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Rodents of Colorado.

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Rodents of Colorado

IN

Their Economic Relation

By W. L. BURNETT



OFFICE OF STATE ENTOMOLOGIST
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JAN 23 1918

LETTER OF TRANSMITTAL

Office of the State Entomologist,
Fort Collins, Colorado, January 1, 1918.

Sir: I have the honor to transmit for publication, as Circular No. 25, Rodents of Colorado in Their Economic Relation.

As you are aware, I have been engaged for some time past in work, under your direction, on the control of rodents found in the State that are known to be injurious to agricultural crops.

A number of circulars on the individual species of these mammals have been published from this office, but none treating on the subject as a whole. In this publication each species known to occur in the state is listed, and the genus, at least, is treated economically, and in some cases the species.

While working on the control of rodents, the data for this circular has been gathered from time to time, and the results of these studies are herewith submitted for your approval.

Respectfully,

W. L. BURNETT,
Deputy Pest Inspector.

To C. P. GILLETTE,
State Entomologist.

Calcutta, 18th Decr 1817

Rodents of Colorado in Their Economic Relation

By
W. L. BURNETT

Introduction

The word "rodent" is from the Latin word *rodo*, to gnaw.

Rodents constitute the largest order of mammals. In Colorado we have 81 species and subspecies, divided by families, as follows:

Family

MURIDAE	Rats, mice, muskrats, etc.
GEOMYIDAE	Pocket-gophers
HETEROMYIDAE.....	Pocket-mice, kangaroo rats
ZAPODIDAE	Jumping-mice
ERETHIZONTIDAE	Porcupines
SCIURIDAE.....	Tree-squirrels, ground-squirrels, prairie-dogs, chipmunks, woodchucks.
CASTORIDAE	Beavers

A rodent can always be distinguished from other mammals by its teeth. Rodents have no canines, and only four incisor or front teeth, never more or less. For a number of years the hares and rabbits were classed with the rodents, but they are now in a separate order known as *Lagomorpha*. The hares and rabbits have four incisor teeth in the upper jaw, this, with a modification of the movement of the elbow joint, and only a lateral motion to the jaws in chewing serve to separate the two orders.

In 1910 Warren's Mammals of Colorado was published, and is the best local list of the kind ever published for any state. However, since that time, some changes have been made in Mammalian nomenclature, both in specific and generic names. Some additions have been made in the list of rodents that occur in the State, and some have been dropped from the list. As far as possible these changes have been made in this paper.

The United States Department of Agriculture estimates the annual loss from injurious rodents throughout the United States as \$100,000,000.00.

In Colorado we have over fourteen million acres infested with prairie-dogs, and over one million acres infested with the Wyoming ground-squirrel. These figures are estimates made from records we have in the office of the State Entomologist. Roughly speaking, these two rodents infest fifteen million acres of land in our State.

If we figure the damage done to crops and forage at a conservative estimate of ten cents per acre, the annual loss is \$1,500,000.00. This is not taking into consideration the loss from the striped ground squirrels, kangaroo rats, pocket gophers, mice, rats, etc.

In our opinion the annual loss to the State from injurious rodents is, at a very conservative estimate, \$2,000,000.00.

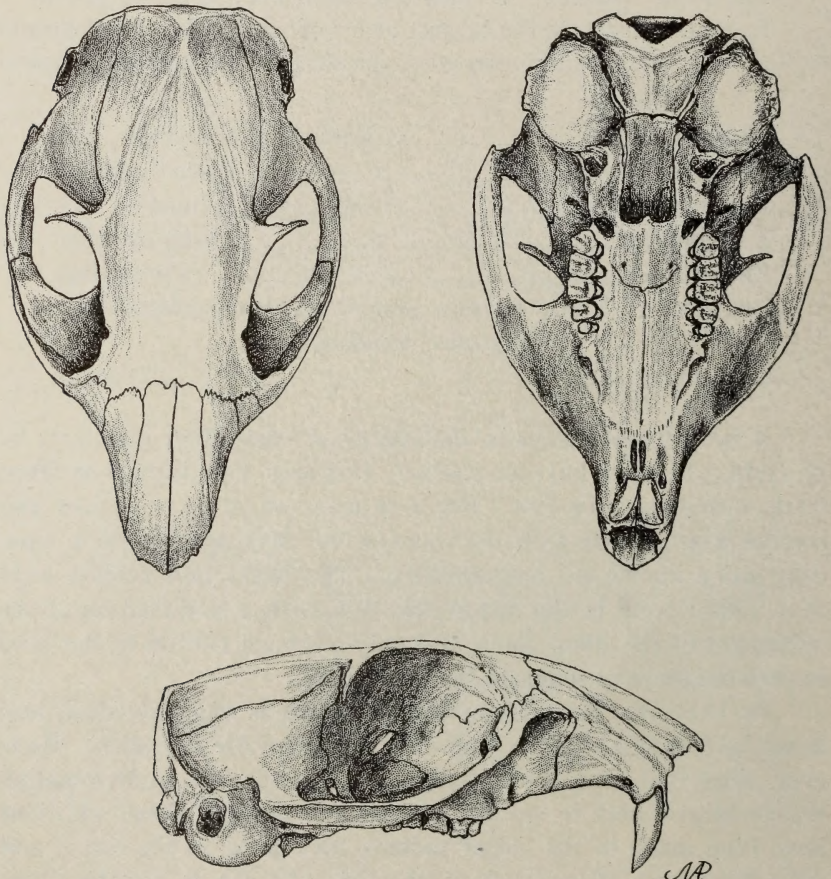


FIG. 1. RODENT SKULL (*Citellus grammurus*). From a specimen taken at Spring Canon, Larimer County. Dorsal, ventral and lateral views. Original. M. A. Palmer, Delineator.

FAMILY MURIDAE

To this family belong such well known rodents as house-mice, house-rats, field- and meadow-mice, muskrats, etc.

The rodents of this family vary considerably in size, the harvest mouse (*Reithrodontomys*) measuring about 5½ inches in length, while the muskrat (*Ondatra*) measures about 22 inches.

Members of this family are found in all parts of the world, and on account of their wide distribution and large numbers, some of the species are the most destructive of all the rodent family. They destroy hay and grain in the fields, vegetables in the garden, trees in the orchard, merchandise of different kinds, cotton, silk, and wool fabrics, etc. They also transmit disease from place to place fatal to man.

