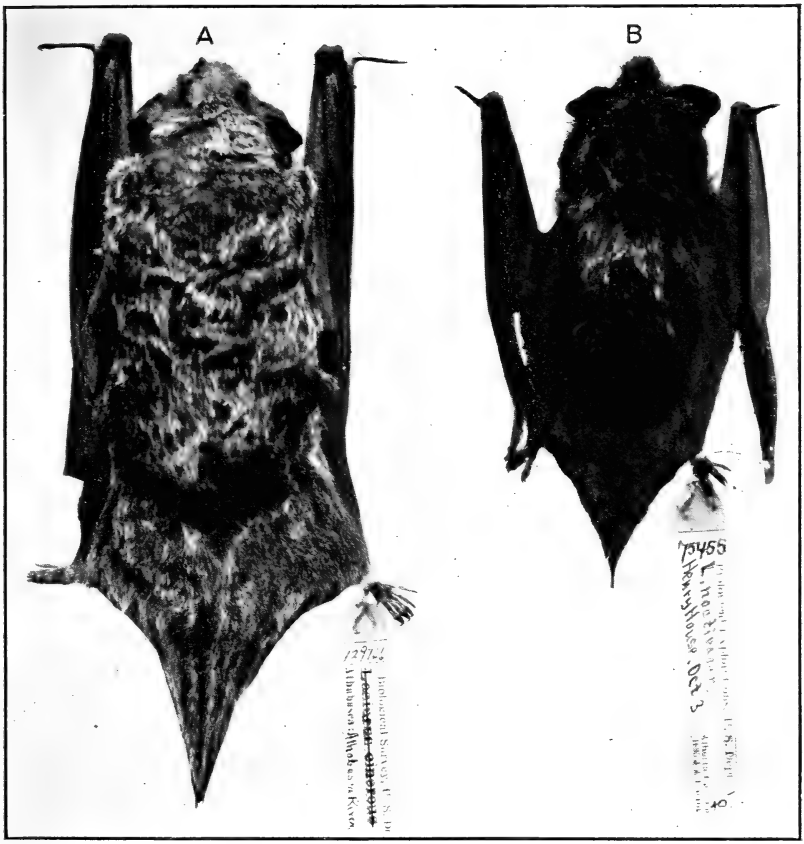


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FIG. 1.—(A) HOARY BAT (NYCTERIS CINERIA); (B) SILVER-HAIRED BAT (LASIONYCTERIS NOCTIVAGANS)

About two-thirds natural size

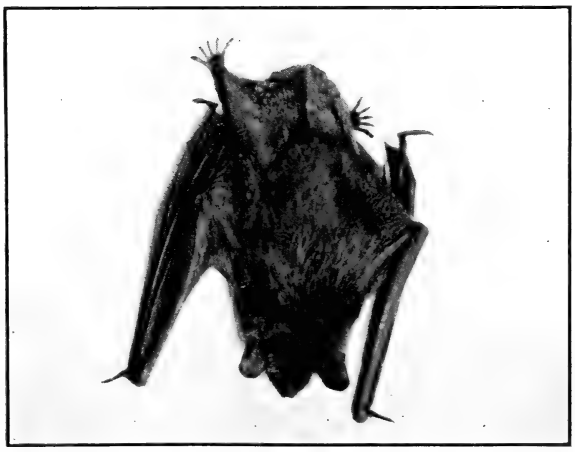

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FIG. 2.—SAY BAT (MYOTIS SUBULATUS SUBULATUS)

About two-thirds natural size

questionable value to man. The extent of their destruction of nocturnal pests and their importance to the welfare of the forests and other products of the country will not be known until a thorough study of their food has been made.

Nycteris borealis borealis (Müller)

Red Bat; New York Bat

Vespertilio borealis Müller, Natursyst., Suppl., p. 20, 1776.

Type locality.—New York.

General characters.—Teeth, 32; size, medium; expanse of wings, about 12 inches; ears, short and rounded, mainly naked inside and on rims; top of tail membranes and feet well furred; color, bright rusty or pinkish yellow with slight frosting of white over back and breast. Measurements of large female, from Grinnell, N. Dak.: Expanse, 330 millimeters; length, 117; tail, 52; hind foot, 10; forearm, 41; a smaller female from the same place measures 298, 104, 45, and 9, millimeters.

