Controlling Rodents and Other Small Animal Pests in Oregon

By Ira N. Gabrielson
Revised by G. H. Hansen

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Controlling RODENTS and Other Small Animal Pests in Oregon

By
IRA N. GABRIELSON

Revised by
G. H. HANSEN

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 other state has a greater variety of these pests and, in proportion to the value of the crops produced, probably no other 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.

For many years the Fish and Wildlife Service, one of the bureaus of the United States Department of the Interior, has been perfecting practical methods of controlling wild-animal pests. These methods have been developed by investigations and experiments conducted throughout the country. The following discussion of methods of control of such pests in Oregon is based on the information gathered by the Fish and Wildlife Service through wide correspondence, study, and experimentation, in cooperation with state agencies and with individuals.

Ground Squirrels

The damage done by ground squirrels probably stands out more conspicuously than that of other groups because of the wide distribution and general abundance of the rodents and their habits 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 do otherwise. Their destructiveness varies from a very small percentage to occasionally 100% of the crop on the land.

All the many methods that have been used in combating ground squirrels are more or less effective. Trapping, shooting, gassing, and poisoning are employed commonly. When the squirrels are excessively abundant 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 used almost universally and is found to be more reliable and cheaper for the results obtained than any other poison tried. Ready to use bait generally is available at reasonable prices at local feed stores.

The poison is mixed on barley or oats, in different standard strengths depending on the species of squirrels to be dealt with. A teaspoon to a tablespoonful is the usual bait. The bait should be broadcast on clean, hard surfaces 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. 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 usually is 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 seen readily 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 on factors not understood thoroughly. One should not, therefore, condemn any poison that results in few squirrels dying above ground, but rather look for results in the decrease of the squirrel population, and reduced damage.

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 theory 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 Fish and Wildlife Service, "consumed 125 kernels of poisoned barley in a period of 24 hours with no trace of ill effects. Thus, without injury to itself, this bird had eaten enough strychnine to kill 12 ground squirrels, each three or more times greater in bulk than the bird. When it is considered that ordinary strychnine is toxic in 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 100 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 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 are ranging over the ground, however, 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 places inaccessible to turkeys. One plan used successfully by many farmers is to build boxes about 18 inches long of 1- x 4-inch material and close them at one end. These boxes 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 the boxes to seek the bait without 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. One good index is to wait a month or six weeks after you have seen the first squirrels or until the young appear at the mouth of the burrow. The period generally recommended is May 1 until July 1 except that squirrels in western Oregon can be poisoned as late as they are out in the fall. 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 conducted effectively. In the higher mountain altitudes this period for effective control work is much later.

Gas and gas cartridges

Gas cartridges found on the market and calcium cyanide are valuable tools in cleaning up ground squirrel infestations where the animals refuse to take bait, or in areas where it is unsafe to use bait. The gas cartridges or cyanide should be introduced into the main burrow entrance. Other entrances into the runway should be closed so the gas will not escape.

At present prices it will cost more to treat a given area with gas than with bait.

Douglas Ground Squirrel

(Citellus beechei douglasi)

The Douglas ground squirrel, sometimes called the gray digger, is the largest ground squirrel in Oregon. Generally brownish, it is 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 30 or 40 feet into the oak trees. It usually can 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.

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. These ground squirrels are also found in southern Klamath County on the east side of the Cascades, and 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, Coos, Klamath, 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 animals prefer the open glades, rocky or bushy hillsides, fence rows, cut over land 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 usually are 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 Fish and Wildlife Service recommends the following formula as most effective throughout the season:

- Barley (clean grain) ........................................... 20 quarts
- Strychnine (powdered alkaloid) ......................... 1 ounce
- Bicarbonate of soda (baking soda) ....................... 1 ounce
- Heavy corn syrup ........................................ ¼ pint
- Thin starch paste .......................................... ¼ 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 \( \frac{3}{4} \) 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 \( \frac{3}{4} \) pint of boiling water. Boil and stir constantly until a clear thin paste is formed.) Stir in \( \frac{1}{4} \) 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 20 quarts of good, cleaned barley and mix well so that each grain is coated.