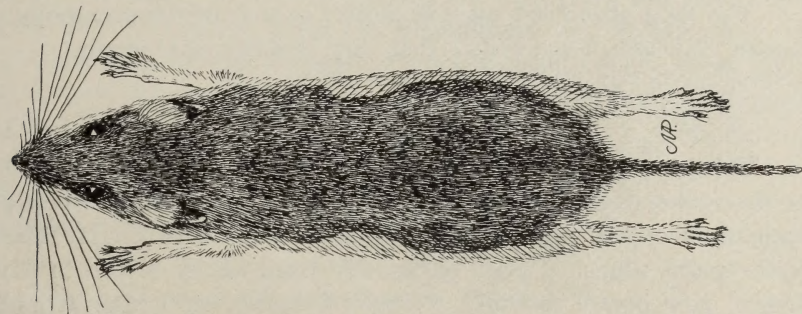


FIG. 2. GRASSHOPPER MOUSE (*Onychomys leucogaster arcticeps*). From a specimen taken at Little Medicine, Wyoming, October 15th. Original. M. A. Palmer, Delineator.

SUBFAMILY CRICETINAE

Genus *Onychomys*

Body stout, pelage, bicolored, upper sides, head and back tawny or grayish, underparts white, with separating line sharply drawn. Immatured pelage of young blue, similar to young *Peromyscus*. Tail short and tapering, bicolored.

Colorado Species of Grasshopper-Mice.

Long-nosed Grasshopper-Mouse, *Onychomys leucogaster arcticeps*.

Pale Grasshopper-Mouse, *Onychomys leucogaster melanophrys*.

The distribution of these two species shows that they are found over most of the State. The food of grasshopper-mice consists of seeds of various kinds, grain, insects such as beetles, grasshoppers, crickets, flesh of other mice, etc. From our observations, the grain eaten is waste grain left on the ground or in shocks in the fields. It is hardly possible that growing grain is eaten to any great extent. From their habit of feeding on weed seeds and injurious insects, they may be classed, for the present, as beneficial.

Genus *Reithrodontomys* (Harvest Mice)

Harvest mice resemble the common house mouse in color, but are usually whiter underneath the body. Size small, about half that of the house mouse. Tail long, scanty haired, upper incisor teeth grooved. Total length 5 to 6 inches.

Colorado Species of Harvest Mice.

Nebraska Harvest Mouse, *Reithrodontomys dychei nebrascensis*.

Big-Eared Harvest Mouse, *Reithrodontomys megalotis*.

Mountain Harvest Mouse, *Reithrodontomys montanus*.

The distribution of the three species of harvest mice is, roughly speaking, over the plains of the eastern part of the State, the San Luis Valley and the southwestern counties.

The food of harvest mice is similar to that of the grasshopper-mouse, although it is possible that they destroy more grain.

Genus *Peromyscus* (Deer-Mice)

The genus *Peromyscus* comprises our well known white-bellied or deer-mice. Small rodents, usually with large ears, tail bicolor, long, small cheek pouches, shining black eyes, soft fur, feet and under parts white. Upper parts vary from tawny brown to dark brown, pale brown to buff. Pelage of young, steel blue or slaty gray. Total length from 6 inches to 7¼ inches. Common all over North America, from the extreme southern border to the Arctic Circle.



FIG. 3. DEER MOUSE (*Peromyscus m. nebrascensis*). From a specimen taken at Ft. Collins. Original. M. A. Palmer, Delineator.

Colorado Species of Deer-Mice.

Tawny Deer-Mouse, *Peromyscus maniculatus rufinus*.

Nebraska Deer-Mouse, *Peromyscus maniculatus nebrascensis*.

Golden-Breasted Deer-Mouse, *Peromyscus crinitus auripectus*.

Tornillo Deer-Mouse, *Peromyscus leucopus tornillo*.

Rowley's Deer-Mouse, *Peromyscus boyleu rowleyi*.

True's Deer-Mouse, *Peromyscus truei truei*.

Long-nosed Deer-Mouse, *Peromyscus nasutus*.

Deer-mice are distributed all over the State, from the lowest elevation to above timberline. They adapt themselves readily to all conditions, being found throughout the foothills and mountain regions, living among the rocks, under decayed logs, around deserted cabins and quite frequently taking up their abode in occupied cabins and their outbuildings.

On the plains they are found in the prairie-dog towns, in burrows under yucca, sage-brush and grease-wool, and around the buildings of the ranchmen.

In walking across the plains if you come across a piece of old flattened tin, or an old board, you can frequently find under such objects the nests of these mice. In the cultivated sections of the state they are found along the ditch banks and fences, often in company with the house-mouse (*Mus musculus*). In a great many cases they occupy the deserted burrows of the striped ground-squirrel (*Citellus t. pallidus*). Traps set around hay stacks will nearly always yield a good catch of these mice. This is also true of shocks of corn, wheat, oats or other grains. Deer-mice destroy considerable grain in the shocks, but as a rule do very little damage in the fields to growing grains.

From our records, deer-mice in Colorado have from five to six young in a litter, and breed six or seven months in the year.

Genus *Neotoma* (Wood-Rats)

Mountain- or wood-rats vary in color from mouse color to reddish brown. Size rather large; tail long, tapering, thinly haired or bushy.

The fur is very soft and silky. Very seldom seen abroad in daylight. Total length from about 11 to 15 inches.

Colorado Species of Wood-Rats.

Bailey's Wood-Rat, *Neotoma floridana baileyi*.

Hoary Wood-Rat, *Neotoma micropus canescens*.

Warren's Wood-Rat, *Neotoma albigula warreni*.

Gale's Wood-Rat, *Neotoma mexicana fallax*.

Desert Wood-Rat, *Neotoma desertorum*.

Mountain Rat, *Neotoma cinerea orolestes*.

Arizona Wood-Rat, *Neotoma cinerea arizonae*.

Pallid Bushy-Tailed Wood-Rat, *Neotoma cinerea rupicola*.

The wood-rats of Colorado represent five groups, *Floridana*, *Albigula*, *Mexicana*, *Desertorium* and *Cinera*. But for convenience sake we will place them in two only, the round-tailed and bushy-

tailed groups. The following species are members of the round-tailed group: *N. baileyi*, *N. m. canescens*, *N. warreni*, *N. fallax* and *N. desertorum*; while *N. c. orlestes*, *N. c. rupicola* and *N. arizonae* belong to the bushy-tailed group. The round-tailed species are seldom found above 8,000 feet altitude, and are found in suitable localities throughout the State, from that altitude down. I have taken *fallax* at 5,200 feet elevation. Warren reports *canescens* from Baca County, *warreni* from Las Animas County, *baileyi* from Yuma and Bent Counties. Cary reports *desertorum* in Rio Blanco County, 5,300 feet elevation. Two members of the bushy-tailed group are also found in low altitudes, *arizonae* in Montezuma and Montrose Counties, and *rupicola* in the northeastern part of the State, but the third member, *orlestes*, ranges up to timberline. Wood-rats inhabit rocky cliffs, deserted mines, old prospect holes, cabins, salt-brush, cactus, hollow junipers, etc. Marvelous tales are told by prospectors and ranchmen concerning the cunningness and sagacity of these interesting little rodents. Wood-rats will carry away and hide most anything portable. Outside of their thievish habits and destruction of stored food, wood-rats are of little economic importance to the farmer.