Distribution and habitat.—There are specimens of the red bat from Devils Lake, Grinnell, the Yellowstone River (probably Buford), and "Chantee Hills." At Wahpeton some boys reported that they often found a very pretty red-colored bat hanging in the plum trees when they were gathering plums. Across the river from Fargo, Murie often found them hanging in plum trees in July and August, and Williams has one taken near Grafton on August 23, 1919. At Hankinson these yellowish-red bats were accurately described and were said to be often found hanging in the leaves. At Stump Lake, where the wind blew so incessantly that the writer was not able to get any bats, people said that two kinds were found, one red and the other dark brown. At Beaver Creek, 4 miles west of Grinnell, where the Missouri makes its first big bend to the southward, Kellogg reported red bats common in the woods and found two hanging in the leaves of branches. The "Chantee" or "Chartee" Hills the writer has not been able to locate; and another specimen collected by Hayden has no positive locality other than the Yellowstone River. The red bats are abundant over the eastern United States, mainly in the Austral Zone, and the few specimens from North Dakota may be wanderers after the breeding season or scattered individuals beyond their normal breeding range.

General habits.—At least in the northern part of their range these bats are migratory and with the beginning of cold weather move southward until suitable hibernation quarters or a comfortable climate and an ample food supply are found for the winter. In the daytime they hang head downward among the leaves of trees or bushes. In July, 1887, in a little grove on the north side of Devils Lake, the writer picked five specimens from the leaf clusters of box-elder trees, where they were hanging at about the height of the head above the ground. They were well concealed by the leaves, but after the first one was noticed there was no trouble in finding others. Their bright yellow color contrasted sharply with the dark green foliage.

In places where common these bats often come out of their diurnal roosts rather early in the dusk of evening and occasionally one is seen flying about on a cloudy day or even in bright sunlight, doubtless when it has been disturbed or the sunlight has penetrated to its

sleeping quarters. They have a quick and erratic flight and when darting back and forth among the trees in the dusk of evening are no easy target for the shotgun. As most of the specimens are obtained by evening shooting, it is not so remarkable that they are scarce in collections even where fairly common outside.

Food habits.—Little is known of the food habits of the red bat, except that it seems always busy catching insects while on the wing, and the stomachs of those collected for specimens are usually distended with a mass of finely masticated insects of great variety, mainly unidentifiable.

Eptesicus fuscus fuscus (Beauvois)

Large Brown Bat

Ágráphiga of the Mandans; *Ishwatáshia* of the Hidatsas; *Hupáñuwakí'kadakena* of the Dakotas (all, Gilmore).

Vespertilio [sic] *fuscus* Beauvois, Catal. Peale's Mus. [Philadelphia], p. 14, 1796.

Type locality.—Philadelphia, Pa.

General characters.—Teeth, 32; size, rather large; expanse of wings, about a foot; ears, prominent and pointed; membranes of ears, wings, and tail, naked; fur, long and lax; color, glossy light hair-brown, slightly paler below; ears and membranes, black or blackish. Measurements: Spread of wings, 324 millimeters; total length, 117; tail, 50; foot, 11; forearm, 44.

Distribution and habitat.—A series of five specimens of these large brown bats taken by Kellogg at Grinnell (where the Missouri River turns southward), August 29 and 30, 1915, and six taken by Sheldon at Cannon Ball, September 2, 1915, give, for the first time, a good representation of this species from the State. The old specimen collected by Hayden at "Fort Union, Nebr." (now Buford, N. Dak.), about 1861, was the only certain previous record on which to admit the species to the State list, although Maximilian in 1833 recorded what was probably this species under his *Vespertilio ursinus*. In 1912 Kellogg also reported two skins seen in the State university collection, taken at Stump Lake. At Grafton, Williams reports having killed a large brown bat a number of years ago, but no later records have been obtained. At Hankinson, in 1912, the writer saw several bats which he believed to be the species flying among the trees, but did not obtain a specimen. One was also recognized in the evening at the Sweetwater Lakes, but not procured. At Buford, in 1910, Anthony shot a large brown bat that he supposed to be of this species, but it fell in the brush on the river banks and could not be found. Having a transcontinental range extending north into the edge of the Boreal Zone, these bats undoubtedly cover the whole of North Dakota in considerable numbers. The specimens from Grinnell and Cannon Ball are decidedly pale and appear to be shading toward the western form, *Eptesicus fuscus pallidus* Young, but are not sufficiently marked to be referred to it.

