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Controlling Rodents and Other Small Animal Pests in Oregon

By

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TABLE OF CONTENTS

	Page
Ground Squirrels	3
Poisoning	4
Gassing with Calcium Cyanide.....	5
Douglas Ground Squirrel	6
Life History and Habits.....	6
Control	6
Oregon Ground Squirrel	7
Life History and Habits.....	7
Control	8
Columbian Ground Squirrel.....	8
Life History and Habits.....	8
Control	9
Piute Ground Squirrel	9
Life History and Habits.....	10
Control	10
Townsend Ground Squirrel	10
Black-tailed Jack Rabbit	10
Life History and Habits.....	10
Control	11
Rabbit Salt Formula	12
Pocket Gophers	12
Life History and Habits.....	12
Control	13
Willamette Valley Pocket Gopher.....	13
Placing the Bait	13
White-toothed Pocket Gopher	14
Rogue and Umpqua Valleys	14
Eastern Oregon	14
Woodchuck	14
Life History and Habits.....	14
Control	15
Mountain Beaver	15
Life History and Habits.....	15
Control	16
Field Mice	16
Life History and Habits.....	16
Control	17
Dry Grain Formula	17
Brown Rat	18
Life History and Habits.....	18
Control	19
Exposing Baits	20
Kangaroo Rat	21
Life History and Habits.....	21
Control	21
Porcupine	21
Control	22
Oregon Mole	22
Life History and Habits.....	22
Control	23

Controlling Rodents and Other Small Animal Pests in Oregon

By

IRA N. GABRIELSON

THIS bulletin has been prepared in response to a general demand from farmers in Oregon for concise information regarding methods of combating the various small animal pests found in the state. No state has a greater variety of these pests and, in proportion to the value of the crops produced, probably no state suffers more serious losses from the various small animals, both native and introduced.

Among the serious pests found here are the several species of ground squirrels, jack rabbits, pocket gophers, field mice, kangaroo rats, woodchucks, mountain beavers, and moles among the native mammals; and among those introduced by man, house rats and house mice. In one locality or another throughout Oregon all these animals are pests of considerable importance. The ground squirrels and pocket gophers are quite generally distributed throughout the state, while the other rodents and the mole are confined to certain sections or localities.

For many years the Biological Survey, one of the bureaus of the United States Department of Agriculture, has been perfecting practical methods of exterminating wild-animal pests and has applied such methods successfully over a wide territory. These have been developed by investigations and experiments conducted throughout the country, chiefly in the West, where injurious native rodents are most in evidence. The following discussion of methods of control of such pests in Oregon is based on the information gathered by the Biological Survey through wide correspondence, study, and experimentation, in cooperation with state agencies and with individuals.

GROUND SQUIRRELS

The damage done by ground squirrels stands out probably more conspicuously than that of other groups on account of the wide distribution and general abundance of these squirrels and because of their habit of destroying grain as it is growing and ripening. Particularly in Eastern Oregon the edges of growing fields may be mowed down by these pests for a distance of a rod, or even more, and farther in the field an area of equal extent may be partly trampled or destroyed by them. Fortunately, four of the five species found in the state spend a large portion of the year in hibernation, thus decreasing the amount of damage they might otherwise do. Their destructiveness varies from a very small percentage to twenty-five per cent, or even more, of the crop on the land. Occasionally they will destroy an entire crop.

All the many methods that have been used in combating ground squirrels are more or less effective. Trapping, shooting, gassing, and poisoning are commonly employed. When the squirrels are excessively abun-

dant the first two methods are out of the question as a practical means of control.

Poisoning. In Oregon, poisoning has come to be the general means of combating these animals. Strychnine is almost universally used and is found to be more reliable and cheaper for the results obtained than any other tried. It does not deteriorate readily, as does cyanide, and is much safer to use than phosphorus. It is now generally mixed by the Biological Survey assistants and the county agents throughout the state and is on sale at a reasonable price by nearly every county agent.

The poison, as generally put out, is mixed on barley or oats, depending upon the kind of squirrels to be dealt with, and in different standard strengths under different conditions. A teaspoonful to a tablespoonful is the usual bait. The baits should be distributed near the entrances of burrows or along the trails made by the squirrels. The amount is governed by the abundance of squirrels rather than by the acreage of land covered. One quart is usually good for from forty to sixty baits and the poison should be distributed accordingly. It can be spread either in traveling on foot or on horseback; in open districts the latter method is commonly used as one can see the holes readily and can cover a much larger area of land than by traveling on foot. In thickly infested land with well-worn trails it is not necessary to search out every hole, as scattering it along the trails will reach practically every squirrel in the district. Many people fail from using too little bait. Where squirrel infestation is heavy a large quantity is usually required. On one ranch in Klamath county 466 dead squirrels were picked up above the ground on two measured acres, while on most ranches the number on a similar area would be not more than from 25 to 30. It can be readily seen that a quantity sufficient to clear one ranch might be totally inadequate on another. The number of squirrels dying above the ground seems to vary from a few to a large percentage of the total killed, depending upon factors not thoroughly understood. Apparently both weather and the condition of the animal have something to do with the distance a squirrel can travel after taking the bait. One should not, therefore, condemn any poison put out from which is found few dead squirrels, but rather look for results in the decrease of the squirrel population.

Many people fear to put out poison for ground squirrels because of the supposed danger to chickens and game birds. While it has been a common assumption that squirrel poison will kill all the quail and similar native birds as well as the squirrels, on the other hand it has long been thought that gallinaceous or scratching birds possess some immunity to strychnine, and within the last few years definite experiments have established the latter to be the case. California quail fed on standard squirrel baits show that they might eat considerable quantities without suffering any harm. "One adult valley quail," says the Biological Survey, "consumed 125 kernels of poisoned barley in a period of twenty-four hours with no trace of ill effects. Thus, without injury to itself, this bird had eaten enough strychnine to kill twelve ground squirrels, each three or more times greater in bulk than the bird. When it is considered that ordinary strychnine is toxic in a direct proportion to the bulk of the animals taking it, the comparative immunity of the valley quail becomes apparent. A limited number of similar experiments with mountain quail and a bobwhite gave like results. In this connection it will be well to call attention to experiments

conducted by the Chief Game Warden of Saskatchewan, Canada, where it was demonstrated that a prairie chicken ate a quantity of poisoned grain sufficient to kill one hundred ground squirrels, without experiencing any ill effects." Chickens have been fed this material from time to time without any harmful effects, and at Oregon State Agricultural College investigators fed a pen of chickens on this poison without injuring them in the least. These experiments have been confirmed by similar ones in other districts. Where ducks, geese, turkeys, and other domesticated fowls, however, are ranging over the ground, it is necessary to use considerable care as they are all more or less susceptible to the action of strychnine. In turkey-raising districts, particularly where the flocks range widely over the foothills country, it has been found advisable to put the bait in inaccessible places. One plan used successfully by many farmers is to build boxes about 18 inches long of 1" x 4" material and close them at one end. These have been distributed over the land and kept supplied with squirrel poison thrown well back into them. It has been found that the squirrels will enter these boxes to seek the bait without any hesitation and at the same time the turkeys will not be endangered.

The squirrel work is to some extent seasonal. While it is possible to poison a few squirrels at almost any time when they are out and active, the best period is after they have been out for some time and the vegetation has reached a certain stage of growth. One good plant index is the yarrow. When the yarrow blossoms are well advanced and about to drop is the time that the squirrels begin to turn to grain for food. They then continue to take grain best until a few days before they go into hibernation. This period is from about May 15 until July 1. Most of the young are out at this time and old enough to feed on grain. Extensive crew operations can be done best during this period. Earlier or later than this, only spot work can be effectively conducted. In the higher mountain altitudes this period for effective control work is about one and one-half months later.