SUBFAMILY MICROTINAE (Voles)

Small-sized voles closely related to *Microtus*, tail short and rounded.

Colorado Species of Phenacomys.

Idaho Mountain Vole, *Phenacomys orophilus*.

Preble's Mountain Vole, *Phenacomys preblei*.

We know nothing concerning the distribution or food habits of these voles. Warren reports *orophilus* from Lake Moraine, El Paso County, and Buffalo Pass. Cary reports it from Fairplay, Park County. *Preblei* is known from the type locality, Twin or Lillie's Peak, near Long's Peak, and by Warren from North Boulder Creek, taken by R. T. Young.

Genus *Evotomys*

Small, short-tail voles, with reddish brown backs.

Colorado Red-backed Mouse, *Evotomys gapperi galei*.

Occurring in the higher mountains of the State, from 8,000 feet elevation and up.

The food of the red-backed mouse consists of grass and seeds of various kinds. Not being abundant anywhere, and being confined to mountain regions, it is of no economic importance.

Genus *Microtus*

Meadow mice, size small, pelage dark, legs and tail short. Distinguished from the true mice by blunt muzzle and small ears hidden in the fur.



FIG. 4. MEADOW MOUSE (*Microtus p. modestus*). From a specimen taken at Ft. Collins. Original in Circular 18, Office of State Entomologist. M. A. Palmer, Delineator.

Colorado Species of Meadow Mice.

Saguache Meadow Mouse, *Microtus pennsylvanicus modestus*.

Dwarf Mouse, *Microtus nanus nanus*.

Cantankerous Mouse, *Microtus mordax mordax*.

Hayden's Mouse, *Microtus haydeni*.

Meadow-mice are found in all parts of the State. The food of Meadow-mice consists of grass, garden and weed seed and corn and wheat in the shock, but very little grain is destroyed at growing time. They eat tubers of all kinds, growing or in pits. But the greatest damage done by these mice is from their habit of feeding on the bark of fruit, shade and forest trees. I am indebted to Mr. A. Maxson, Entomologist for the Great Western Sugar Company, for the following note: "Meadow-mice wintered in a silo of seed beets. When the silo was opened in the spring, fifty mice were killed and a large number escaped. The mice had destroyed the crowns of ninety per cent of the beets."

Meadow mice did considerable damage to fruit trees on the western slope during the winter of 1914-15. On some of the mesas in Garfield County in the spring of 1917, they were destroying alfalfa. Meadow-mice form one of the important foods of several of our common hawks and owls.

Genus *Ondatra*

Rat-like animals, with robust form, tail long, thinly haired, scaly, rather short legs, and large feet, toes of hind feet partly webbed, fur waterproof.



FIG. 5. MUSKRAT (*Ondatra z. cinnamomina*). From a specimen taken at Ft. Collins, May 5th. Original. M. A. Palmer, Delineator.

Colorado Species of Muskrats.

Rocky Mountain Muskrat, *Ondatra zibethica osoyoosensis*.

Great Plains Muskrat, *Ondatra zibethica cinnamomina*.

The distribution of the two species in Colorado is in all the plains region and the mountains to 10,000 feet elevation or higher. The dividing line between the distribution of the two species in the State may at this time be roughly given as the Medicine Bow Range and the Great Continental Divide. Hundreds of specimens must be examined, however, from all parts of the State before definite lines can be drawn. The meadow-mouse (*Microtus sp.*) and the muskrats are closely related, although the latter is of much greater size, the meadow-mouse measuring about 7 inches in length, while the muskrat measures about 22 inches. Muskrats form one of our greatest sources of small skins for fur.

The London sale one year exceeded 5,000,000 pelts. Muskrats build dome-shaped houses composed of roots, grasses, rushes and other plants upon which they feed. I observed a muskrat one fall that was busy carrying corn stalks from a corn field which was alongside of a slough that was some three or four feet lower than the corn field. The bank was sloping and the muskrat would climb

the bank and go back into the cornfield about fifty feet and cut the dry corn stalks and drag them to the slough, where he was busy building a winter home with them.

Besides the houses, muskrats sometimes live in burrows in banks. They are chiefly nocturnal and are active the year around.

The muskrat's food consists of aquatic plants, sedges, pond lilies, garden vegetables, beets, parsnips, cabbage, celery and the like. They also feed on mussels. The writer has in mind a slough near Fort Collins that, a few years ago, was well stocked with mussels, but muskrats got in and now not a mussel is to be found.

Muskrats are very abundant on Harvy Gulch Mesa, near Silt, Garfield County, where, in some of the fields, they burrow out from the irrigating ditches and eat the sugar beets.

They also burrow under the ditch banks, causing them to cave off and fill the ditches with earth to such an extent that the ditches have to be cleaned out every spring before the water can be run in them. They also cause serious breaks in reservoir banks. I have known of only one case of albinism in muskrats. A cream colored one was caught a few years ago near Fort Collins. Muskrats have been known to enter cellars where they are located near streams, their entrance being made through drain pipes from cellar to stream. The writer's attention was called to one case of that kind where they had destroyed a number of stored potatoes.

SUBFAMILY *MURINAE*

Genus *Rattus* (Rats)

Three members of this genus are found in the United States, only one of which is found in Colorado, the common House-rat. These three species have all been introduced by man into this country from the Old World. House-rats have ears short, naked or nearly so, tail long and scaly and nearly naked. Upper parts rusty grayish brown, underparts ash white. Total length from 12 to 17 inches.

House-Rat, *Rattus norvegicus*.

House-rats in the last few years have invaded most of the eastern part of the State. We have records of captures from Longmont, Boulder, Flagler, Barr, Loveland, Fort Collins, Greeley, Eads, Julesburg, Ault, Pueblo, Holly, Lamar, Windsor, Sterling, Colorado Springs and Denver.



FIG. 6. HOUSE RAT (*Rattus norvegicus*). From a specimen taken at Ft. Collins, April 6th. Original. M. A. Palmer, Delineator.

House-rats eat grain of all kinds, both in the fields and in storage, also small fruits and vegetables, flowering bulbs, butter, cheese, poultry and birds, contaminate milk and cream, rob hens' and birds' nests; they gnaw through building material and zinc drain pipes, and destroy mattresses, upholstery and shoes, and have been known to steal jewelry and set fire to buildings by gnawing matches. They also disseminate disease germs that are fatal to man.

Genus *Mus* (Mice)

Like the former genus, house-mice have been introduced into the New from the Old World, and are now found in all the settled portions of the country. House-mice are too well known to need description.

House-Mouse, *Mus musculus*.

In Colorado the house-mouse is found in all the settled portions of the State. They are frequently caught in traps set for field mice far from settlements. I have seen it on top of the world, at Corona, Boulder County, altitude 11,660 feet.