General habits.—At Cannon Ball Sheldon found these brown bats between the walls of old buildings, and specimens taken 4 miles west of Grinnell by Kellogg were found around a house in the Badlands. Like many other species of bats, they spend the daylight hours hidden away in cracks and dark cavities in walls, roofs, or cornices

of buildings, in hollow trees, under bark, and less commonly in the clefts of rocks. In the rather late dusk of evening they come out and after quenching their thirst at the nearest pond or stream begin their nightly hunt for winged insects. Usually they are found flying rapidly about buildings and trees or through the open spaces in forests and groves. Their flight is swift and erratic as they snap up one flying insect after another, and it is only an occasional specimen that can be brought down with fine shot as they zigzag against the twilight sky. Where they are at all common, bat shooting may become very exciting, both from the effort and dexterity required to bring down specimens and also from the possibility of getting rare species. In some places only one species will be abundant, while others are rare or entirely absent, and in other localities several species and genera will be found equally abundant and hunting over the same ground.

Hibernation.—In fall these large brown bats become excessively fat, with a heavy layer of very oily tissue lying under the skin and filling the body cavities. Although probably in part migratory, they seem to hibernate throughout their range, disappearing with the first frosty nights, occasionally reappearing on warm evenings, but again entering their permanent hibernation before the real cold weather begins. They crawl away into the cracks and walls of buildings or any sufficiently sheltered place where they can spend the winter without too much exposure to cold. Occasionally during the most severe weather, when houses are overheated, some of these bats are roused from their winter sleep in the walls and appear inside the rooms, flying about in good condition, apparently under the misapprehension that summer has arrived. Such specimens are usually found to be exceedingly fat, but with empty stomachs. In spring they are one of the first bats to appear with the warm days, the time of beginning plant and insect activity.

Migration.—To what extent these bats migrate is not known, but like other species they probably make considerable flights to and from their favorite winter quarters. In the mountains, where they range high in the Canadian Zone late in summer, they undoubtedly return to lower milder levels to find winter quarters. It is doubtful whether an extensive north-and-south migration is common to the species.

Breeding.—The mating season is late in July or early in August, and the young are born in June of the following year. In June the males and females are usually found in separate localities or, if in the mountains, at different levels. By June 20, females are usually found carrying one or two large embryos, which at birth are very large for the size of the parent. The two mammae are located on the sides back of the wing bases, so that when the mother hangs head downward the suckling young are neatly cradled in the fold of the wing. As with other species of bats, the young are probably carried clinging to the mother's body until able to fly and catch their own food. Their development is evidently rapid, for by July 26 the young are flying, and immature specimens have been collected as early as July 24.

Food habits.—Not much is known of the species of insects on which the brown bats feed, but there seems always to be an abundant sup-

ply, and soon after the bats have begun flying their stomachs are found distended with a finely ground mass of insect remains. In some localities traces of various beetles are detected in the stomachs. Little is known of the species but it is certain that a vast number of insects are consumed by each bat.

Economic status.—The comparative value of different species of bats can not be determined until their food habits have been thoroughly studied and their choice of food and the species of insects consumed more fully determined. In general, however, their usefulness can be well compared with that of insectivorous birds, for many of the most destructive insects are active only at night and if by day they escape the birds, they are devoured in millions by these aerial guardians of the night.

Lasionycteris noctivagans (LeConte)

Silver-haired Bat; Silvery Bat; Black Bat

(Pl. 21, fig. 1)

V[espertilio] noctivagans LeConte, Cuv. Anim. Kingdom, McMurtrie ed., vol. 1, p. 431, 1831.

Type locality.—Eastern United States.

General characters.—Teeth, 36; size, medium; spread of wings, about a foot; ears, medium, nearly quadrate, about as broad as long, naked; upper base of tail membrane, hairy; fur, long and soft; color, dark brown, sooty, or black with white-tipped hairs over back and belly; ears, wings, and feet, sooty or black. Measurements of adult female, from Grafton: Spread of wings, 301 millimeters; total length, 105; tail, 42; hind foot, 9; forearm, 42.

