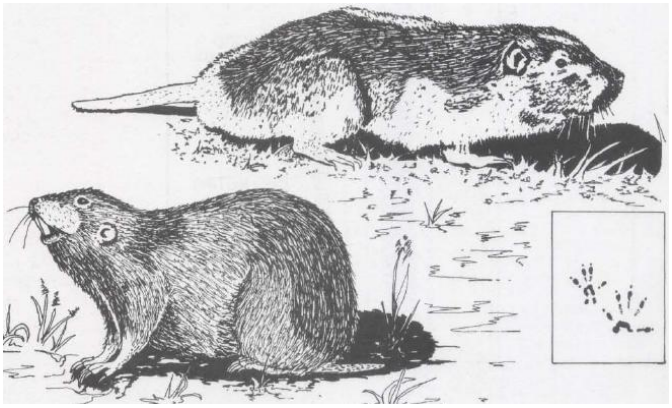
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Gophers (pocket gophers)

Thomomys spp.

Family: Geomyidae

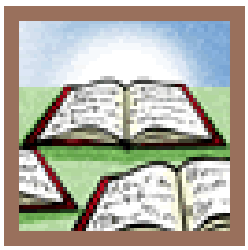


Introduction: Pocket gophers are burrowing rodents that get their name from the fur-lined external cheek pouches, or pockets, that they use for carrying food and nesting materials. They are well equipped for a digging, tunneling lifestyle with powerfully built forequarters, large-clawed front paws, fine short fur that doesn't cake in wet soils, small eyes and small external ears, and highly sensitive facial whiskers to assist movements in the dark. In California the Botta's pocket gopher (*T.bottae*) is the most common species (see picture above). Pocket gophers live alone in an extensive underground burrow system that can cover an area of several hundred square feet.

Identification: Pocket gophers range in length from 6 to 12 inches. They are stout bodied, short legged rodents. Eyes and ears are quite small, their front claws are curved. Their common name is derived from their fur lined external cheek pouches, or pockets in which they carry food or nesting materials. The pocket gopher's lips close behind its four large incisor teeth, keeping dirt out of its mouth when it uses its teeth for digging.

Pocket gophers rarely travel above ground except for when the young are dispersing to new sites. They are sometimes seen while feeding and pushing dirt out of their burrow system. The mounds of fresh soil that are the result of burrow excavation indicate their presence. Their mounds are usually crescent shaped and are located at the ends of short lateral tunnels branching from the main burrow system. One gopher may

push up several mounds in one day. They are active by day and night, year round. Note, the lack of fresh mounding is not an indication that they are not present and active, since gophers at times fail to produce mounds and in turn backfill old tunnels with the excavated soil.



Legal Status: Pocket gophers are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.

Damage: Pocket gophers often invade agricultural crops where they feed mostly underground on a wide variety of roots, bulbs, tubers, grasses, and seeds, and even bark at the base of trees. Pocket gopher mounds interfere with the harvest of hay and grain crops and cover up plants. Gopher burrows may weaken banks of ditches and canals. Underground cables are sometimes gnawed by gophers. Their gnawing may damage plastic water lines and lawn sprinkler systems.

Range: The five species of pocket gopher found in California occupy all areas except parts of dry deserts, very rocky areas, and the highest mountain meadows. The Botta pocket gopher has the widest range within California covering most agriculturally important areas west of the Sierra crest.

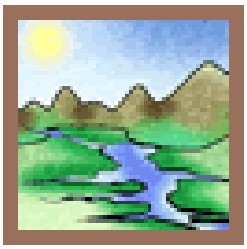
Botta Pocket Gopher

Mountain Pocket Gopher

Northern Pocket Gopher

Townsend's Pocket Gopher

Western Pocket Gopher



Habitat: Valleys and mountain meadows are the most typical pocket gopher habitats. The Northern pocket gopher also inhabits grassy prairies, brushy areas and open pine forests east of the Sierra and in northeastern California. Gophers are most abundant in better soils and where there is ample moisture and plant growth.

Biology: At altitudes of 5,000 feet or higher, breeding is mainly in June and July. In irrigated lands having continued green forage, gophers breed almost throughout the year and a female may bear three litters. Litters average five to six, but they vary from one to thirteen. The frequency of pregnancies increases with age and size of females. The gestation period for the Botta pocket gopher is about 19 days and the young remain in the nest for several weeks. After weaning, the young are expelled by the mother to wander overland to start tunnels in new places. They are particularly vulnerable to predation at this time. Hawks, owls, gopher snakes, badgers, foxes, weasels, and coyotes prey on gophers. Gophers rarely live beyond three years.