FAMILY *GEOMYIDAE* (POCKET-GOPHERS)

This is the pocket-gopher family, and nine different genera are found in North America, only three of which are found in Colorado.

Members of this family of rodents practically spend their life cycle beneath the ground, seldom coming above the surface.

In build they are specially adapted to this underground life, having short, thick bodies and powerful forelegs armed with long claws adapted for digging. The eyes and ears are small; the incisors or front teeth are long and sharp, and used on a pick to loosen the dirt. The external cheek pouches are used only to carry food.

Genus *Thomomys*

Pocket-gophers of this genus are distinguished by their small size, upper incisor teeth without the median line as in *Geomys*, and the inner edge with a slight groove. The legs and fore feet are built for digging, but do not have the powerful build as in *Geomys* or *Cratogeomys*. Total length from about $7\frac{3}{4}$ inches to $9\frac{1}{2}$ inches. In color they range from dark brown to buffy gray; eyes small and shot-like; neck not noticeable.

Colorado Species.

Yellow Pocket-Gopher, *Thomomys perpallidus aureus*.

Jicarilla Pocket-Gopher, *Thomomys perpallidus apache*.

Fulvous Pocket-Gopher, *Thomomys fulvus fulvus*.

Espanola Pocket-Gopher, *Thomomys fulvus pervagus*.

Coues' Pocket-Gopher, *Thomomys talpoides clusius*.

San Luis Pocket-Gopher, *Thomomys talpoides agrestis*.

Green River Pocket-Gopher, *Thomomys ocius*.

Colorado Pocket-Gopher, *Thomomys fessor*.

The distribution of the genus *Thomomys* in Colorado is, roughly speaking, from longitude 105° westward to the Colorado-Utah line. They range at a high altitude. I saw gopher workings at Corona, Boulder County, altitude 11,660 feet.

The food of pocket gophers consists of alfalfa roots and other forage crops, parsnips, carrots, beets, potatoes, melons, bulbs of flowering plants, etc. They also damage small trees by cutting the roots just below the surface of the ground. Their runways often cause ground on side hills to wash, either with rain or irrigating water, and ditch banks to break, and their mounds thrown up in meadows and alfalfa fields cause breakage of sickle bars when mowing.

Pocket-gophers practically round out their life cycle in their underground burrows, seldom coming to the surface, and then only at night. It has been the common belief among naturalists that this only occurs during the rutting season, when they are seeking mates. Recently Mr. Harold C. Bryant (University of California Publications in Zoology, Vol. 12, No. 2, pp. 25-29, 1913) has, in a way, disapproved this theory. I quote from his article, page 22:

“An incident bearing on the life-history of the pocket-gopher has been recently reported to the writer by Mr. J. E. Light, of Berkeley, California. He found on the morning of May 1, 1913, more than fifty pocket-gophers (*Thomomys bottae bottae*) stuck in a strip of oil about two feet wide, which had been left alongside of a street in process of repair in North Berkeley. These facts have been fully verified by the writer.” * * *

“Ten of the gophers were collected the next day within a stretch of two-hundred feet. Two of these were apparently adult males, the rest being females and half-grown young.

“If this incident be taken as evidence, gophers come out of their burrows at night and travel above ground. Some mammals are known to travel about during the rutting season more than at other times. The time of the year and the occurrence of large numbers of half-grown individuals, however, would seem to preclude the use of this fact in explanation of the phenomenon in this case.”

The writer has only witnessed one case of this nocturnal wandering of the pocket-gophers. That was in Fort Collins a few years ago, when a gopher was captured early one spring morning far from gopher workings.

Genus *Geomys*

Pocket-gophers of this genus are rather large, heavy-set animals with short legs, no perceptible neck, small eyes, large forefeet armed with long claws adapted for digging. Tail rather short, thick, almost hairless. Skull and jaws massive.



FIG. 7. POCKET GOPHER (*Geomys lutescens*). From a specimen taken near Ft. Collins. Original in Circular No. 23, office of State Entomologist M. A. Palmer, Delineator.

Yellow Pocket-Gopher, *Geomys lutescens*.

The yellow pocket-gopher is distributed in Colorado over the plains country from the Arkansas River north to the Wyoming line, and west to the edge of the foothills.

Genus *Cratogeomys*

Size large, resembling *Geomys*, but upper incisors have only one longitudinal groove.

Colorado Species.

Chestnut-faced Pocket-Gopher, *Cratogeomys castanops castanops*.

We have no records of the distribution of this pocket gopher, but Warren reports it from Bent, Prowers, Las Animas, Pueblo and Baca Counties.

FAMILY HETEROMYIDAE

Pocket-mice and kangaroo-rats belong to this family, both having external cheek pouches like the *Geomyidae*. Tail and hind legs elongated. Except to the naturalist, pocket-mice are probably the least known of all our rodents, and this is also true, to a large extent, of kangaroo-rats. It is a common belief with some ranchmen that kangaroo-rats have an abdominal pouch like the opossum and kangaroo in which to carry their young, but this is not a fact.

Genus *Perognathus* (Pocket-Mice)

Pocket-mice are related to the kangaroo-rats, but the hind limbs and tail are of a moderate length. Coloration similar to kangaroo-rats, but underparts tend to bluffy, pelage coarse; size medium to small; cheek pouches external and large.

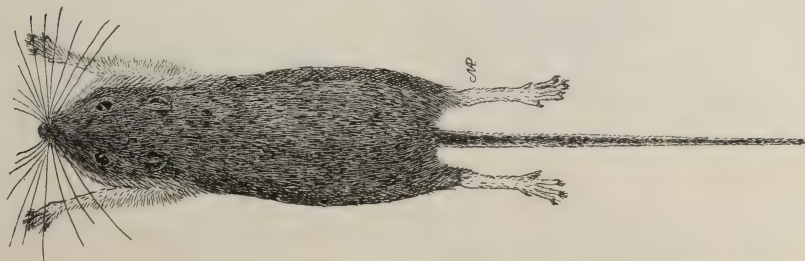


FIG. 8. POCKET MOUSE (*Perognathus paradoxus*). From a specimen taken near Ft. Collins, October 18th. Original. M. A. Palmer. Delineator.

Colorado Species.

Buff-bellied Pocket-Mouse, *Perognathus fasciatus infraluticus*.

Plains Pocket-Mouse, *Perognathus flavescens flavescens*.

Apache Pocket-Mouse, *Perognathus apache apache*.

Baird's Pocket-Mouse, *Perognathus flavus flavus*.

Kansas Pocket-Mouse, *Perognathus hispidus paradoxus*.

We know very little about the food habits of pocket-mice. Seed of the desert plants, no doubt, are the principal food.