Gassing with calcium cyanide. Until the past few years gas of any kind has not been commonly used in Oregon in controlling ground squirrels. With the development of calcium cyanide, which is readily handled in rodent work, the efficiency of gassing has been greatly increased until it is now a very valuable means of squirrel control. This is particularly true in districts where some difficulty is encountered in getting the squirrels or in cleaning up an area after poisoning, there frequently being a few animals that refuse to take bait. Gas is somewhat more expensive, especially in areas of heavy infestation where poisoning from horseback is possible. To treat a given area, gas at present prices will cost considerably more than strychnine, owing to the fact that there are several holes to each squirrel and it is necessary to treat many more holes than there are squirrels present. Cyanide comes in several forms put out under various trade names in a dust form to be used in a dusting machine of some kind. This material is very efficient, ranking about equally with strychnine. The purchase of a machine is an unnecessary expense, however, as equally good or even better results can be obtained by the use of a granular form of cyanide which can be deposited in the squirrel burrows with a large spoon. It is therefore strongly recommended that where cyanide is employed in controlling ground squirrels the granular form be used in preference to the dust, since the former is cheaper, more rapid, and equally efficient.

Cyanide is deadly enough to kill anything, but at the present time there are no efficient methods for killing moles or gophers. The trouble is with the method of placing the material and not with the material itself. At present it is recommended for use only against ground squirrels and house rats which have burrows into which the gas can readily penetrate. It would be well to exercise caution in recommending this material for anything except uses on which it has been thoroughly tested. So far as rodent control is concerned, its efficient use in Oregon at the present time can be counted on only in the above recommended cases.

DOUGLAS GROUND SQUIRREL (*Citellus beecheyi douglasi*)

Common names. Douglas ground squirrel; gray digger.

Description. Largest ground squirrel in Oregon, generally brownish mixed with blackish color about the head. There is a silvery white area on the sides of the head and neck, and a blackish brown wedge-shaped patch with the apex at the shoulders. The entire body is more or less covered with white or whitish spots, giving the squirrel a general dappled appearance at close range. The tail is long and bushy, this being the only Oregon ground squirrel with a tail even approaching in size that of the tree squirrels. The color of this animal varies considerably during the season, but the blackish wedge-shaped patch on the back and the large tail will at any time identify it. It is sometimes confused with the big silver-gray tree squirrel, as in Oregon it often climbs thirty or forty feet into the oak trees. It can usually be distinguished from the tree squirrel, however, since the ground squirrel, when it discovers a man approaching, invariably starts for the ground, while the tree squirrel will remain in the tree and climb higher. The length of an adult male is from 17 to 19 inches.

Distribution in Oregon. The Douglas ground squirrel is distributed in Western Oregon from the Columbia River to the California line, and also through the Columbia Gorge and south along the eastern foothills of the Cascades at least as far as Redmond in Deschutes County. There are also a few scattered pairs in Klamath County on the east side of the Cascades, and a few that have followed the mountains and foothills up from California are found near Lakeview in Lake County. The Coast Region is practically free from them although scattered individuals may be found throughout even these counties. The following counties are particularly concerned in dealing with this squirrel: Wasco, Hood River, Multnomah, Washington, Yamhill, Clackamas, Polk, Marion, Benton, Lincoln, Lane, Douglas, Josephine, and Jackson.

Life history and habits. The gray digger appears late in February or early in March and remains active until October or November. A few individuals come out on bright sunny days throughout the winter, but most of them undoubtedly spend some of the year in hibernation. This is the only ground squirrel found in the state that habitually stores food to last through the winter, and this fact, together with its long period of activity, combines to make this species one of the most destructive. The individuals do more damage than those of any other species, but the OREGON ground squirrel is so much more abundant that in the aggregate it does the most damage. The animals do not go far into the heavy timber but prefer the open glades, rocky or bushy hillsides, fence rows, cut-over lands, and similar places. They have a tendency to congregate in colonies, but this is not so conspicuous as in other species. Particularly in the foothills the great majority of the individuals seem to congregate on the south and east slopes. Such slopes, with a scattered growth of oak or brush, are ideal digger country in Oregon.

The young are usually born in April and average about eight, according to data obtained in Oregon; in other words, the net increase is about fourfold each season. So far as known, they do not breed more than once a year.

Control. Many methods of destroying these animals have been tried, but probably the most economical and satisfactory in all ways is the use of

poison. The Biological Survey recommends the following formula as most effective throughout the season:

Barley (clean grain).....	16 quarts
Strychnine (powdered alkaloid).....	1 ounce
Bicarbonate of soda (baking soda).....	1 ounce
Heavy corn sirup.....	$\frac{1}{2}$ pint
Thin starch paste.....	$\frac{1}{2}$ pint
Glycerine	1 tablespoonful

Mix thoroughly in a clean vessel 1 ounce of powdered strychnine (alkaloid) and 1 ounce of common baking soda. Over this pour $\frac{1}{2}$ pint of thin, hot starch paste and stir well. (The starch paste is made by dissolving 1 heaping tablespoonful of dry gloss starch in a little cold water, which is then added to $\frac{1}{2}$ pint of boiling water. Boil and stir constantly until a clear thin paste is formed.) Stir in $\frac{1}{2}$ pint of heavy corn sirup and 1 tablespoonful of glycerine, making sure that none of the heavy sirup paste sticks to the bottom of the container. Pour this mixture over 16 quarts of good cleaned barley and mix well so that each grain is coated.

Persons handling this material should remember that it is exceedingly dangerous to all kinds of livestock as well as to human beings. All receptacles should be carefully scalded and scrubbed before being used for anything else, and the grain itself should be stored where no stock can possibly get to it.

OREGON GROUND SQUIRREL (*Citellus oregonus*)

Common names. Sage rat; picket-pin gopher; ground squirrel; many others.

Description. A medium-sized, short-tailed squirrel, from 10 to 12 inches long; general brownish gray color; tail rufous in color.

Distribution in Oregon. This is the most abundant squirrel in Oregon and is found throughout the eastern part of the state except along the Columbia River Gorge and in the higher mountains. It is particularly fond of meadows and cultivated lands and is usually the squirrel it is necessary to fight in this district. The following counties are infested practically throughout their entire area except in the higher mountains: Klamath, Lake, Harney, Malheur, Baker, Grant, Wheeler, Crook, Deschutes, Jefferson, Union, and Wallowa; the southern parts of Umatilla, Morrow, and Gilliam counties; and Wasco County east of the Deschutes River. (See description and range of Piute ground squirrel.)

Life history and habits. Under favorable conditions, the Oregon ground squirrel occurs in almost unbelievable numbers. It shares with the other species of ground squirrels of the semiarid districts the curious and interesting summer aestivation, as well as the winter hibernation common to many other animals. When the dry, hot weather of July comes the squirrels at the lower altitudes begin to disappear, while those in the mountains may be active until September 1 or later. Before denning up they become fat and sluggish and spend considerable time lying in the sun at the mouth of their burrows, a habit in marked contrast with their activities earlier in the season. No food supplies are stored as they go into a deep and lasting sleep which carries them through from July or August until the following spring. During February they begin to appear above ground again in the lower altitudes and after a few days become exceedingly voracious and active. At this time mating begins and the pasture lands are alive with racing squirrels. The young are born chiefly during the month of April. One hundred and ten females examined early in April showed that their average litter would have been eight. So far as is known

they breed only once a year. As this squirrel stores no food, the damage it does is confined to the crops actually eaten or trampled when it is running through the fields. It is a common sight to see a border in a field, anywhere from a few feet to rods in width, destroyed, and a close examination reveals that a large percentage of the grain in the remainder of the field has either been eaten or cut down. At times these ground squirrels eat only the joints or stems and leave the remainder of the plant untouched. On the range their damage is great, although of course not so heavy as in cultivated districts. The habit of cutting out the joints makes the damage greater than it would be otherwise.