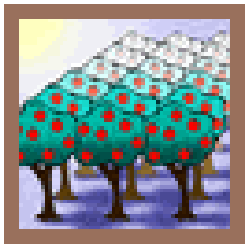
Gophers do not hibernate or become completely inactive at any time of year.

They continue their burrowing at ground level where snow covers the ground, retreating underground as the snow melts. Gnawing or girdling of young orchard trees is most likely to occur during late summer when the ground is dry and green vegetation is scarce. Surface activity decreases on hot, dry lowlands during summer and during and after heavy rains. Gopher burrows are sometimes utilized by other animals, including: salamanders, toads, snakes, mice, weasels and

some arthropods.

The pocket gopher is named for its external fur-lined cheek pouches, one on each side of its mouth. Food consists mainly of the underground parts of plants, especially the succulent portions. Forbs, however, are often cut back above ground, around the mouth of a burrow, or pulled down through the surface soil into the burrow system. Stems are cut in short lengths and transported in the cheek pouches to storage chambers in the burrow system.

Pocket gophers lead an almost completely subterranean existence, venturing above ground only to push dirt out of the burrow, seek new territory after weaning or to graze on succulent plants near a burrow entrance. Except during the breeding season, gophers are anti-social; intruding gophers are viciously repelled. Burrow entrances are plugged to prevent entry and to stabilize temperature and moisture within the burrow system. Each gopher establishes its own territory covering from 200 square feet for a young gopher to 2,200 square feet for an old, established gopher. Burrows are dug mainly with long for claws though the incisor teeth are used to cut roots or dislodge small stones. The burrow system consists of main tunnels 2 to 2-1/2 inches in diameter, running more or less parallel with the soil surface. Gophers push accumulated dirt from their excavations out lateral exits, forming characteristic crescent-shaped mounds of soil which are soon plugged with fresh soil. Nearly vertical feeding laterals are also dug but these are inconspicuously plugged. The nest is a hollow ball of finely shredded plant fibers commonly filling a chamber about eight inches in diameter. It is deeper in the ground than most of the tunnels. Food is stored near the nest or in enlarged chambers.



Damage Prevention and Control Methods: Because of the nature of pocket gopher damage, a successful control program depends on early detection and prompt action. For limited infestation trapping or using poison baits placed by hand can be effective. For larger infestations, additional efforts are often necessary. Once pocket gopher damage has been controlled, establish a system to monitor the area for reinfestation. A monitoring program is important because pocket gophers may move in from other areas and cause more damage in a short time, probably by using old tunnels. Experience has shown it is easier, less expensive, and less time consuming to control gophers before their numbers build up.

Exclusion

Because of expense and limited practicality exclusion is only effective in limited areas. Temporary protection from gophers may be achieved by using a 3 foot or wider roll of ½ inch wire mesh buried to a depth of 2 feet with a 6 inch flare turned outward from the area to be protected. Unfortunately, this labor intensive below ground fence will over time be breached by the gopher's extensive burrowing activity (Salmon 1990).

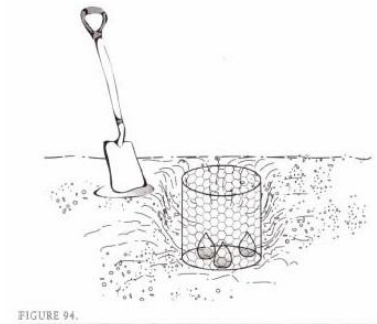


FIGURE 94.
Planting baskets made of 1-inch chicken wire protect bulbs from pocket gophers. Leave about 3 inches (7.5 cm) of the basket exposed above the ground.

Small areas such as bulb beds may be protected from pocket gophers by complete underground screening with wire mesh. If wire mesh is used place deep enough so that root growth is not restricted. Raised beds also offer excellent protection when the bottom of the bed is lined with wire mesh.

Plants and bulbs can be protected by using wire mesh baskets. Larger wire baskets can be made to accommodate fruit trees, but the basket can interfere with root growth. One way to install the basket is to line the planning hole with wire mesh. Common recommendation is a hole as deep as the root ball and twice its diameter. For bare root planting the hole should be large enough so the roots can be planted without restriction. For the best protection at least 6 inches of the wire basket should project above ground level.

Trenching may be successful for small-scale operations. A steep or vertical-walled ditch 18 inches wide by 24 inches deep is dug around the plot to be protected. Open-topped 5-gallon cans, spaced at intervals of 25 feet, are sunk so that their tops are level with the bottom of the ditch. Gophers getting into the ditch will be likely to fall into the cans, from which they cannot escape.

Habitat Modification

The following methods utilize knowledge of pocket gophers habitat requirements and feeding behavior to reduce or eliminate damage.

Flooding: When irrigated croplands and orchards are periodically flooded, some gophers are either drowned or forced out by the incoming water. Most survive in burrows in the levees. Others are driven into the open, where they are susceptible to predation (Loeb 1990).