Perognathus fasciatus infraluteus has only been taken at the type locality, which is about 8 miles northeast of Loveland, Larimer County, Colorado. It was taken in 1892 by Wm. G. Smith, an eccentric English naturalist, and donated to the British Museum. It was described in 1893 by Thomas as new. In 1894, members of the Biological Survey took several specimens at or near the type locality. At the time these specimens were taken, this section was desert land, but now it has been brought under cultivation, and as pocket-mice are a desert-loving species, it is doubtful if more specimens can be secured from the type locality.

SUBFAMILY *DIPODOMYINAE*

Genus *Perodipus* (Kangaroo-Rats)

Kangaroo-rats with five toes, long hind limbs and tails, the latter pencilled at the tip; fur soft and silky; upper parts from pale to dark buff, under parts white.



FIG. 9. KANGAROO RAT (*Perodipus richardsoni*). From a specimen taken near Loveland, Larimer County. Original. M. A. Palmer, Delineator.

Colorado Species.

Mountain Kangaroo-Rat, *Perodipus montanus montanus*.

Richardson's Kangaroo-Rat, *Perodipus richardsoni*.

Moki Kangaroo-Rat, *Perodipus longipes*.

From records in the office of the State Entomologist the distribution of Kangaroo-rats in Colorado is as follows:

Richardsoni at Loveland, Prowers, Haxtum, Orchard, Boyero, Sterling, Aroya, Florence, Fowler, Earl, Eads, Trinidad, Pueblo, Las Animas, Adena, Boone and Rene, and having a general distribution in suitable localities over the eastern half of the State.

Montanus at San Acacio, Del Norte and Blanca.

Warren reports *longipes* from western parts of Montezuma, Montrose and Mesa Counties.

From our observations no rodent that occurs in the San Luis Valley, except the prairie-dog, is so abundant and destructive as the kangaroo-rat. The ditch banks in this valley are honeycombed with its burrows, and in a number of cases several hundred yards of ditch banks must be repaired each spring before they will hold water used for irrigating purposes. Its burrows are also found in the fields, and the dirt thrown out in some places make mounds as large as a medium sized wash-tub.

This rat stores large quantities of food in its underground storerooms. As much as a half-bushel of stock peas and other seeds have been found in a single burrow. It is very destructive to grains of all kinds, and in some sections is a serious pest. From our observations, kangaroo-rats have three young at a birth, never more or less.

SUBFAMILY ZAPODINAE

Genus *Zapus*

Small rodents with long, tapering tails, coarse bicolored pelage, and hind legs developed for jumping.

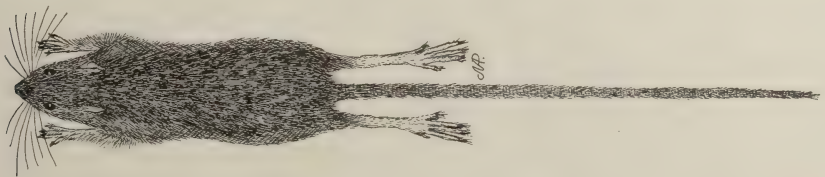


FIG. 10. JUMPING MOUSE (*Zapus princeps*). From a specimen taken at Elkhorn, Larimer County, June 11th. Original. M. A. Palmer, Delineator.

Colorado Species.

Prairie Jumping-Mouse, *Zapus hudsonius campestris*.

Rocky Mountain Jumping-Mouse, *Zapus princeps princeps*.

Warren reports *campestris* from Larimer, Weld, Arapahoe, Jefferson and Boulder Counties, and *princeps* from La Plata, Saguache, Costilla, Boulder, Gilpin, Gunnison and Rio Blanca Counties. I have taken the latter in Larimer County at 8,000 feet elevation.

FAMILY *ERETHIZONTIDAE*
SUBFAMILY *ERETHIZONTIDAE*
Genus *Erethizon* (Porcupines)

Form stout, tail short and thick, color blackish or greenish yellow, dorsal and lateral portions of the body, including the upper part of the tail, covered with sharp spines mixed with stiff hairs, ventral portion covered with stiff bristles. Skull thick, nasals long in the Colorado species, incisor teeth large, outer surface orange.

Colorado Species of Porcupines.

Yellow-haired Porcupine, *Erethizon epixanthum*.

Porcupines are found in Colorado throughout the higher mountain portions of the State. However, every fall, we have a vertical migration of these rodents, and a number invade the plains regions adjacent to the foothills, some falls to a greater extent than others.

In the fall of 1915 this migration was very general in the Fort Collins district. Two were seen on the college campus, two were killed in the business section, and a number were reported from the country.

Porcupines feed upon the bark of trees and upon grass and vegetables. The only damage reported to us is that of destroying standing timber by barking the trees.

FAMILY *SCIURIDAE*

Among the members of this family are found our worst mammalian pests, prairie-rogs and ground-squirrels. The members of this family vary much in size, from the active little chipmunk to the slow, easy-going woodchuck. Other members of this family are the pine-squirrel, and tuft-eared squirrel, the handsomest and most graceful of all our rodents. Some live in burrows out on the treeless prairies, where they build nests in these undergrown burrows for their young, others occupy the same relative position in the mountain meadows, and still others live among the rocks and trees.

Genus *Marmota*

Form stout, tail medium short, a patch on chin and between eye and nose white, cheek pouches small. Total length about 23 inches. Inhabiting the mountainous portions of the state from between 6,000 and 7,000 feet elevation up to timber-line. The lowest elevation we have a record of is 6,700 feet.

Colorado Species of Woodchucks.

Park Woodchuck, *Marmota flaviventris luteola*.

Warren's Woodchuck, *Marmota flaviventris warreni*.

Dusky Woodchuck, *Marmota flaviventris obscura*.

Figgin's Woodchuck, *Marmota flaviventris campioni*.

The food of woodchucks consists of native grasses, clover, alfalfa and garden truck. They are very fond of the leaves of the rhubarb, and are about the only rodent known to the writer that will eat onions.

We have had several complaints from different parts of the State about woodchucks taking possession of camp buildings and gnawing the timbers and boards. In their food habits, woodchucks have one redeeming feature; they are very fond of dandelion.

Genus *Cynomys*

To this genus belongs our well known prairie-dogs. Form robust, tail short, flat, ears rudimentary, very shallow cheek pouches, fore paws adapted for digging, hair short and coarse. Total length about 13 to 15 inches. Color, light to reddish brown.

Colorado Species of Prairie-Dogs.

Plains Prairie-Dog, *Cynomys ludovicianus*.

White-tailed Prairie-Dog, *Cynomys leucurus*.

Gunnison Prairie-Dogs, *Cynomys gunnisoni gunnisoni*.

Zuni Prairie-Dog, *Cynomys gunnisoni zuniensis*.