Control. The best season for control operations is late in May through June when the females and young are above ground, and they can be readily killed. As with all other species of ground squirrels found in Oregon, poisoning is the most economical and efficient method of combating these pests. Many different formulas are in use throughout the squirrel district. For the Oregon ground squirrel the Biological Survey uses exactly the same formula as for the Douglas ground squirrel except that 16 quarts of oats are substituted for the barley of that formula and a tablespoonful of salt is added to the mixture for every ounce of strychnine used. In mixing the bait only clean, bright grain should be used. Grain filled with dust, oat hulls, and weed seed is worse than useless, as the strychnine paste will be collected by the refuse rather than spread over the grain. It is necessary to clean nearly all oats before using in this mixture. The poison should not be placed in piles or thrown down the holes but should be scattered out, a teaspoonful to a place, along squirrel trails and about the holes. Properly scattered, this will not endanger livestock, as the animals will not pick up enough to harm them. The squirrels, on the other hand, will hunt it up, a kernel at a time, and pack it into their cheek pouches. In thickly infested land the quickest and most efficient results will be obtained by scattering the poison from horseback.

COLUMBIAN GROUND SQUIRREL (*Citellus columbianus ruficandus*)

Common names. Ground squirrel; red squirrel; red digger.

Description. Excepting the gray digger, or Douglas ground squirrel, this is the largest ground squirrel in Oregon. It is a large, heavy-bodied animal with a short tail, and is a general reddish brown in color with particularly red under parts.

Distribution in Oregon. Found throughout the Blue Mountains district over Eastern Oregon in Wallowa, Union, and Baker counties, in northern Malheur and Harney counties and west in Grant County, in the Malheur Forest to the Crook County line, and in eastern Umatilla County. This animal sticks more or less closely to the timber and thus is found throughout and about the edges of the Wallowa, Malheur, and Umatilla National forests.

Life history and habits. The Columbian ground squirrel, like the Douglas squirrel, is more or less an open-timber dweller. It has been noted in abundance on ridges about 7,000 feet in altitude in the Wallowa Forest and descends from these timberlands into the lower valleys. During recent years it is showing an increasing tendency to move farther into the cultivated districts, and is now quite common a mile or two from the edge of the timber in many localities in the eastern part of Oregon.

Particularly in Wallowa, Union, and Baker counties, Columbian ground squirrels are closely associated in many districts with Oregon ground squirrels and in these communities come out of hibernation some time later than the latter. They also stay out later in the summer and are

quite common in the higher mountains until September. Stockmen assert that one of their worst habits is eating out the joints of the grass stems, apparently for the juices contained there. The effect of this is to mow the grass and allow it to waste. The squirrels destroy many times as much grass in this way as they actually eat. They also do a great deal of damage to grain and hay crops in fields near their habitat. So far as known, these squirrels store no food for the winter season, and retire to their underground hole in summer to remain until the following spring, usually some time in March.

The average number of young born to a litter is given by William T. Shaw, formerly of Pullman, Washington, as five. At this rate their increase is not quite so rapid as that of the gray digger and the Oregon squirrel. Next to the gray digger, the Columbian ground squirrel is, individually, the most destructive squirrel found in the state, but owing to its restricted range the average damage done by this species is considerably less than that done by the Oregon ground squirrel.

Control. The following rolled-oat formula has proved very effective against this species of squirrel in Oregon. The whole oats commonly mixed for controlling the Oregon ground squirrel is not effective.

Mix one tablespoonful of gloss starch in $\frac{1}{2}$ teacup of cold water, and stir into one pint of boiling water to make a thin, clear paste. Add one tablespoonful of salt to starch paste. Mix one ounce of powdered strychnine (alkaloid) with one ounce of baking soda (bicarbonate), and stir with the starch to a smooth, creamy mass free of lumps. Stir in $\frac{1}{4}$ pint of heavy corn sirup and one tablespoonful of glycerine, and finally one scant teaspoonful of saccharine. Apply to 10 quarts of steam-rolled oats and mix thoroughly to coat each kernel.

Each quart is sufficient for 40 to 60 baits. This quantity, scattered (one teaspoonful to a place) along squirrel trails, or on clean, hard surfaces near the holes, will not endanger stock.

Calcium cyanide is more valuable in controlling this squirrel than any other native rodent in Oregon. It is a difficult squirrel to kill and many people are not successful with poison.

PIUTE GROUND SQUIRREL (*Citellus mollis*)*

Common names. Picket-pin; sage rat; gray sage rat; and many others.

Description. Easily confused with the Oregon ground squirrel but yet readily distinguished in the field by a little careful observation. The prevailing color tone of the Oregon ground squirrel is brown or grayish brown, while that of the Piute squirrel is silver gray. The Piute squirrel is a small animal with a pure white belly; when it is standing still or running, the white seems to extend on to the side. The Oregon squirrel has a short, reddish-brown tail with a black tip, while that of the Piute squirrel is the same color as that of the body. The flash of the white as the squirrel runs about is the best mark for the Piute squirrel, as the Oregon squirrel is nearly the same color below as on its back. The distinction is an important one and a person should carefully determine which species is to be dealt with before attempting to poison.

Distribution in Oregon. Found throughout a large district in Eastern Oregon, from Shaniko and Redmond southeast across the state. Crook, Jefferson, Deschutes, Harney, Lake, and Malheur counties contain the largest population of these squirrels, while southern Wasco and parts of other counties have some infestation.

*For convenience several closely related forms with similar habits are treated under this heading.

Life history and habits. This squirrel has the habit of sleeping through the hot summer months as well as through the winter, and when it retires to its underground sleeping den in July or August it is seen no more until the following spring. In territory inhabited and in points of numbers it probably ranks second to the Oregon squirrel, but in economic importance it should be placed about fourth.

Control. For some reason this species is not so easy to kill with strychnine as is the Oregon squirrel. It is necessary to use only 12 quarts of oats to the ounce of strychnine and add one tablespoonful of salt; otherwise the formula is the same as for the Douglas squirrel.

TOWNSEND GROUND SQUIRREL (*Citellus townsendi*)

The Townsend ground squirrel is a small sage rat, much like the Piute squirrel, and is found in very limited areas in Gilliam, Morrow, and Umatilla counties along the Columbia River. It can be controlled with the formula used for the Piute ground squirrel.

BLACK-TAILED JACK RABBIT (*Lepus californicus*)

Common name. Jack rabbit.

Description. A large, long-legged, long-eared rabbit, easily distinguished from the less common white-tailed jack rabbit by the color of the tail, and from the cottontail by its much larger size.

Distribution in Oregon. Covers the entire state, except along the coastal region. In Curry County a few are found to the Pacific. Abundant throughout Eastern Oregon; not abundant, but increasing in numbers and extending its range throughout the Willamette Valley.

Life history and habits. The damage resulting from the activities of rabbits is even more noticeable and spectacular than the work of the ground squirrels. In Eastern Oregon the rabbits retire during the spring to the vast sagebrush areas to breed. They are so widely scattered at this season that campaigns or drives against them have little chance of success, and, even if successful, the cost would be prohibitive. When the hot weather of the summer months dries up the feed in the sagebrush, the entire rabbit population moves into the cultivated districts or to the vicinity of springs where green feed is still available. By the time they reach the cultivated areas the rabbits are in straggling bands, often numbering into the hundreds. When one of these bands reaches a cultivated field the result is disastrous. Growing crops on entire fields are destroyed in a single night. These bands remain about the valleys, retiring into the sage during the day and returning to the crop areas at night to feed. When rabbits are numerous, well-worn trails are soon in evidence leading from the sage to favorite feeding spots. The fall rains, which renew the growth of grass in the desert, cause the rabbits to retire to the hills again, where they remain as long as the feed lasts or until heavy snows drive them out. When this happens they return and feed on the crowns of the alfalfa plants and on the stacks, often undermining the latter until they fall over.