Persons handling this material should remember that it is extremely dangerous to all kinds of livestock as well as to human beings. All receptacles should be scalded and scrubbed carefully 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*

Among the other common names for the Oregon ground squirrel are sage rat, ground squirrel, and picket-pin gopher. It is a medium-sized, short-tailed squirrel, from 10 to 12 inches long; general brownish-gray color; tail rufous in color.

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. 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 sluggishness, 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 that 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 fields 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.

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 killed readily. 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 Fish and Wildlife Service uses exactly the same formula as for the Douglas ground squirrel except that 12 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, steam rolled grain should be used. In recent years bait prepared at Pocatello Supply Depot has been tinted with yellow food coloring. It has been found that birds seldom take artificially colored grain. 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.

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.
Columbian Ground Squirrel

(Citellus columbianus ruficandus)

The Columbian ground squirrel is also known as the ground squirrel, red squirrel, and red digger. 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.

This squirrel is found throughout the Blue Mountain 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. It sticks more or less closely to the timber and thus is found throughout and about the edges of the Wallowa, Malheur, Whitman, and Umatilla National forests.

Life history and habits

The Columbian ground 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 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.

Mix 1 tablespoonful of gloss starch in $\frac{1}{4}$ teacup of cold water, and stir into 1 pint of boiling water to make a thin, clear paste. Add 1 tablespoonful of salt to starch paste. Mix 1 ounce of powdered strychnine (alkaloid) with 1 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-syrup and 1 tablespoonful of glycerine. 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 (1 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 an other native rodent in Oregon. This is a difficult squirrel to kill and many people are not successful with poison.

Piute Ground Squirrel

*(Citellus mollis)*

Other common names for this squirrel are picket-pin, sage rat, gray sage rat, and many more. It is 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 sides. The Oregon squirrel has a short, reddish-brown tail with a black tip, while that of the Piute squirrel is the same color.

*For convenience several closely related forms with similar habits are treated under this heading.*
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 determine carefully which species is to be dealt with before attempting to poison. 

The Piute ground squirrel is 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.

**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 point of numbers it probably ranks second to the Oregon squirrel.

**Control**

It is necessary to use only 12 quarts of oats to the ounce of strychnine and add 1 tablespoonful of salt; otherwise the formula is the same as for the Oregon ground squirrel.

**Black-Tailed Jack Rabbit**

* (Lepus californicus)  

The black-tailed jack rabbit is 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. The black-tailed jack 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 scattered so widely 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 of hay, 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 complaint. 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**

In eastern Oregon great drives sometimes are 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 stack 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 formula usually being the best in districts where no surface alkali is present.

In combating jack rabbits, feeding grounds or runways should be located definitely. Moist, poisoned alfalfa leaves often have 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 Dry Alfalfa.** Mix 1 ounce of strychnine (alkaloid) 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.** Green alfalfa is frequently used as a summer poison. Mix 1 ounce powdered strychnine (alkaloid) with 20 pounds of chopped green alfalfa. 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 5 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. Mix 1 ounce of strychnine (alkaloid) 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.

**Starch formula.** 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 pounds of fine salt, 2 pounds of alfalfa meal, and 1 ounce of strychnine (powdered alkaloid). A very satisfactory method of exposure is to bore about two-thirds of the way through a short 2- x 4-inch 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 the blocks so that livestock will not reach them.

**Woodchuck**  
*(Marmota flaviventris)*

The woodchuck is also commonly known as marmot, ground hog, or rock chuck. It is a rather large rodent, about 24 inches long, 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.

The woodchuck is found throughout that part of Oregon lying east of the Cascades, in rather local colonies and is 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 habits

The woodchuck is one of the larger rodents and has a short, heavy body and powerful legs, developed for digging. It is rather sluggish and slow in its movements and, as it usually does not get far from its burrow, the damage it does is confined chiefly 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, 4 to 6 in number, are born early in spring, and are naked and blind at first. 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 formulas have been found most effective against these animals:

Form 1.

<table>
<thead>
<tr>
<th>Chopped green alfalfa</th>
<th>15 pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strychnine (powdered alkaloid)</td>
<td>1 ounce</td>
</tr>
</tbody>
</table>

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

Form 2.