Distribution and habitat.—With a breeding range apparently over the Transition and Canadian Zones across the continent, these bats cover at least all the forested parts of North Dakota during the breeding season and the months of greatest insect activity. There are specimens from Fort Union, Bottineau, Minot, Fargo, Grafton, and Stump Lake. A specimen in the National Museum, collected by F. V. Hayden at Fort Union, has no date but was entered in the catalogue in 1863. On August 23, 1887, the writer found two of these bats under a piece of loose bark on a dead tree in the edge of the Turtle Mountains near Bottineau. On May 12, 1913, Williams took an adult male at Stump Lake; and on July 22, 1915, he collected a less than half grown young at Grafton. It was brought to him alive, and flew about the room before it was killed. An adult female was taken by Kellogg in a pile of fence posts at Grafton on June 11, 1915, and one recorded in the Field Museum catalogue was taken by W. E. Snyder at Minot. A specimen sent to the Biological Survey for identification by Professor Freeman, of the agricultural college, was collected on September 12, 1914. At Wahpeton the writer was told that a black bat was found there. These meager records for the State do not so much indicate the rarity of the species as the difficulty of obtaining specimens and information regarding the habits of a strictly nocturnal species which can not be caught in traps. In reality, these bats are probably common at one season or another in every patch of woods over the State.

General habits.—More than most species the black bats are forest dwellers, apparently very largely depending on the cover of loose

bark and hollow trees for their diurnal roosts and keeping mainly among the trees in their nocturnal flight. They usually appear rather late in the evening and, after quenching their thirst at the nearest water, begin their rapid flight between and around the branches of trees. The lateness and swiftness of their flight render them especially difficult to shoot and apparently as many specimens are picked up in their hiding places as are obtained with the shotgun.

Food habits.—Like other bats, they are eager in their pursuit of night-flying insects, but the particular species chosen or rejected are not known. Their habit of hunting among the trees would indicate their especial value in forest protection.

Breeding habits.—The mammae in these bats are one pair, arranged on the sides just back of the wing base. The young, as indicated by embryos, are usually two, but sometimes only one. The female taken by Kellogg at Grafton on June 11 contained two embryos, and the young taken by Williams on July 22 was apparently not more than 2 or 3 weeks old. In his Mammals of the Adirondack Region, New York, Merriam (1884, p. 190) states that females killed during the latter part of June were heavy with young, and that up to July 1 not one had given birth to offspring, but that all killed after July 4 were then suckling their young. He also records the discovery of an old crow's nest which contained embedded in the sticks and litter 13 young bats, with their eyes not yet open. Although not positively identified, they were supposed to be the young of this species. Merriam also says that these bats begin to fly when 3 weeks old, those killed on the first evening weighing only about half as much as their parents.

Migration and hibernation.—The black bat is one of the species with a well-established record for migration, appearing in fall and winter far south of its summer range and possibly moving far enough south to avoid the necessity of hibernation. More probably, however, it is prepared to creep away under cover and become dormant for a period of cold weather and scant food supply even in the southern part of its winter range. As with the hoary bat, its migratory habits may well explain the uniformity of characters of the species over a wide range across the continent.

Myotis lucifugus lucifugus (LeConte)

Little Brown Bat

V[espertilio] lucifugus LeConte, Cuv. Anim. Kingdom, McMurtrie ed., vol. 1, p. 431, 1831.

Type locality.—Georgia; probably Riceboro.

General character.—Teeth, 38; size, very small with small, pointed, naked ears, which laid forward, do not reach to the tip of the nose; wing and tail membranes, naked and dark brown; fur, soft, glossy hazel brown, bright buffy below. Measurements by Doctor Mearns of specimen from Fort Snelling, Minn.: Expanse, 260 millimeters; total length, 94; tail, 41; hind foot, 9; forearm, 38; ear from notch at base, 13 millimeters. A very fat male at Elk River, Minn., measured as follows: Expanse, 260; total length, 96; tail, 37; and hind foot, 10 millimeters, and weighed 12.68 grams.