In Western Oregon the jack rabbit is increasing in numbers, gradually extending its range as the land is cleared. A few are found north to the Columbia River bottoms, and in Polk, Marion, and Lane counties they have become abundant enough in some communities to cause considerable com-

plaint. How far this increase in numbers will continue, time alone can tell, but active effort against the rabbits is now necessary in these districts to prevent serious loss of truck crops.

Every few years an epizootic disease decimates the rabbit population and for several seasons the damage to crops is so small as to be unnoticed, but gradually increases as the rabbits again become more abundant. The most advantageous and logical time for combating the rabbits is when their numbers are at this low ebb. Killing a few at such a time is more effective than killing many hundreds at a time of abundance.

Control. The poison salt formula mentioned below has been found to be the most effective method of dealing with this pest in Western Oregon.

In Eastern Oregon great drives are often organized against the rabbits in which they are driven out of the sagebrush by long lines of men and either shot or driven into corrals and killed with clubs. These corrals are built of woven wire with wings often extending a mile on each side. The drive assembles some distance away, spreads out in fan shape and swings so as to drive the rabbits toward the fence and then along it into the corral.

Poisoning rabbits in Oregon depends largely on the seasonal conditions. Cold weather with much snow on the ground, which drives the rabbits to stacks and sheltered places where the vegetation projects through the snow, is the most favorable time. The rabbits from great areas are at this time concentrated in a few spots, take the poison readily, and can be killed at small cost. During the summer, when they are concentrated, large numbers can be killed with one or the other of the baits recommended below, the salt usually being the best in districts where no surface alkali is present.

In combating jack rabbits, feeding grounds or runways should be definitely located. Moist poisoned alfalfa leaves have often proved very effective in fall when natural feed has dried up. In localities where alfalfa is not raised, grain heads may be substituted. When rabbits are feeding on alfalfa crowns, after the last fall cutting or after pasturing, they readily take small handfuls of the leaves. Drags in plowed land will often make a runway in which the baits can be laid.

Poisoned alfalfa. Dissolve 1 ounce of strychnine sulphate in 1 gallon of hot water and sprinkle over 10 pounds of dry alfalfa leaves. Well-formed leaves free from dust or sticks should be used. They should be mixed thoroughly until all the moisture is absorbed. The poisoned leaves should be distributed in small handfuls, in lines a few feet apart, across portions of the field where observations show the rabbits to be feeding. Stock should be excluded.

Poisoned green alfalfa (summer poison).

Chopped green alfalfa.....	20 pounds
Strychnine (powdered alkaloid).....	1 ounce

Sift the strychnine over the alfalfa as it is being turned about so as to dust all the leaves. This bait should be placed along trails in small handfuls 200 yards or more back from the fields in which the rabbits are feeding. The poisoned alfalfa should be exposed in late afternoon but completed before dark for the rabbits start collecting near the fields about five o'clock in the evening and will feed on the fresh green leaves placed there for them. Baits placed too close to the fields will be passed over by the rabbits for their attention is centered on the growing green feed.

Poisoned rye heads. In localities where alfalfa is not raised, rye, emmer, or wheat heads are excellent mediums for poison, and frequently surpass alfalfa leaves in effectiveness,

particularly in dry-land sections. Where possible, grain heads for poisoning should be cut and cured when the grain is in the dough stage, as it is more palatable and attractive to rabbits when cut at this time. Dissolve 1 ounce of strychnine sulphate in 6 quarts of hot water and sprinkle over 10 pounds of grain heads. Mix thoroughly until all moisture is absorbed. The heads should be cut from the stem just below the last kernel and as little straw taken as possible.

Poisoned rye heads are a good bait to place along trails through sagebrush where the rabbits remain during the day, or may be feeding. Care should be used to protect any stock on such areas.

Cedar shingles.

Strychnine (powdered alkaloid).....	1 ounce
Bicarbonate of soda (baking soda).....	1 ounce
Flour	3 tablespoonfuls

Mix together dry, 1 ounce of powdered strychnine (alkaloid), 1 ounce of baking soda, and 3 tablespoonfuls of flour. Add a little cold water and stir thoroughly to a smooth, creamy paste. Split the shingles and dip the tops in the paste and stick them into the ground along the rabbit trails and runways. These baits can be easily taken up when they are no longer needed and all danger to stock is thereby eliminated. In many communities this poison has proved very effective.

Starch formula (rabbits). Dissolve 2 ounces (heaping tablespoonful) of gloss starch in a little cold water, pour into 2 or 3 quarts of boiling water, and stir until a thin starch paste is formed. Stir into the starch paste 1 ounce of strychnine (alkaloid) until a creamy paste, free from lumps, is formed. Mix the paste thoroughly over 10 pounds of grain heads until every head is coated. The heads should be cut from the stem just below the last kernel and as little straw taken as possible. Ten pounds of alfalfa leaves or chopped alfalfa may be used in place of grain heads in alfalfa districts.

Rabbit salt formula. Mix dry 2 ounces of fine salt, 2 ounces of alfalfa meal and 1 ounce of powdered strychnine alkaloid. A very satisfactory method of exposure is to bore about two-thirds of the way through a short 2" x 4" block with a 1½-inch bit and after dampening the salt-alfalfa bait with water place it in this container. The blocks should be placed in or near the rabbit trails or under bushes where they have their "forms" (hiding places during the day). Care should be taken in placing these blocks so that livestock will not reach them.

POCKET GOPHERS (Various species of the genus *Thomomys*)

Common names. Pocket gopher; ground rat.

Description. The various species of pocket gopher found in Oregon are all of varying shades of brown (except one black species), ranging from light brownish yellow to bluish brown and dark brown. They vary in size from the small mountain forms, 7 inches long including tail, to the huge Willamette Valley species, measuring 12 inches or more in length. The species all have heavy shoulders, and stout fore legs armed with strong claws for digging. The gnawing teeth are large and powerful and so set as to be used in digging. On each side of the head is a large fur-lined pouch which opens externally instead of into the mouth as in the case of the squirrel.

Distribution in Oregon. Pocket gophers of more than a dozen species or subspecies are found in practically every part of Oregon, but are most abundant and destructive in the cultivated valleys in the state.

Life history and habits. The burrows of pocket gophers honeycomb many alfalfa fields, and a large percentage of the stand of alfalfa is ruined by having the roots cut. As these ugly, solitary little beasts spend much of their life underground they often escape notice until the damage they do becomes very great. Their burrows also often cause breaks in irrigation ditches, costing hundreds of dollars in repair work, in addition to the crop loss occasioned by the flooding. Besides alfalfa and clover, root crops of all sorts, grain, and fruit trees are similarly injured by the gophers.

Each individual pocket gopher leads a solitary life except during the breeding season when seeking a mate. Four to six young are usually born to a litter, and some of the Oregon species breed twice a year. When the young are about half grown they leave home and start a burrow of their own. One animal may spend its entire life within one or two hundred yards of its birthplace, or may travel as much as a mile.

The loose mounds of earth thrown up mark the course of the tunnels. The entrances are kept plugged except when the occupant is actually working; this habit has developed as a means of protection against such natural enemies as snakes and weasels that can travel in such underground burrows. If an opening is made in the burrow the gopher soon returns to this point and plugs it again. In trapping advantage is taken of this habit.