<table>
<thead>
<tr>
<th>Chopped green alfalfa</th>
<th>15 pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strychnine (powdered alkaloid)</td>
<td>1 ounce</td>
</tr>
<tr>
<td>Water</td>
<td>1 quart</td>
</tr>
<tr>
<td>Heavy corn sirup</td>
<td>1 quart</td>
</tr>
</tbody>
</table>

Mix the water and heavy corn sirup 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 the latter is not well accepted.
Great care should be taken in distributing this poison as it is necessary to put a considerable quantity, dangerous to livestock, in a place. 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 dusted with strychnine also are effective against these animals.

**Mountain Beaver**  
*(Aplodontia rufa)*

The mountain beaver is also known as the mountain boomer or sewellel. It looks somewhat like a tailless muskrat, being a heavy-bodied, short-legged rodent, from 12 to 13 inches long, with coarse fur of a general brownish color.

The beaver is found throughout the Coast and Cascade mountain ranges and along the foothills of both. It is 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 that makes the skin of the muskrat so valuable.

It digs long, winding tunnels with several entrances, usually on hillsides. 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 along 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 captured easily, 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 quartered, 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 apples 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.

The recommended winter bait for mountain baver consists of sword fern fronds broken into pieces about 10 inches long and dusted with strychnine (alkaloid) at the rate of 1 ounce of strych-nine (alkaloid) to 10 pounds of fern fronds.

About 3 of these pieces should be placed back in the active burrows where they will retain their lethal qualities for as long as 5 months. The active portions of the burrows are indicated by food piles. These food piles should be removed when the bait is placed.

Field Mice
(Various species of the genus *Microtus*)

All mice of the genus *Microtus* are much alike. Their common names are field mouse and meadow mouse. 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 often are mistaken for young moles.

These 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 6 to 10 each. At this rate, when conditions become excep-
tionally 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 localities in Klamath, Hood River, Umatilla, Yamhill, Clackamas, Marion, 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 frequently will 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 blamed frequently 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**

- **strychnine.** Meadow mice were at one time controlled with the use of strychnine bait. Repeated use of strychnine apparently has developed races of these mice that refuse this poison. This is true especially in orchard districts. Better success usually can be attained using zinc phosphide baits.

- **Zinc phosphide.** A poisoned bait that may be used in orchards or on small areas is zinc phosphide on apple bait, and is prepared as follows: cut 1 quart of apples of a firm variety into half-inch cubes without peeling or coring. Put these in an enamel pan and sift over them 1 teaspoonful (1.5 grams) of the blended zinc phosphide rodenticide, stirring constantly with a paddle to insure even distribution. The rodenticide is made by mixing thoroughly two-thirds ounce of finely pulverized zinc phosphide and one-third ounce of pulverized magnesium carbonate. (This blended rodenticide may be obtained from the Pocatello Supply Depot, Pocatello, Idaho.) Put out one or two pieces of apple in the runways of field mice under shelter of weeds, grass, boards, or other cover.
In seasons or areas where there is considerable rainy weather, the following formula is recommended. It may be used also in dry areas:

- White feed wheat ........................................ 9 pounds 12 ounces
- Amber petroleum jelly .................................. 1 ounce
- Mineral oil .................................................. 1 ounce
- Zinc phosphide ........................................... 1.6 ounces

To prepare, warm the mineral oil and petroleum jelly together until they are fluid but not hot. Add the zinc phosphide and stir briskly to suspend the poison. Pour the suspension over the wheat in an open box or mechanical mixer and mix thoroughly until the kernels are evenly coated. Ready-to-use baits containing zinc phosphide are available in many stores that sell feed, seed, or farm supplies.

This should be broadcast in the runway systems and around the mouths of the tunnels made by the mice. It also may be placed in 2 tablespoonful amounts in bait stations made by rolling 9- x 13-inch strips of tar paper into 2-inch rolls. These can be fastened with rubber bands or paper clips and placed in the runway systems.

During the past few years successful field mouse control by the use of some of the newer insecticides, notably toxaphene and endrin, has been reported. Toxaphene has been used in a few areas in Oregon though no extensive field testing has been done with this chemical for field mouse control. Costs usually range up to $10 per acre.

Spraying cover crops with the insecticide endrin is reported to give good mouse control in orchards in the state of Washington. However, for proper treatment, costs of between $11.25 and $13.12 per acre are reported for spray material alone. Costs for baiting with zinc phosphide treated grain usually run less than one-fourth that amount and in Oregon have generally been quite effective in controlling field mice.