Distribution and habitat.—The little brown bats with their several subspecies cover all but the extreme northern part of North America, but the ranges of the different forms have not been determined and are somewhat indefinite. The type species, *lucifugus*,

covers the eastern United States and apparently reaches its western limit in eastern North Dakota, grading into *carissima* toward the western part of the State. The only specimens that seem to be typical of this little dark form are from Hankinson and Fargo, although specimens from Stump Lake, Devils Lake, and Esmond Lake are evidently intermediate in character and could be referred to either *lucifugus* or *carissima*. Those from the western part of the State at Towner, Goodall, Cannon Ball, and Bismarck are referred to *carissima*, although not fully typical of that paler western form. Apparently one form or the other is common all over the State wherever there are buildings, water, and mosquitoes, without much regard to timber.

General habits.—The little brown bats are mainly cave, cliff, or house dwellers, spending the daylight hours hung up in dark crevices, caverns, and rooms, where well protected from the daylight. From their dark retreats they come out at the dusk of evening and after visiting the nearest open water, where their thirst can be quenched as they skim over the surface, they begin hawking after insects, around and around the buildings, under and among the branches of the trees, or over the ponds and marshes wherever insect life is abundant. If the wind is blowing, the bats work in the shelter of buildings or trees or get inside of buildings where insects also take refuge from the wind. They are quick, crooked fliers and by no means an easy mark for the collector, unless they can be silhouetted against the western light for sufficient distance to allow time for a double shot. At Hankinson this seemed to be the most common of the small bats that flew in considerable numbers about the buildings on warm evenings, and the fact that few specimens were taken was due to the limited spaces between the buildings and the treetops. Near Fargo they were numerous over the surface of the river in the evenings, but were usually flying so low among the trees that no clear shots could be obtained against the light portions of the sky. After drinking, they usually left the river to circle about the buildings in town or on the farms, where shooting was not permitted. It is always a great exasperation to a field naturalist to see unknown species of bats circling about buildings and over the streets of towns where he can have no hope of obtaining specimens unless one strays into his room at night and can be captured with a towel. Occasional specimens are thus obtained, but in most cases our meager information of the distribution and habits of bats is very slowly accumulated.

Breeding habits.—In these bats the embryos are usually, and perhaps always, one, and the single pair of mammae are on each side back of the wing bases. Of the habits and care of the young so little is known that a most interesting field for close observation remains almost untouched.

Food habits.—About the buildings where these bats are usually most numerous the insect life often seems to consist largely of mosquitoes, flies, and nocturnal beetles and moths. The actual species eaten are not well known, but the bats are certainly industrious gleaners and in a few minutes after they have begun to fly their stomachs are found filled to capacity.

Myotis lucifugus carissima Thomas

Yellowstone Bat

Myotis (*Leuconoe*) *carissima* Thomas, Ann. and Mag. Nat. Hist., vol. 13 (ser. 7), p. 383, 1904.

Type locality.—Yellowstone Lake, Yellowstone National Park.

General characters.—Teeth, 38; about the size of typical *lucifugus;* ears, small and pointed; fur, glossy; colors, light hazel brown above, buffy below; ears and membranes, dark brown or blackish; tail membranes, edged with gray; young of the year, darker, without gray edges on tail membranes. Measurements of typical specimen, from Yellowstone Park: Expanse of wings, 260 millimeters; total length, 94; tail, 40; hind foot, 10; forearm, 38.

Distribution and habitat.—This northern Rocky Mountain form of *Myotis* ranges at least from western Montana to the Black Hills and over western North Dakota. Specimens from Towner, Goodall, Bismarck, and Cannon Ball, while not typical, are nearer this species than to the eastern little brown bat, while some of those from the Devils Lake country show intermediate characters. Apparently the intergradation between the two forms is gradual across the middle part of the State.

General habits.—On the Mouse River, 8 miles north of Towner, Kellogg collected 28 specimens of these bats on August 2, 1915. They were found behind a barn door and all of the 9 adults were females; of the 17 dark-colored but full-grown young of the year, 8 were males and 9 females. This was evidently a breeding colony from which the adult males were keeping a respectful distance. On September 4 Kellogg collected an adult male at Goodall, at the edge of the forest along Antelope Creek. At Fort Totten on July 15 he collected a male at the edge of the forest and on July 17 a female as it was flying around buildings in the evening. On November 19, 1919, Russell Reid found one dead hanging on the wall of a house in Bismarck. It evidently had been dead for some time, as the temperature had been 10° F. as early as October 26. At Cannon Ball, on August 20, Sheldon collected four adult females, part of them in the eaves of an old building, while others were shot in the evening as they flew about, after it had become so dark that it was hard to find them. In the Yellowstone Park, where the subspecies was first discovered, they occupy a large warm cave, called the Devil's Kitchen, in great numbers through the summer, but apparently leave for cooler caves in which to hibernate during the cold season. In the Bitterroot Valley, western Montana, a large breeding colony was found in a bridge over the Bitterroot River; they returned each spring from their winter quarters and many of the old and young were taken for specimens.