The combined distribution of these four species, according to our records, includes all of the counties of the State with the exception of Grand, Gilpin, Summit, Garfield, Pitkin, Ouray, Hinsdale, Mineral and San Juan. Warren reports them from Ouray and Mineral. These prairie-dogs occupy about fourteen million acres of land, and, if the average number of dogs to the acre is five, there would be seventy prairie-dogs to every man, woman and child in the State. Sixty-four prairie-dogs consume as much grass as two sheep. Why not raise sheep in place of prairie-dogs? They eat native grasses, alfalfa, small grain of all kinds, potatoes and other vegetables, and also beans, seeds of squash, cantaloupes and watermelons.

Contrary to newspaper reports, prairie-dogs do not dig to water, but get along with what moisture they derive from the vegetation upon which they feed; and rattlesnakes and owls do not occupy the same burrows with them in perfect harmony.

Genus *Citellus* (Ground Squirrels)

To this genus belongs our well known ground-squirrels or spermophiles, a group of rodents showing a great diversity of form and color. Some species have rather small bodies and short tails, others have large bodies and long bushy tails not unlike our tree-squirrels (Genus *Sciurus*). They are more or less striped, spotted or marked in various colors.

These squirrels are sociable, active little creatures, living in burrows or among the rocks. They are locally known as gophers, which is very confusing as the true gopher is a different animal, having external cheek pouches, while the ground-squirrels have internal cheek pouches.

Wyoming Ground-Squirrel, *Citellus elegans*.

We have records of this squirrel from Moffat, Eagle, Larimer, Jackson, Clear Creek, Summit, Rio Blanca, Routt, Grand, Garfield and Pitkin Counties.

We have no record of its occurrence below 6,000 feet elevation, and, with the exception of the prairie-dogs, it is the most destructive rodent found in the State. It eats grain and tubers of all kinds, native grasses, timothy and alfalfa.

The Wyoming ground-squirrel is active only about five months in the year, from about April 1 to September 1. These dates varying in different localities.

The young are born in May and number from six to ten, according to the dissections I have made of gravid females.

Rock Squirrel, *Citellus grammurus*.

We have recorded this squirrel in Colorado on the eastern slope, from the edge of the foothills up to 8,000 feet elevation, and the New Mexico line, north, to within a few miles of the Colorado-Wyoming line, where we have a specimen from the Keach Ranch, near Alford P. O.

On the Western Slope we have records of the occurrence of the rock-squirrel as follows: New Castle, Rifle, Carbondale and Glenwood Springs in Garfield County; Cedaredge, Eckert, Cory, Delta and Hotchkiss in Delta County; Grand Junction, Fruita, Paonia and Clifton in Mesa County, and Montrose in Montrose County. Warren reports it from Crestone, Saguache County, and under the name of *Citellus variegatus utah* from Montezuma, San Miguel, Montrose, Mesa, Delta and Garfield Counties.

The total length of the rock-squirrel is about 17 or 18 inches, and the tail is the longest of the *Citellus* group occurring in the State. In color they resemble the Eastern gray-squirrel somewhat. From our records the food of the rock squirrel consists of seeds of various kinds, apples, cherries, apricots, chokecherries, blackberries, squash and melons. They also eat garden peas, grains of all kinds and feed to some extent on the seed pods of the Yucca and Indian breadroot (*Psovalea*).

The rock-squirrel probably eats less flesh than any other of the ground squirrels. Caged specimens that we had in the College Museum for several months, refused to eat insects, or flesh of any kind.



FIG. 11. SPOTTED GROUND SQUIRREL (*Citellus obsoletus*). From a specimen taken at Wolf Creek, Elbert County, in April. Original. M. A. Palmer, Delineator.

Colorado Species of Spotted Ground-Squirrels.

Kennicott's Ground-Squirrel, *Citellus obsoletus*.

Large spotted Ground-Squirrel, *Citellus spilosoma major*.

Our records show that *obsoletus* has a general distribution over the eastern plains, north of the Arkansas valley. Just how far west its range extends we do not know. I have taken it at Wolf Creek, Elbert County, and observed it at Dent and Dover in western Weld County.

In conversation with a ranchman living ten miles north of Wellington, Larimer County, he stated that while poisoning prairie-dogs in the summer of 1916 he found a small spotted ground-squirrel dead in the dog-town. On being shown a specimen each of *obsoletus* and *pallidus*, he at once picked *obsoletus* as like the one he had found dead. He was also familiar with *pallidus*, saying that it was very common, but the spotted one that he had found dead was the only one of that kind he had seen. If this is not a

mistake, it is the first record for Larimer County. The food of the spotted ground-squirrels is the same as for the striped. Our records for *major* are as follows: Goodpasture, Pueblo County; Rocky Ford, Otero County, and Prowers, Bent County. Warren also reports it from Prowers and Baca Counties.



FIG. 12. STRIPPED GROUND SQUIRREL (*Citellus t. pallidus*). From a specimen taken at Ft. Collins, in May. Original. M. A. Palmer, Delineator.

Colorado Species of Striped Ground-Squirrels.

Pale Striped Ground-Squirrel, *Citellus tridecemlineatus pallidus*.

Little Striped Ground-Squirrel, *Citellus tridecemlineatus parvus*.

The distribution of *pallidus* in Colorado, from our records, is as follows: The plains of the eastern part of the State from latitude 38° north to the Colorado-Wyoming line, and from the Colorado-Kansas-Nebraska line westward to Log Cabin in Larimer County, and Howard in Fremont County. Warren reports it also from South Park and Leadville; Cary from Jackson County; from Wet Mountain and Huerfano Valleys, from near La Veta in the Cucharas Valley, and near Buena Vista.

Warren reports *parvus* from Rio Blanca, Western Routt (now Moffat) and Garfield counties, and the San Luis Valley. I have taken it at Lay, Moffat County, and San Acacio, Costilla County, and have seen it at Del Norte, Rio Grande County, and at La Jara, Conejos County.

Outside the State it occurs in northeastern Utah and southwestern Wyoming. The San Luis specimens are not typical, but, in my opinion, in time the two forms will be separated. In order to do this we should have hundreds of specimens of typical *parvus*, and the same number of specimens from the San Luis Valley. As

it is, with only the few specimens we have, when they are mixed together and labels hidden, the San Luis specimens can be readily picked out.

The food of the striped ground-squirrels consist of grain of all kinds, but corn is their favorite food. They also eat weed seeds of various kinds, and in the fall are very fond of the seed of the Buffalo-bur (*Solanum rostratum*). They also eat grasshoppers, crickets, cutworms and beetles in large numbers and, in confinement at least, will catch and devour mice with the eagerness of a cat. They sometimes take on the habit of killing and eating small chickens also.

Genus *Eutamias* (Chipmunks)

The members of this genus are active little creatures, with slightly bushy tails and longitudinal body stripes, five dark and four light, and internal cheek pouches, which they use to carry food. They are equally at home among the rocks, sage brush or cactus. Their characteristic flit of tail and sharp clatter makes them conspicuous objects.