In addition, the hazards of using such potent insecticides for mouse control would appear to be high since Washington recommends using the same precautions for endrin that you would exercise when spraying with parathion or TEPP. No field trials with this chemical have been carried out in Oregon.

Orchard sanitation is very important since mice are associated with weed and grass cover. A clean, cultivated orchard with clean fence rows seldom is troubled with mouse infestation. Sodded orchards should be mowed closely and the cuttings should be removed late in the summer. Mulching with hay or straw around orchard trees is not recommended since this affords excellent mouse cover right up to the tree.
CONTROLLING RODENTS IN OREGON

House Mice

(Mus musculus musculus)

The formulas for poisons for field mice 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 sugar or powdered sugar ..................................... 2 ounces
Strychnine (alkaloid) .................................................... ½ ounce

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

Yellow cornmeal and rolled oats .................................... 19 pounds
Warfarin ........................................................................ 1 pound

Should be exposed in bait boxes along runways frequented by the mice. Bait should be kept in the stations permanently.

Warfarin (the trade name of a chemical) reduces the ability of the blood to clot and the animal dies of internal hemorrhage after having eaten the bait for a period of several days. This material is very safe to use and is being recommended over all other lethal agents for home control of rats and mice.

The small, guillotine mousetraps also are effective and the persistent use of a few will clear any ordinary dwelling of mice in a short time.

Brown Rat

(Rattus norvegicus)

The brown rat also called house rat or wharf 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.

While some of the more remote districts of the state as yet do not 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 Fish and Wildlife Service every month as to methods of dealing with the 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 3 to 4 months of age and, where food is abundant, breeds from 6 to 10 times a year averaging in some parts of the United States 10 to the litter, the rate of increase is very rapid once a foothold is secured.

**Control**

Dealing with rats on the farm is difficult particularly 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 the supporting posts. Various kinds of traps are used successfully against rats. The baits must be changed from time to time and care should be used in setting the traps. 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 Fish and Wildlife Service and it is now able to recommend this preparation in preference to previous methods used.

Red squill has the peculiar property of being deadly to rats and mice and relatively harmless to domestic animals and poultry. Care
should be exercised in putting the bait out since bait destroyed by animals other than rats and mice is wasted. It may cause some illness in certain domestic animals if ingested in large enough quantities.

Enough bait should be placed at one time to destroy all the rats and mice found on the premises.

Since rats' tastes vary, it is best to mix a variety of baits or a combination bait that will appeal to them all. The following formulas have been found to be very effective:

**FORMULA 1.**

- Raw pork back fat ........................................ 2 pounds
- Poultry grade rolled oats .................................. 7 pounds
- Bacon grease .................................................. \( \frac{1}{4} \) pint
- Powdered red squill ........................................... 1 pound

**FORMULA 2.**

- Fresh fish or canned salmon ................................ 2 pounds
- Poultry grade rolled oats .................................. 7 pounds
- Powdered red squill ........................................... 1 pound

**FORMULA 3.**

- Beef suet ...................................................... 2 pounds
- Carrots .......................................................... 2 pounds
- Rolled oats ...................................................... 5 pounds
- Powdered red squill ........................................... 1 pound

To prepare any of these baits mix the materials together and then run the mixture through a coarse screened food chopper. Expose baits in rat runways. After 3 days clean up all old baits.

Another material used to control rats is the anticoagulant material Warfarin. Warfarin baits should be mixed 1 part Warfarin to 19 parts other material. One good formula includes cornmeal as follows:

- Yellow cornmeal and rolled oats ............................. 19 pounds
- Warfarin powder ............................................. 1 pound

Five percent sugar can be added to this mixture to increase acceptability of it. If the bait is dusty 5 percent mineral or cooking oil can be added.

Warfarin baits should be exposed in permanent bait stations in rat runways. The baits should be left out year round so that any rats migrating through will be killed.

**CALCIUM CYANIDE.** Cyanide dust, used in some of the various dusters on the market, has proved a 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 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 red squill or Warfarin will allow a poisoned animal to reach its home. Around farm building, particularly, the rats have underground retreats and are not apt to smell enough to cause much annoyance.¹

**Kangaroo Rat**

*(Dipodomys columbianus)*

The kangaroo rat is 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.