Control. Any of the special pocket gopher traps on the market are good, and practically all of them work on one principle. For the big Willamette Valley species the traps commonly known as cinch traps are the most effective. To set these traps, it is only necessary to open the tunnel at a newly constructed mound, enlarge the opening to accommodate the trap if it is necessary, set the trap, and thrust it into the opening, leaving the hole open. In all these traps the trigger is set back between the jaws so that as the animal comes, pushing earth ahead of him to plug the opening, his body is between the jaws when the trigger is tripped by the load of earth. For small areas a few traps persistently used will do as well as, or better than, any other method of clearing the land of these animals. On large farms, however, trapping is too slow and expensive, and poisoning is usually resorted to.

WILLAMETTE VALLEY POCKET GOPHER (*Thomomys bulbivorous*)

The pocket gopher found in the Willamette Valley is the largest and most destructive species of this animal found in Oregon. They are very abundant in some sections and have omniverous appetites for field and garden crops. They are very easily killed by the use of the following bait:

10 pounds green clover tips
1 ounce strychnine (alkaloid)

Gather the clover tips fresh from the field at a time when the dew or moisture of any kind is gone. Wet tips will not mix satisfactorily. If gathered in the rain spread them out in a dry place and allow water to dry off. Avoid getting grass or any foreign material mixed with them as they are not good bait and will take up strychnine that should go on the clover tips, thus reducing the efficiency of the bait.

Mix by spreading the tips on a heavy paper or in a tight box so as to keep the strychnine from sifting through; then sprinkle the strychnine on from a pepper shaker and stir until thoroughly mixed. Do not mix more than can be put out in one day.

In alfalfa fields green alfalfa tips may be used in place of green clover tips in the above formula.

Placing the bait. Small handfuls of fresh tips may be inserted in the fresh runways by opening with a trowel or tile spade from the mounds until the main runway can be reached. The tips are then deposited in the main runway and a clod and loose earth placed over it, so that no earth will fall on the bait and light will be excluded.

WHITE-TOOTHED POCKET GOPHER (*Thomomys bottae leucodon*)

Rogue and Umpqua valleys. The pocket gopher found in this district is the white-toothed pocket gopher (*Thomomys bottae leucodon*), a much smaller animal than that found in the Willamette Valley. Its habits are essentially the same, but the clover bait is not particularly effective against it. The most effective bait is as follows:

1 ounce strychnine (alkaloid)
16 quarts vegetable bait

Dust over 16 quarts of sweet potatoes, carrots, or parsnips. These bait materials should be cut into pieces $\frac{1}{2}$ "x $\frac{3}{4}$ "x $1\frac{1}{2}$ " and thoroughly dusted with the above mixture. In irrigated sections baits can be readily placed by use of a gopher probe which can be made by almost any one. The essential thing is to have a sharp implement penetrate to the gopher runways. The ones used by the Survey are made of gas pipe drawn out to a point at one end with a T made of a short piece of pipe inserted to form a step about 12 inches above the point. A handle can then be soldered into the pipe at a convenient distance, forming a suitable implement at small cost. By probing around the fresh mounds the runways can soon be located and baits then dropped through the opening in the runway and the probe hole closed by use of clods or grass covered by earth.

Suitable and inexpensive pipe probes may be obtained through the U. S. Biological Survey Supply Depot, Pocatello, Idaho.

Eastern Oregon. There are several species of gophers found in Eastern Oregon, but all require about the same treatment. From The Dalles south through the sagebrush section, spreading east at least to Burns and the Malheur country we have *Thomomys quadratus*. In the Blue Mountain section the little brown pocket gopher (*Thomomys fuscus*) is found, and in the country around Ontario, the larger *Thomomys naevadensis townsendi*. These are the three principal pocket gophers of Eastern Oregon. All of them are quite readily poisoned by the bait given for the white-toothed pocket gopher of the Rogue River Valley.

WOODCHUCK (*Marmota flaviventris*)

Common names. Marmot; woodchuck; ground hog.

Description. The woodchuck is a rather large rodent with coarse hair, heavy body, short bushy tail, and powerful legs and feet armed with heavy claws suitable for digging. The general color is yellowish brown, with the yellow more pronounced beneath and rather obscured on the back by black and brown.

Distribution in Oregon. Found throughout that part of Oregon lying east of the Cascades, in rather local colonies and often abundant in restricted areas. It is increasingly abundant in Eastern Oregon and frequently comes in contact with cultivated lands where it does considerable damage. The rim rocks, full of holes and crevices, are favorite haunts in this district, and a person driving along a road near such a rim on a bright day can often count a dozen or more sunning themselves.

Life history and habit. The woodchuck is one of the larger rodents and has a short, heavy body, bushy tail, and powerful legs, developed for digging. It is rather sluggish and slow in its movements and, as it does not usually get far from its burrow, the damage it does is chiefly confined to fields lying close to the rocks where it makes its home. It seems to feed on almost any kind of cultivated crop but the chief complaint against it in Oregon comes from men who are trying to grow clover or alfalfa near its

colonies. The animals are hearty feeders and can destroy great quantities of forage in a short time.

Unlike some of the other rodent pests of the state, the woodchucks do not lay up any winter food supply but live through this season in a state of hibernation. They prepare for hibernation by feeding heavily and accumulating great stores of fat. Toward the end of the season they become sluggish and just before they den up for the winter can barely waddle about. The young, born early in spring, are naked and blind at first, but they grow rapidly and soon are seen playing around the entrance to their homes.

Control. Experience indicates that while woodchucks may be killed readily enough with strychnine, very few die outside the burrows and, therefore, unless a close watch is kept the conclusion will be drawn that the poison is not killing them. The following formula has been found most effective against these animals:

Formula 1.

Chopped green alfalfa.....15 pounds
Strychnine (powdered alkaloid).....1 ounce

Sift the strychnine over the alfalfa as it is being stirred. Green clover tips or green grain heads may be substituted if alfalfa is not available.

Formula 2.

Chopped green alfalfa.....15 pounds
Powdered strychnine (alkaloid).....1 ounce
Water1 quart
Karo syrup1 quart

Mix the water and karo and then stir in the strychnine. When thoroughly mixed, dip the alfalfa tips in small lots at a time in the mixture and squeeze out the excess moisture. Let dry a short time before exposure. This formula is a substitute for No. 1 in case it is not well accepted.

Great care should be taken in distributing this poison as it is necessary to put a considerable quantity in a place and it is dangerous to livestock. The best method is to pile it in handfuls in crevices in the rocks where stock cannot reach it. Pieces of carrot, apple, or sweet potato, with strychnine inserted in slits, are also often effective against these animals.

MOUNTAIN BEAVER (*Aplodontia rufa*)

Common names. Mountain beaver; mountain boomer; sewelle.

Description. The mountain beaver looks somewhat like a tailless muskrat. It is a heavy-bodied, short-legged rodent, from 12 to 13 inches long, with coarse fur of a general brownish color.

Distribution in Oregon. Found throughout the Coast and Cascade mountain ranges and along the foothills of both; more common in the northern counties, the principal districts from which damage has been reported being Multnomah, Lincoln, Tillamook, and Clackamas counties. It is primarily an inhabitant of the cool humid country between the summit of the Cascades and the Pacific Ocean.

Life history and habits. The mountain beaver is one of the most curious rodents found in the Northwest. While much like a tailless muskrat in appearance, it lacks the soft underfur which makes the skin of the muskrat so valuable.