Colorado Species.

Utah Chipmunk, *Eutamias dorsalis utahensis*.

Colorado Chipmunk, *Eutamias quadrivittatus quadrivittatus*.

Las Animas Chipmunk, *Eutamias quadrivittatus animosus*.

Hopi Chipmunk, *Eutamias hopiensis*.

Busy Chipmunk, *Eutamias amoenus operarius*.

Least Chipmunk, *Eutamias minimus*.

Related Chipmunk, *Eutamias minimus consobrinus*.

Cary's Chipmunk, *Eutamias minimus caryi*.

Chipmunks inhabit all the sections of the State from the eastern base of the foothills to the western line, and parts of eastern Las Animas and western Baca Counties.

Chipmunks feed on grain and seeds of various kinds. They are very fond of the seeds of juniper berries, and of the hawthorn. I shot one at Spring Canon, Larimer County, out of a hawthorn bush that had in its cheek pouches 48 seeds of the latter berry. They feed extensively on the seeds of the mountain maple, and prickley pear also. I shot one that had in its cheek pouches 29 seeds of this cactus. Just how they extract these seeds without getting a mouthful of the small spines that covers the pears, I am unable to say.

When abundant they make themselves a general nuisance around gardens, but are easy to control with poisoned grain.



FIG. 13. Left, ANTELOPE SQUIRREL (*Ammospermophilus leucurus*). Right, CHIPMUNK (*Eutamias operarius*). Original. M. A. Palmer, Delineator.

Genus *Callospermophilus*

The ground-squirrels of this genus have side stripes, rather prominent ears, body robust, tail short and skull broad.

Colorado Species.

Say's Ground-Squirrel, *Callospermophilus lateralis lateralis*.

Wortman's Ground-Squirrel, *Callospermophilus wortmani*.

These ground-squirrels are commonly known as the big chipmunk, and range over the western part of the State at an elevation of about 6,000 feet to about 10,000 feet. The food of these ground-squirrels is seeds of various kinds and garden truck. In some localities they are a great pest to mountain gardeners.

Genus *Ammospermophilus*

The ground-squirrels of this genus are of small size with small ears and short tail. They are inhabitants of the sandy arroyos covered with sagebrush and greasewood, and are also found to some extent among the rocks, around the edges of these arroyos.

Only one species of the Antelope-squirrels occurs in the State, and that is *Ammospermophilus leucurus cinnamomeus*. It occurs in southwestern Colorado. I have observed it at Palisade and Hotchkiss, and Warren also reports it from Montrose, Coventry, Bedrock and western Montezuma County.

We know nothing of the food habits of this antelope-squirrel, but it can hardly be of any economic importance.

Genus *Sciurus*

The tree-squirrels belong to this genus. The eastern gray- and fox-squirrels are well-known members, and are familiar to most of the residents of the State, because of early association in the East and Middle West. The gray- and fox-squirrels are not natives of Colorado, but have been introduced into several parks in different sections. However, the genus is well represented in the mountainous portions of the State, where the pine-squirrel or chickaree, and the tuft-eared-squirrels occur. The members of this genus all have long, bushy tails.

Colorado Species of Tree-Squirrels.

Mimic-Squirrel, *Sciurus aberti mimus*.

Plainbacked-Squirrel, *Sciurus aberti ferreus*.

Pine-Squirrel, *Sciurus fremonti fremonti*.

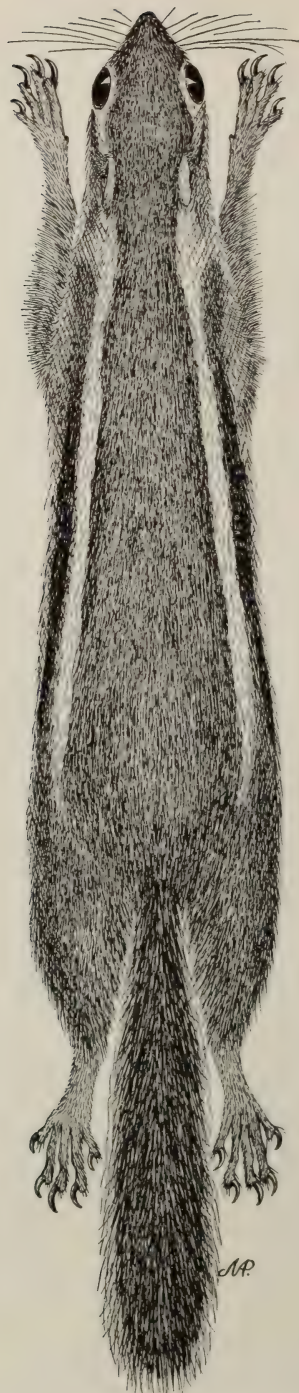


FIG. 14. SAY'S GROUND SQUIRREL (*Callospermophilus lateralis*). From a specimen taken in Estes Park, July 7th. Original. M. A. Palmer, Delineator.



FIG. 15. TUFT EARED SQUIRREL (*Sciurus a ferreus*). From a specimen taken at Risk Canon, Larimer County, January 13th. Original. M. A. Palmer, Delineator.

Squirrels of the *aberti* group have long ear-tufts in winter. In one species, *ferreus*, there are three color phases at least, namely, the normal phase, in which the upper parts are gray and the under parts white, a dark brown, and a black phase. In some sections of this squirrel's range the brown and black phases predominate, but in the northern part of the State, at least Larimer County, the gray color is most common.

The tree-squirrels of Colorado are confined to the pine area, the seeds of the pine and spruce forming the bulk of their food.

I have seen *fremonti* make some remarkable leaps, high above our heads, across mountain roads, from one pine tree to another.

FAMILY CASTORIDAE (BEAVERS)

Genus *Castor*.

Beavers are the largest rodents found in Colorado, in fact, the largest in North America. Fur very dense, waterproof, tail broad and flat, hind feet webbed, larger than fore feet. Skull and lower jaw massive.

Colorado Species.

Broad-tailed Beaver, *Castor canadensis frondator*.

Beavers are found in Colorado pretty generally where there is sufficient water for their purpose. The food of beavers consists of bark of trees and bushes, for which they usually store a quantity of branches for use in the winter. The only complaint of damage by beavers we have had is from the damming of streams, which often diverts water from irrigating ditches and floods meadows.

NATURAL ENEMIES OF RODENTS.

As natural enemies of rodents, hawks and owls rank first, with the weasel, skunk and badger as close seconds. Hawks and owls have long been known by naturalists to be of great economic importance because of their habit of feeding extensively upon rodents injurious to agricultural crops. With the exception of the goshawk, sharp-shinned hawk, and horned owl, these valuable birds are protected by law in most states.