Crop Varieties: Varying crop types can assist in dispelling gophers. For example, alfalfa; it is known pocket gophers do not like large root varieties.

Crop Rotation: Using a crop rotation scheme of grain crops and alfalfa, the resulting habitat is incapable of supporting pocket gophers, since the underground structures do not supply enough food for pocket gophers year round.

Grain Buffers: Similarly, planting 50 foot buffer of grain around hay fields provides unsuitable habitat and can minimize gopher immigration into the field.

Weed Control: Chemical or mechanical control of forbs can limit gopher populations in rangeland situations.

Frightening: Not Recommended. Sounds, vibrations, electromagnetic devices, or other means has not proven effective in driving gophers from an area or preventing their damage.

Fumigants

The extent of the burrow system, the chance for leakage of gas through the softer earth of laterals, the closeness of the main runs to the surface of the ground, and the fact that gophers may quickly plug off their burrows when a poisonous gas is detected and so escape destruction, makes use of many gases unsatisfactory (Matschke 1998). Aluminum phosphide tablets, however, have been found to be extremely effective with a 90% success rate if soil conditions are proper for a good gas seal (Baker 2004). Aluminum phosphide is a Restricted Use Material and a permit is required for purchase and use. Various gopher "bombs" are sold for gopher control. When lighted and placed in the burrows, they generate a gas

intended to overcome gophers. In general they are not very effective.

Aluminum Phosphide Treatment:

Aluminum phosphide is a highly toxic rodenticide and requires a 'Restricted Materials Permit' for use in California and must be used under the supervision of a certified applicator. All applicators must be trained in the use, according to the product label. Use 2 to 4 tablets per burrow opening. Place the label recommended amount (in the tunnel through the probe hole. Place a stone or dirt clod over baited probe hole and push down with boot heel to seal probe hole without collapsing the tunnel. Use lower rates in small burrows or under moist soil conditions and higher rates in large burrows or when soil moisture is low. Check treatment area after 72 hours and retreat as before all new gopher mounds.

Magnacide "H"

Restricted use pesticide with similar restricted use requirements. Use a professional licensed applicator. It is not generally used for pocket gopher control. Recent tests showed that it was relatively ineffective.

Repellents

Repellents are not effective in protecting areas from pocket gopher damage. The plant gopher (*Euphorbia lathyris*) has been suggested as a repellent, but no scientific evidence supports its effectiveness

Toxic Bait

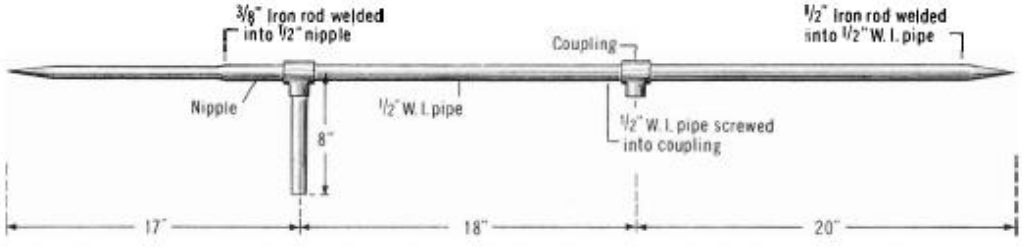
CDFA label 0.01% Chlorophacinone grain bait

All gopher bait is placed underground. Strychnine treated bait is the most common rodenticide used for pocket gopher control but zinc phosphide and anticoagulants are also registered for use. Despite the fact all gopher bait is placed underground animals such as dogs can dig it up and be exposed to bait in this manner.

Hand baiting (probe method): A probe is used to locate main runways so bait can be placed underground where gophers will find it. A runway usually runs in a straight line between two mounds at a depth of six to eight inches. Probe around fresh mounds or between two fresh mounds since these indicate the most recent presence of gophers. When the runway is located, the probe will give way and drop about two inches. If a bait dispensing probe is being used, deposit bait into the runway. If not, the opening to the runway should be enlarged by rotating the probe or by using the larger end of the probe. Bait may then be dropped in the burrow. Insert one teaspoon of grain bait at two or more places in each runway according to label instructions. When using the anticoagulant chlorophacinone, place a total of 1/2 cup of treated grain into the burrow runway. One quarter (1/4) cup of bait should be placed in two locations per gopher system. Cover the probe hole with a clod or rock to keep out light and prevent dirt from falling on the bait.