It digs long, winding tunnels with several entrances, usually on hill-sides. It is only within the past few years, as man began to clear more

and more of the hillside lands, that the mountain beaver has appeared in the role of a crop pest. The animals seem to eat almost any garden and field crop. They usually cut the tops of various plants and pile bundles of them like tiny hay shocks at the entrance of their burrows; after these are dried they are carried into their underground storerooms. The young are born in April. The litters are small compared to most of our rodent pests, two or three being the usual number.

Control. The animals are easily captured, blundering into steel traps set in their runways without any attempt at concealment. Over small areas trapping can be employed. On large areas poisoning may be done and followed with trapping. The best poison bait known at this time is apple cut into about four slices or quarters and dusted with powdered strychnine in the proportion of 1 ounce of strychnine to 16 quarts of bait.

Before exposing the poisoned bait it is advisable to place clean pieces of apple in active runways and holes and leave for two or three days. Then replace these with the poisoned baits. There may be a few that will not take the baits; so where it is observed there is fresh activity following the poisoning, use traps.

Reinfestation of deserted runway systems has been observed to take place quickly, which indicates distant individual migration; entire colonies should therefore be treated at as nearly the same time as possible.

FIELD MICE (Various species of the genus *Microtus*)

Common names. Field mouse; meadow mouse.

Description. All mice of the genus *Microtus* are much alike. They have short legs and tails, comparatively long and coarse fur, heavy bodies, and short, rounded ears. All the common Oregon species are black or dark brown in color, and by casual observers are often mistaken for young moles.

Distribution in Oregon. Meadow mice prefer low-lying, fertile lands, grassy meadows, borders of swamps, and similar places. Some one of the various Oregon species will be found in such localities throughout the state.

Life history and habits. There are many species of native mice in Oregon other than those of the genus *Microtus*, but investigation of any report of mouse damage almost invariably reveals the field mouse as the culprit. These mice, when present in even moderate numbers, destroy much of the crops, while under favorable local conditions they often increase so rapidly as to be a menace to all growing vegetation. The animals are very prolific as they breed several times a year and produce litters of from six to ten each. At this rate, when conditions become exceptionally favorable their numbers increase enormously in a short time and appear so rapidly as to suggest an invasion. Reports of serious damage have come from such widely scattered localities as Wallowa, Malheur, and Polk counties. Sporadic damage also occurs at other points from time to time where conditions have become especially favorable to a rapid increase in the numbers of the rodent.

The damage done by field mice varies from peeling the bark from the roots of fruit trees and girdling them, usually under cover of snow or litter that may have accumulated about the base, to destruction of meadows and pasture grass. Meadow mice often congregate under the shocks of seed clover, as in the Willamette Valley, and cause considerable loss by hulling out the seed. Where mice are damaging orchards, clean cultivation and

clearing up the litter about the trees and along the fences will frequently be a remedy. In Western Oregon the mice use mole runways for highways and often destroy carrots, parsnips, and similar vegetables to which they gain access through the mole's workings. Consequently the mole is frequently blamed for damage of which he is the indirect but innocent cause.

Meadow mice have a host of natural enemies including hawks, owls, shrikes, crows; snakes, badgers, weasels, skunks, and similar animals and these should be protected where they are not doing damage sufficient to offset the good they do as mousers.

Control. In small areas trapping with guillotine traps is successful in reducing the numbers of these rodents. These traps should be baited with oatmeal and set near the holes or set in the runways without bait. The following poisons have also been found to be effective against these little pests:

Dry grain formula. Mix thoroughly 1 ounce of powdered strychnine alkaloid and 1 ounce of powdered glucose (dextrose or cerulose) or corn sugar. Put the mixture in a tin pepper-box and sift it gradually over 20 pounds of crushed oats in a tub, stirring the grain constantly so that the poison will be evenly distributed.

Dry mixing, as above described, has the advantage over the moist poisons in that the mixture may be kept any length of time without fermenting. If it is desired to use a bait that will keep well and withstand rough handling the following formula is recommended:

Wet Grain Formula.

Steamed rolled oats.....	12 pounds
Powdered strychnine alkaloid.....	1 ounce
Borax (20-Mule Team).....	2 ounces
Powdered glucose or corn sugar.....	1 ounce
Sodium sulphite.....	1 ounce
Wheat flour.....	1 ounce
Water	1 pint
Glycerine	1 tablespoonful

Dissolve the borax, sugar, and sodium sulphite in the cold water. Mix the strychnine, flour, and paste with a little of the cold solution. Then add all of the cold solution and bring to a boil over heat, stirring constantly to prevent sticking. When a smooth paste is obtained stir in the glycerine. Put the grain in a tub and after pouring the hot mixture over it, mix thoroughly.

The poisoned grain prepared by either of the foregoing formulas is to be distributed over the infested area, not more than a teaspoonful at a place, care being taken to put it in mouse runs and at entrances of burrows. To avoid destroying birds it should, whenever possible, be placed under such shelters as piles of weeds, straw, brush, or other litter, or under boards.

In infested fruit orchards having a cover crop it is advisable to place, one month or more before it is planned to expose the poisoned grain, small piles of weeds, straw, or hay, or an old cement sack, or a wide board under each tree where mice are present. One to three to the tree should be distributed at equal distances about it and three feet or more away from it. This will give the mice time to concentrate and establish nests and runways under the shelters. The bait can be placed under these where birds and animals other than the mice will not find it. It will not be necessary

to place poison in any other locations in the orchard except near the fences, where concentration stations should be established.

For poisoning mice on small areas, as lawns, gardens, seedbeds, vegetable pits, and the like, a convenient bait is ordinary rolled oats. This may be prepared as follows: Dissolve $\frac{1}{8}$ ounce of strychnine in 1 pint of boiling water and pour it over as much oatmeal (about 2 pounds) as it will wet. Mix until all the grain is moistened. Put it out, a teaspoonful at a place, under shelter of weed and brush piles or wide boards.

The formulas for poisons for field mice given above will aid in controlling house mice where they are troublesome. Another effective poison is made of dried bread crumbs, corn sugar, ground bacon and strychnine alkaloid. Let a few slices of bread dry without molding. Run these through the meat chopper, also the bacon. Into this mixture put the sugar and then the strychnine. The formula is as follows:

Ground dried bread crumbs.....	2 pounds
Ground bacon	2 ounces
Corn or other finely ground sugar.....	2 ounces
Strychnine alkaloid	$\frac{1}{8}$ ounce

Expose where the mice run. This is a good formula for business houses as well as residences.

The small guillotine mouse traps are very effective and the persistent use of a few will clear any ordinary dwelling of mice in a short time.

BROWN RAT (*Rattus norvegicus*)

Common names. Brown rat; house rat; wharf rat.

Description. The brown rat is so well known that it hardly needs to be described. It is a large rodent, averaging 16 inches in length, with coarse brown fur, rather prominent ears, and a long naked tail.

Distribution in Oregon. While some of the more remote districts of the state do not as yet have the rat to deal with, it is found in the great majority of the cities and towns as well as on most of the farms.

Life history and habits. The house rat has been called the most destructive animal in the world, and no doubt it deserves this disreputable distinction. While individual animals of many other species exceed a single rat in destructiveness, these rats, by their great numbers, more than make up the difference.

Accustomed for centuries to living about human habitations, the rat has developed an astonishing ability to adapt itself to all conditions and is found alike in rural and urban districts.

It has been estimated that the annual loss in the United States due to depredations by rats is more than \$200,000,000, a greater loss by far than that caused by any one native rodent. The people of Oregon contribute their share of the annual toll exacted by the rat, the loss being particularly great in the Willamette Valley, and more and more inquiries reach the Biological Survey every month as to methods of dealing with this pest.