Notwithstanding these wise laws, hundreds of thousands of these useful birds are annually destroyed by gunners and thoughtless farmers, who consider them enemies to game birds and poultry. Goshawks, sharp-shinned hawks and horned owls are not common in Colorado. Our common hawks are marsh hawk, western red-tail hawk, Swainson's hawk, sparrow hawk, and two species of rough-legged hawks. Our common owls are long-eared, short-eared, and Rocky Mountain screech, none of which make a practice of molesting the poultry yard. Of the hawks mentioned above, ranking in order of their economic importance, are Swainson's, and the marsh hawk. The marsh hawks occasionally eat poultry, Swainson's rarely. Not only is Swainson's hawk of great importance as a destroyer of rodent pests, but it feeds at certain times of the year almost exclusively on grasshoppers. The writer has seen hundreds of these birds, in the fields during fall migration, hopping around, catching grasshoppers.

Badgers, skunks, weasels, black-fotted ferrets, wildcats and coyotes feed extensively on rodents.

I have observed weasels a number of times working over the plains and mountain meadows, infested with prairie-dogs, ground-squirrels and gophers, moving soft-footed and stealthy as a phantom shadow, investigating every burrow. With their slender bodies they can enter very small openings, follow the windings of the burrows, and they are very destructive to the rodent at the end

of the burrow. (I would like to write something about the beneficial traits of the coyote, but I am not looking for trouble.)

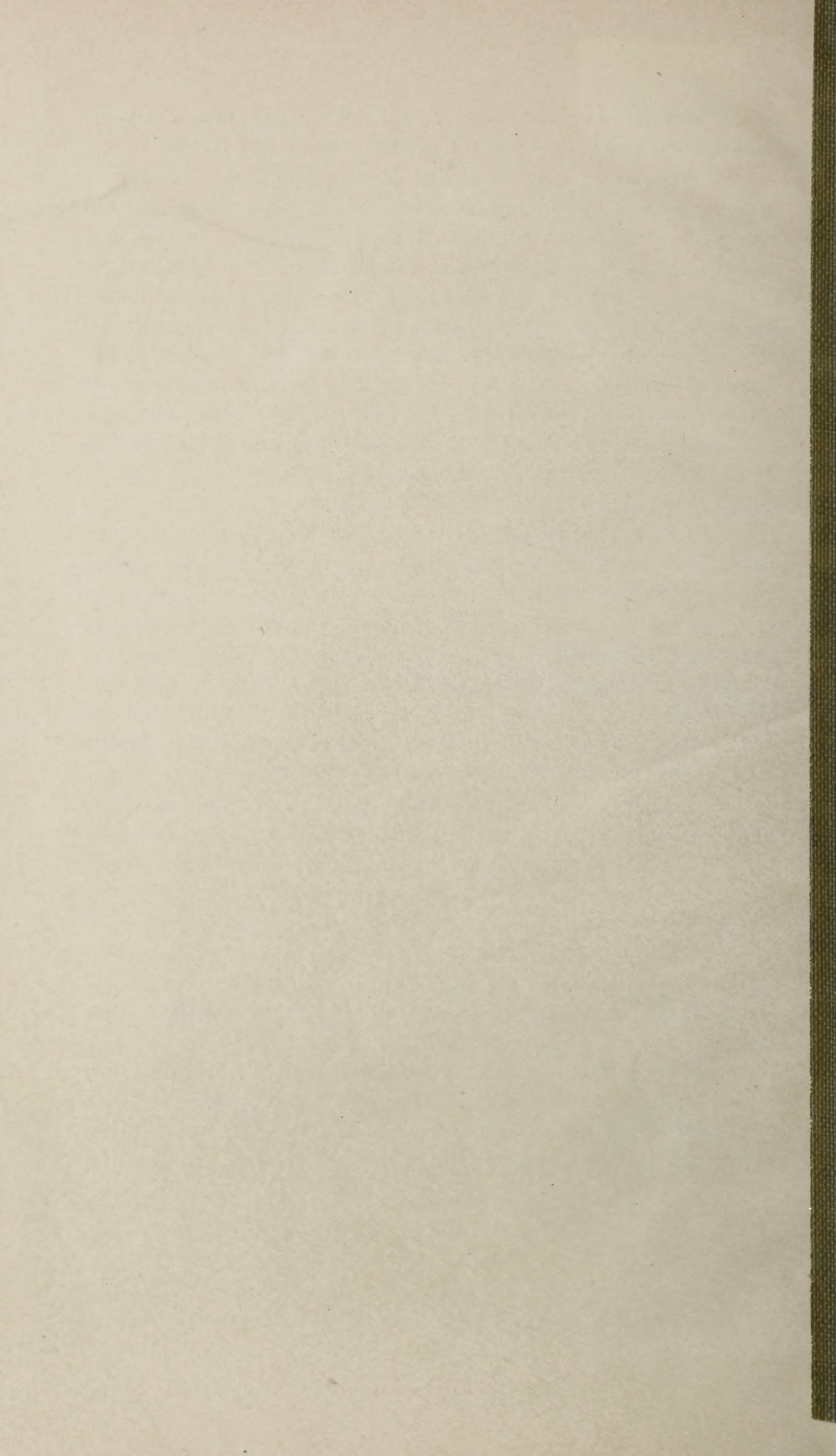
Our friend (?), the house-cat, is supposed to be a destroyer of rodent pests. To a certain extent that is true. They also kill young chickens, ducks and useful birds, and are also a disseminator of disease, tuberculosis, tonsilitis, scarlet fever, small pox, hydrophobia, etc. They are also commonly infested with a skin disease known as ringworm. The scratch or bite of a cat has been known to produce tetanus or lockjaw. Most cats are good mousers, so are traps and poison. House-rats are hard to trap or poison, so are rat-catching cats hard to find. Feed cats well and they are, as a rule, poor mousers. Don't feed them and they are better mousers. They also kill more birds and chickens, paw over more manure and garbage, and thus become germ infected.

In Colorado we do not have many stray cats, but the Atlantic states have them by the thousands, where they destroy untold numbers of useful birds.

The writer has always made it a point to kill, if possible, all stray cats he finds in the fields or woods. (Also some that are not strays, if they are far enough from home.) So let us eliminate the house-cat as an important factor in rodent control, and, on account of their habit of feeding on useful birds, place them where they belong, a household pet of doubtful character.

You seldom read an article, bulletin or circular on either snakes or rodents but what the writer elaborates on the beneficial traits of snakes, from their habit of feeding on injurious rodents. The writer has been guilty of the same offense in times past, but of late years we have had a change of sentiment on this subject.

Snakes are cold-blooded animals, their food is taken whole, and usually alive, and the food is slowly dissolved by the acid juices in the stomach. On account of snakes being cold-blooded, digestion is slow, about two weeks' time being required to digest the ordinary ground-squirrel. On account of this fact, and as the period of snake activity is short, they are of very little importance economically compared with warm-blooded animals, where digestion is rapid and a large amount of food is required.



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