The kangaroo rat is found in suitable localities throughout the semiarid section east of the Cascades, and in parts of the Rogue River Valley.

**Life history and habits**

These 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 use.

**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 successful with guillotine rat traps, but such a method of control usually is too slow to be practical.

¹ Full information regarding the rat-proofing of buildings, and other measures looking toward permanent relief from the rat pest, are contained in Farmers' Bulletin 1638 prepared by the Fish and Wildlife Service, and Conservation Bulletin 8, copies of which may be obtained on request addressed to Division of Publications, United States Department of the Interior, Washington, D.C.
Porcupine
(Erethizon epixanthum)

The porcupine is a rather large, clumsy, and stupid animal. Quills on the back and tail come out very easily, and most people who live in the country frequented by this animal know this. It lives largely upon the bark and buds of native trees but feeds also on fruit trees, bushes, and field crops. It is slow moving, sluggish, and easily killed when found.

This animal is associated 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. It is rare that a porcupine is found in northern Oregon west of the summit of the Cascades, although occasionally they are caught in the Willamette Valley.

Porcupines in the past 2 or 3 years have become pests of considerable importance to farmers. Complaints of damage to alfalfa, fruit trees, and berry bushes have been received from widely scattered locations. These places usually are found to be adjoining timbered areas from which the porcupines can travel easily into the cultivated sections.

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

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:

Strychnine (alkaloid) ........................................ 1 ounce
Table salt, very fine ........................................ 12 ounces

Thoroughly mix and expose in the dens among rocks frequented by porcupines. The mixture should be exposed in blocks (described below). The block should be wired or nailed to a limb and thrust far back into the den.

When 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 a 2 x 4 into 4-inch lengths. With a 1-inch bit, 3 holes are bored in 1 edge of the block 1 inch deep as close together as possible. These holes are cleaned out so as to form a good slot. Bore 3 nail
holes through the block, 1 in each of the upper corners and 1 below the slot. This slot is filled with bait material made as follows:

- Strychnine (alkaloid) .................................................. 1 ounce
- Table salt, very fine .................................................... 13 ounces
- Vegetable shortening ................................................... 3 ounces

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

Select trees that are being used regularly, as can be seen by the droppings on the ground beneath. Nail the block to the trunk 8 to 10 inches above a suitable limb and 10 feet or more above the ground.

Where porcupines are using rest trees, systematic hunting with rifles is effective in reducing the number of animals. Exposure of bait in dens is more important than exposure in rest trees.

**Pocket Gophers**

(Various species of the genus *Thomomys*)

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 forelegs 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 that opens externally instead of into the mouth as in the case of the squirrel.

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 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 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 injured similarly by gophers.

Each individual pocket gopher leads a solitary life except during the breeding season when seeking a mate. Four to 6 young usually
are 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 each starts a burrow of its own. One animal may spend its entire life within 1 or 2 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 necessary only 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 used persistently 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 usually is the best means of control.

Willamette Valley Pocket Gopher

*Thomomys bulbiverous*

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

- Green clover tips ........................................... 10 pounds
- Strychnine (alkaloid) ..................................... 1 ounce

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 the clover tips as such materials 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 placing the clover tips in a large paper sack so as to keep the strychnine from sifting through. Then sprinkle the strychnine on from a pepper shaker. Close end of sack and shake until

Mound made by pocket gopher in alfalfa field is shown on the left. Note the low, flat shape and plugged tunnel entrance. The mound of earth thrown up by the mole is shown at the right. Note the more conical shape.
the clover tips are slightly dusted with the strychnine. 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. In the winter months when green alfalfa and clover tips are not available a good degree of control can be obtained by the use of vegetable baits such as carrots, sweet potatoes, and parsnips cut in $\frac{1}{4}$- x $\frac{1}{4}$- x 3-inch pieces. This bait should be mixed as follows:

<table>
<thead>
<tr>
<th>Cut vegetable bait</th>
<th>16 quarts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strychnine (alkaloid)</td>
<td>1 ounce</td>
</tr>
</tbody>
</table>

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 then are 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. When using the vegetable bait a probe made of a $\frac{1}{4}$-inch tail-gate iron should be used to locate the runway 10 to 12 inches from the fresh mound. The probe hole should be enlarged with a piece of sharpened $\frac{3}{4}$-inch pipe and the bait dropped down this hole into the runway. The probe hole then should be covered with a clod so as to exclude all light and keep the bait clean.