In addition to this heavy economic loss, the rats are filthy in their living habits and the most dangerous of wild animals to man's health because of the communicable diseases they carry and spread among human beings, such as bubonic plague, typhus fever, Weil's disease, and trichinosis.

As the brown rat begins breeding at three to four months of age and where food is abundant breeds from six to ten times a year, averaging in

some parts of the United States ten to the litter, the rate of increase is very rapid, once it secures a foothold.

Control. Dealing with rats on the farm is particularly difficult because of the abundant food supply usually available. As far as possible, buildings, particularly granaries, should be rat-proofed. The cheapest way usually is elevating these buildings about 18 inches from the ground, with sheets of tin or other metal placed on top of the supporting posts. Various kinds of traps are successfully used against rats. The baits must be changed from time to time and care should be used in setting them. One can learn only by experience what kind of traps to use. In one case, after failing entirely with wire cage traps and catching only a few rats with the guillotine traps, the writer succeeded in catching a considerable number with ordinary steel traps set in their runways and carefully concealed.

In order to fight a rat infestation no known means can be neglected and poison should be used wherever possible. Fortunately, after considerable investigation, a method of preparing red squill in standard strengths has been developed by the Biological Survey and it is now able to recommend this preparation in preference to previous methods used.

Red squill because of certain peculiar properties is deadly to rats and mice and relatively harmless to cats, dogs, poultry, and farm animals. For this reason it is safer to use about farm buildings than any poison previously used. However, it is well to keep it away from farm animals as much as possible, as it does no good as a rat bait if destroyed, and it might possibly cause some illness among animals eating it.

The following directions for the preparation and use of red squill baits have been issued by the Biological Survey in Leaflet 65:

"In using powdered red squill to destroy rats the choice of bait is most important. The goal is to destroy every rat at one application; otherwise survivors become suspicious and are hard to dispose of later. This requires an ample supply of baits that will appeal strongly to appetites of the rats. Unfortunately, the tastes of rats, like those of human beings, vary, so that it is not possible to appeal to the palate of every rat with a single food. In order to obtain the best results several kinds of bait should be exposed at the same time, so that every rat will have a choice of foods. The following directions for preparing baits are the result of long experience of specialists in rat control:

"Fish.—Fresh fish ground in a meat chopper is one of the most attractive baits for rats. If fresh fish is not available, a cheap grade of canned salmon, canned mackerel, or sardines in oil may be used. Mix 1 ounce of powdered red squill with a little water to form a thin paste free of lumps, add to 1 pound of fish, and mix thoroughly.

"Meat.—Mix 1 ounce of powdered red squill with a little water to form a thin paste free of lumps, and add to 1 pound of fresh ground meat and mix thoroughly. Hamburg steak is most commonly used.

"Cereals.—Mix together dry 1 ounce of powdered red squill and 1 pound of cereal meal, such as oatmeal, graham flour, corn meal, or bran. Add 1 pint of sweet milk or water and stir to a mushy consistency.

"Fruits and vegetables.—Using a pepper shaker, dust powdered red squill over thin slices of fresh fruit or vegetables and stir or shake as the powder is applied to insure even distribution. A small muskmellon, for example, should be cut into about 16 slices and each slice cut into 3 sections. This will require 1 ounce of powdered squill and will make 48 baits. Three medium-sized tomatoes or three bananas, each cut into about 16 sections, may be similarly used for each ounce of squill powder.

"One of the best basic bait materials is bread crumbs obtained by grinding dried slices of bread in a meat chopper. Several formulas are suggested:

Formula 1.

Ground dried bread crumbs.....	7 ounces
Ground bacon (back fat strips).....	2 ounces
Powdered red squill.....	1 ounce

Formula 2.

Ground dried bread crumbs.....	7 ounces
Ground fresh fish (preferably halibut).....	2 ounces
Powdered red squill.....	1 ounce

Formula 3.

Hamburger	8 ounces
Corn meal or bread crumbs.....	1 ounce
Powdered red squill.....	1 ounce

Formula 4.

Breakfast rolled oats.....	4½ ounces
Bread crumbs	2¼ ounces
Ground bacon (back fat strips).....	2¼ ounces
Powdered red squill.....	1 ounce

"To prepare any of these formulas mix thoroughly the bait materials first and then stir in the powdered red squill.

"Exposing baits. So far as possible all sources of food for rats should be removed before exposing squill baits. Garbage cans should be covered, food hoppers emptied, and all accessible food put into tight containers. The freshly prepared bait should be exposed late in the afternoon in order that it may be reasonably fresh when the rats commence feeding. Every part of the premises where rats are likely to be present should be thoroughly treated, particularly those places in which rats have been accustomed to feed. A large number of small baits is more effective than a few large baits. Put out the bait in quarter-teaspoon pieces, or in quantities about the size of the average marble. Place them consecutively, first a meat bait, then a fish bait, then a cereal bait, then meat, and so on. In poultry pens it is best to expose the baits in the feeding troughs while the chickens are shut up; or the baits may be exposed behind boxes or boards so leaned against the wall to form a runway for rats that the chickens can not reach them.

"Baits should be left out for three days, after which all those uneaten should be collected and destroyed. If any sign of live rats is noted after one week, wait two additional weeks and then prebait for several nights before exposing more red-squill bait. Prebaiting is important if an unsuccessful effort has previously been made to destroy rats. This consists of exposing fresh untreated foods prepared in precisely the same way as the squill baits except that the squill is omitted. These clean baits should be put out at 2-day intervals, and all not consumed should be destroyed the morning following their exposure until the suspicion of the rats has been

overcome and they take the baits freely. When this occurs, substitute the squill baits and a complete clean-up should result."

Calcium cyanide. Cyanide dust, used in some of the various dusters on the market, has proved a very valuable supplement to poisoning operations in controlling rats in any area where they are living in underground burrows such as around city dumps, waterfronts, and barnyards. This dust is pumped into the burrows until a killing concentration is obtained and is a very valuable means of reducing a large rat population on a given area. Used together with poison it will result in a practical clean-up in almost any district. Follow absolutely the directions printed on the cans, as it is a dangerous material if handled carelessly.

No poison, so far as known, will dry up carcasses and prevent decay and bad smells, nor will any of the usual poisons drive the rats from buildings to die. The brown rat, however, usually has a burrow somewhere and a slow-acting poison, such as barium carbonate, will usually allow a poisoned animal to reach its home. Around farm buildings, particularly, the rats have underground retreats and are not apt to smell enough to cause much annoyance.*

Hawks, owls, skunks, snakes, and similar animals prey on rats, and excepting those individuals that develop a taste for poultry, all these species should be protected.

KANGAROO RAT (*Dipodomys columbianus*)

Common name. Kangaroo rat.

Description. A small rodent easily known by its kangaroo-like form, having small front legs, long powerful hind legs, and a long, furred tail. The fur is soft and silky, soft grayish brown in color above and white below.

Distribution in Oregon. Found in suitable localities throughout the semiarid section east of the Cascades, and in parts of the Rogue River Valley.

Life history and habits. Kangaroo rats live in scattered colonies where suitable conditions are found. In Oregon at least, they seem to prefer sandy soil, where they live in burrows dug by themselves. As they are strictly nocturnal, few people ever see them, although when a colony becomes established near a grain field the evidence of their work is soon very plain. In addition to grain, they destroy all kinds of garden and field crops. They do not hibernate and, consequently, they store large supplies for winter uses.

Control. The poison recommended for the Piute ground squirrel is effective against kangaroo rats whenever they become numerous enough to do any damage. Trapping also may be resorted to successfully with guillotine rat traps, but such a method of control is usually too slow to be practical.