Breeding habits.—In a large number of specimens examined only one embryo was found in each. The mammae, as in other species of the genus, are two in number, one on each side back of the wing base. Little is known of the breeding habits other than that some females were shot while flying about with the young clinging to them, and others collected had evidently left the young at home while hunting for their food.

Migration and hibernation.—In fall these bats disappear with the first cold nights and consequent reduction in the abundance of insect life. Some may hibernate in buildings, but apparently most of them resort to caves, the location of which they seem to be

familiar with, and here they hang during the winter and remain dormant in the cool, but not freezing, air. In a level prairie country like North Dakota, it may be necessary for them to make long journeys in search of winter quarters, but their migration is as imperfectly known as their other habits.

Myotis subulatus subulatus (Say)

Say Bat

(Pl. 21, fig. 2)

V[espertilio] subulatus Say, Long's Exped. Rocky Mountains, vol. 2, p. 65, 1823.

Type locality.—Arkansas River, near La Junta, Colo.

General characters.—Teeth, 38; small and very similar in appearance to *lucifugus*, but readily distinguished by its longer ears, which reach, when laid forward, well beyond the tip of the nose. From the larger-eared *evotis* it is distinguished by darker color of fur and narrower, more pointed ears; ears and membranes, naked and dark brown; fur, soft and lax; color, yellowish-brown, slightly paler below. Measurements: Expanse of wings, 247 millimeters; total length, 95; tail, 41; hind foot, 9; forearm, 37; ear from notch at base, 16.

Distribution and habitat.—Miller gives the range of the Say bat as North America, east of the Rocky Mountains, but its distribution is irregular; and although abundant in many places, it is often locally scarce, or absent. Over a wide strip of prairie country from the Gulf of Mexico to Manitoba there are very few records of its occurrence, while to the eastward and westward in rough country where caves are more numerous, the map shows many records. The only specimens from North Dakota are a few collected long ago and labeled "Fort Union," "Fort Buford," or the "Upper Missouri." These few, collected by Hayden, Carpenter, and Rothhammer, are in the National Museum collection. Specimens have been taken south, west, and east of the State and may be found at any locality over it, but they are more likely to be found in the western Badlands country in close proximity to cliffs and caves. Their presence near Buford is probably accounted for by the many little caves or openings in the rocky cliffs bordering the Missouri Valley. Some of the many small bats seen along the Little Missouri at Medora, and others along the river south of Bullion Butte, may also have been in part of this species. They are known to roost and hibernate in caves, but of their specific habits our knowledge is very indefinite.

Breeding habits.—Examination of females taken for specimens indicates two as the usual number of young of this species, although the mammae are of the same number and position as in other species of the genus *Myotis*, one on each side back of the wing base.

Myotis evotis (H. Allen)

Little Long-eared Bat

Vespertilio evotis H. Allen, Monogr., Bats North Amer., p. 48, 1864.

Type locality.—Monterey, Calif.

General characters.—Teeth, 38; size rather small; ears, strikingly large, naked, black; wing and tail membranes, dusky or black; fur, soft and lax; color, glossy buffy yellowish above, buffy or whitish below. Measurements of an adult male taken near Grinnell by Kellogg: Expanse of wings, 292 millimeters; total length, 90; tail, 42; hind foot, 9; forearm, 39; ear from notch at base (measured dry), 18.

Distribution and habitat.—The little long-eared bat is found in western United States and Mexico, mainly in the Austral and Transition Zones. A single specimen from Beaver Creek, 4 miles west of Grinnell, is the only record of the species for North Dakota and this is a considerable extension of its known range eastward, Loveland, Colo., being its previously known easternmost locality. The specimen, an adult male, found by Kellogg in his room on August 26, 1915, was clinging to the side of a smooth plastered wall. It may represent a stray wanderer in this Badlands region of cliffs and caves, or it may have been within the regular range of the species. If the latter is the case, additional specimens should be obtained from other places.

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