**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:

<table>
<thead>
<tr>
<th>Cut vegetable bait</th>
<th>16 quarts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strychnine (alkaloid)</td>
<td>1 ounce</td>
</tr>
</tbody>
</table>

Dust over 16 quarts of sweet potatoes, carrots, or parsnips. These bait materials should be cut into pieces $\frac{1}{2}$- x $\frac{1}{2}$- x 1 1/2-inches and dusted thoroughly with the above mixture. In irrigated sections bait can be placed readily by use of a gopher probe that can be made by almost anyone. The essential thing is to have a sharp instrument penetrate to the gopher runways. The ones used by the Fish and Wildlife Service 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 then can 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 be located soon and baits 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 United States Fish and Wildlife Service 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 3 principal pocket gophers of Eastern Oregon. All of them are poisoned quite readily by the bait given for the white-toothed pocket gopher of the Rogue River Valley.

**Oregon Mole**

(*Scapanus townsendi*)

The mole is a small, black animal. It has velvety fur; long, pointed, naked nose; naked tail; and powerful, shovel-like forefeet. Its eyes and ears are little developed and hard to locate in many individuals. The forelegs are muscled heavily and armed with powerful claws, being well fitted for their task of digging through the soil.

Moles are 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 al-
most their entire lives underground although occasionally they come out and travel on the surface at night. They are very harmful 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 be distinguished easily 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. Moles are not true rodents in that their main food consists of bugs and earthworms. They do feed to some extent on bulbs, peas, corn, and root vegetables. Mice use mole runs and often damage crops for which the mole gets the blame.

Control

Recently a successful method of poisoning moles has been developed by members of the Fish and Wildlife Service. This method uses thallium sulphate as the lethal agent and employs the use of earthworms as the carrying agent for the poison.

Preparation of the bait is as follows: Obtain one pint of earthworms of medium to large size—care being taken that the worms are not obtained from around manure piles since these manure worms have a taste or odor which is objectionable to the mole. Wash the worms in clean water to remove all the dirt and excessive mucous. Dissolve 1 ounce of thallium sulphate in 1 1/4 pints or 600 cubic centimeters of clean water. Pour this solution over the clean worms, making sure they all are immersed in it, and leave to soak for 6 to 8 hours; then remove the worms.

Using a 1/4-inch tail-gate rod for a probe, locate the moles’ runways 8 to 10 inches out from the fresh mounds. When the runway is located, rotate the probe to enlarge the hole, and drop 2 earthworms through into the runway. A wooden or metal forceps about 10 inches long may be used to place the worms in the probe hole. The probe hole then should be covered with a clod. About 3 baits should be placed to a runway system.

Cautions:
- Do not use worms from around manure piles.
- Do not use water containing chlorine as it interferes with action of the thallium sulphate.
- Do not handle solution or worms except with rubber gloves.
- Do not allow any of the unused solution to remain around the house, but pour it out in a hole or cover with dirt.
A scissors-jaw trap, set at the proper depth in relation to mole tunnel, with 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.

Thallium treated vegetable and grain baits now found on the market have proved successful in controlling moles in some areas. Since thallium sulphate is difficult to obtain either in liquid or powdered form, these ready-to-use baits are recommended.

Extensive experiments looking to the control of moles by the use of cyanide dust have been carried on by the Fish and Wildlife Service 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 a most successful way of dealing with these animals. 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 50 moles through the season on 1 such highway.

Traps that are used for mole and gopher work are pictured below and on page 32 of this bulletin. These traps are the Out-of-Sight mole trap, Macabee, Victor, and the Cinch trap.
A small metal rod about 3 feet long to use for a probe and a medium-sized tile spade are the best tools to use in setting these traps. Locate the main runway by probing with the small rod between two mounds. When this is located, open up this runway with the shovel by inserting into the ground crossways of the tunnel and just the width of the trap. Fit the trap in position squarely straddling the runway, making certain that no part of the trap is in the tunnel. 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-loop trap works better than the scissors-jaw, because it is not clogged so easily.