PORCUPINE (*Erethizon epixanthum*)

Description. The porcupine is a rather large, clumsy, and stupid animal. It has quills on the back and tail which come out very easily, and there are few people who live in the country frequented by this animal who do not know this. It lives largely upon the bark and buds of native trees and feeds also upon fruit trees, bushes, and field crops. It is slow moving, sluggish, and easily killed when found.

*Full information regarding the rat-proofing of buildings, and other measures looking toward permanent relief from the rat pest, are contained in Farmers' Bulletin 1533 prepared by the Biological Survey, entitled "Rat Control," copies of which may be obtained on request addressed to Division of Publications, United States Department of Agriculture, Washington, D. C.

Distribution in Oregon. This animal is connected quite closely with the yellow pine areas, being found throughout Eastern Oregon wherever there is sufficient timber, and in the southern part on the western slope of the Cascades. In northern Oregon it is a rare animal west of the summit of the Cascades, although occasionally taken in the Willamette Valley.

Porcupines in the past two or three years have become pests of considerable importance to farmers. Complaints from widely scattered locations of damage to alfalfa, fruit trees, and berry bushes have been received. These places are usually found to be adjoining timbered areas from which the porcupines can easily travel into the cultivated sections.

This is an animal very much on the increase in Oregon. As already stated, complaints are being received in a constantly increasing stream, of damage to timber interests and to farmers.

Control. These animals are exceedingly fond of salt, and good control has been obtained in several sections by the use of poisoned salt mixed as follows:

1 ounce of strychnine (alkaloid)
12 ounces very fine table salt

Thoroughly mix and expose in the dens among rocks frequented by porcupines. Extreme care should be taken in placing this material so that stock and wild animals cannot get to it. Mixed in this proportion, it is exceedingly deadly and will kill stock just as quickly as porcupines.

Where the porcupines are using trees in which to rest rather than dens in rock piles or lava flows, they can be poisoned by placing the bait in blocks nailed to the trunks of trees above a limb on which they can sit and feed on the salt mixture. The block is made by cutting up a 2" x 4" into 4" lengths. With a 1" bit three holes are bored in one edge of the block one inch deep as close together as possible. These holes are cleaned out so as to form a good slot. Bore three nail holes through the block, one in each of the upper corners and one below the slot. This slot is filled with bait material made as follows:

1 ounce of strychnine (alkaloid)
13 ounces of very fine table salt
3 ounces of snowdrift or crisco.

Mix the strychnine and salt and then stir the snowdrift (soft) in thoroughly.

Select those trees that are being used fairly regularly as can be seen by the droppings beneath the tree. Nail the block to the trunk 8" to 10" above a suitable limb and high enough above the ground to prevent stock and game animals from reaching it.

Where the porcupines are using the rest trees, systematic hunting with rifles is an effective method of reducing the number of animals.

OREGON MOLE (*Scapanus townsendi*)

Common name. Mole.

Description. The mole is a small black animal. Its velvety fur; long, pointed, naked nose; naked tail; and powerful, shovel-like fore feet are the points first noticed by a person seeing it for the first time. Its eyes and ears are little developed and are hard to locate in many individuals. The fore legs are heavily muscled and armed with powerful claws, being well fitted for their task of digging through the soil.

Distribution in Oregon. Found throughout Western Oregon from the Columbia River to the California line, and from the Cascades to the Coast.

Life history and habits. The common mole of Western Oregon is one of the largest of North American moles. The animals spend almost their entire life underground although they come out and travel on the surface occasionally at night. They are very destructive to lawns and gardens,

throwing up unsightly mounds and covering the growing vegetation with earth. Such mounds of earth thrown up as a result of their activities are unmistakable evidence of their presence, and can easily be distinguished from those of the pocket gopher, another burrowing animal. Those of the mole are more conical in shape and are built up by successive plugs of earth shoved up through the center of the mound like a miniature volcano. The pocket gopher mound is low and flat, built up of armfuls of earth shoved out of the mouth of the burrow, usually to one side of the opening.

Control. As yet no method of successfully poisoning the mole has been worked out, for the mole is not a rodent but lives chiefly on earth worms, insects, and other live animal forms. Poison baits exposed in its runways by members of the Biological Survey have usually been covered with earth or eaten by field mice using the runways.

Extensive experiments looking to the control of moles by the use of cyanide dust have been carried on by the Biological Survey in Oregon and Washington, so far with almost entirely negative results. There may be some possibilities in the use of this material, but at present it cannot be recommended for the control of moles or gophers.

Trapping has proved to be the only successful way of dealing with these animals, and has one advantage over trapping for any of the other small mammal pests, in that the skins, if properly prepared, will bring enough to pay for the time and trouble of trapping and skinning.

It seldom pays to set traps in the shallow surface runways made by the mole in soft ground. The animal almost literally swims through such ground searching for food and seldom uses such a runway again. The deeper runways, however, are used as highways more or less by several moles, and reliable farmers have reported catching as many as fifty moles through the season on one such highway.

Two types of traps used successfully against moles are the scissors-jaw trap and the diamond-jaw trap, both of which are very efficient when properly set. Both types depend on a trigger sprung when the mole follows its natural instinct of burrowing through an obstruction of loose earth placed in the runway. These traps are shown on the next page.

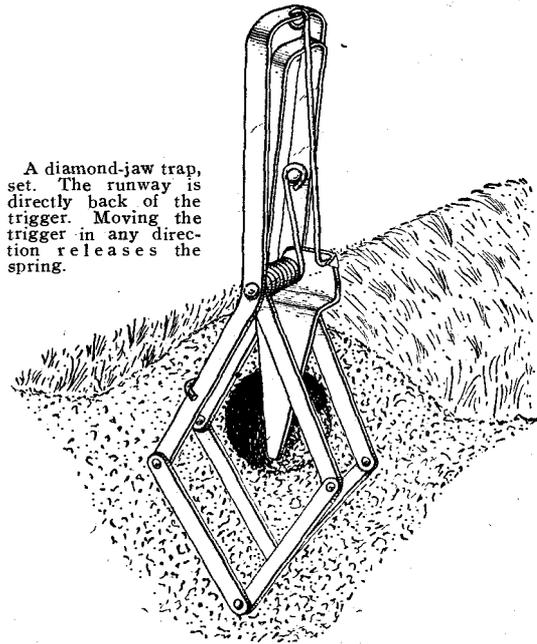
A good strong garden trowel is the best tool to use in setting these traps. Make the opening to the deep runway by removing the mound and probing with a stick to find the short tunnel leading to the main runway. When this is located, break into it, taking care to make the opening thus made with loose earth and set the trap in this, taking care to align it so that the jaws of the scissors trap straddle the course of the runway, or those of the choker trap encircle it. Pack the earth firmly under the trigger so that the mole will not be able to work through the trap without springing it. In gravel soil the choker trap works better than the scissors-jaw, because it is not clogged so easily with gravel, stones, or trash.

The skins of the moles should be saved as they find a ready sale to most furriers. Skins should be cured flat and stretched as nearly the same shape as possible. The animal should be skinned by slitting from the chin to the tail, peeling out the body, and cutting the tail and legs off far enough down not to cut any of the fur. Pin the skins on boards in an oval shape and dry thoroughly in the shade. It has been found that the skin of the Oregon mole is superior to that of the European mole and it usually brings a fair price.*

*Complete bulletin, "Farmers' Bulletin 1247," on the subject of moles is issued by the Biological Survey, United States Department of Agriculture.



A scissors-jaw trap, set at the proper depth in relation to mole tunnel, the jaws straddling the burrow, a ridge of firmly packed soil in place under the trigger, and the set ready to be filled in with loose soil.



A diamond-jaw trap, set. The runway is directly back of the trigger. Moving the trigger in any direction releases the spring.