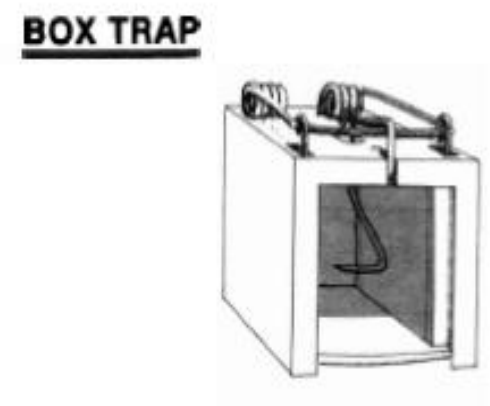
Probes: Simple gopher probes can are available commercially or can be made using a 1/4 inch steel rod, pointed at the tip. A larger rod or dowel can be used to enlarge the hole through which bait is deposited.

If larger areas are to be treated, a special metal probe may be constructed, being more effective, easier to use, and time saving.



Anticoagulant Bait Blocks: Paraffin bait bars or blocks containing an anticoagulant are generally available for pocket gopher control. When using anticoagulant bait blocks, open the burrow system as if setting a trap. Place bait blocks in two locations per gopher system. Close openings in system as above. Bait blocks are weather resistant and should be effective for some time.

Mechanical Burrow Builder Baiting: On extensive areas, use a "burrow builder" machine to make artificial burrows across the field at the same depth as the natural burrows. The machine drops bait automatically at 9-12 inch intervals in these tunnels. Strychnine is the common bait used in these devices. One to two pounds of this bait will treat one acre by this method. Consult the



machine operating manual for specific instructions such as rate of application and operations or adjustment procedures.

Trapping: Trapping is recognized as a safe and effective method to control pocket gophers when done in the context of an effective pocket gopher control program. However, it is time consuming and labor intensive.

Several types of gopher traps are available. Two common traps are the two pronged pincer trap and the squeeze type box trap. These traps are triggered when the gopher pushes against a flat vertical pan or wire trigger.

To place traps after you have opened a main tunnel, open it with a shovel or garden trowl and set traps in pairs facing opposite directions. This placement ensures the gopher will be intercepted from either end of the burrow. The box trap is generally easier to set but requires more excavation; this can be an important consideration in lawns and some gardens. Box traps are especially useful when the gopher's main burrow is less than 3 inches in diameter. This is because small burrows must be enlarged to install pincer traps. All traps should be wired to stakes to make them easier to locate. After setting the traps, exclude light from the burrow by covering the opening i.e. with dirt clods, sod, cardboard or some other material. Fine soil can also be put around the edges to form a seal. Note, if light enters the gopher may plug the burrow with soil, filling the traps and making them ineffective. Check traps often and reset them when necessary. If no gopher is caught within 2 to 3 days, reset the traps in a different location. Human odor on traps has no apparent effect on trapping success.

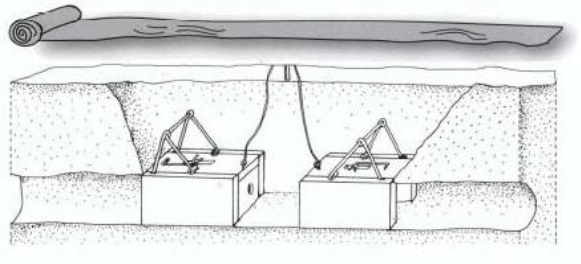


FIGURE 89.
After placing box-type traps for gopher control, fill in the openings so that no light enters the hole.

Directions for Use

All bait material is to be placed below ground.

Aluminum Phosphide:
Place the label recommended amount (2 to 4 tablets) in the tunnel through the probe hole. Place a stone or dirt clod over baited probe hole and push down with boot heel to seal probe hole without collapsing the tunnel. Use lower rates in small burrows or under moist soil conditions and higher rates in large burrows or when soil moisture is low. Check treatment area after 72 hours and retreat as before all new gopher mounds.

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A probe is used to locate main runways so bait can be placed underground where gophers will find it. A runway usually runs in a

straight line between two mounds at a depth of six to eight inches. Probe around fresh mounds or between two fresh mounds since these indicate the most recent presence of gophers. When the runway is located, the probe will give way and drop about two inches. If a bait dispensing probe is being used, deposit bait directly into the runway. If not, the opening to the runway should be enlarged by rotating the probe or by using the large end of the probe. Bait may then be dropped in the burrow. Insert one teaspoon of grain bait at two or more places in each runway. When using the anticoagulant chlorophacinone, place a total of 1/2 cup of treated grain into the burrow runway. One quarter (1/4) cup of bait should be placed in two locations per gopher system. Cover the probe hole with a clod or rock to keep out light and prevent dirt from falling on the bait.

Probes: When only a few runways are to be treated, a 1/4 inch steel rod, pointed at the tip, will serve to locate the runnels and a larger rod or broomstick can be used to enlarge the hole through which bait is deposited.

If much treatment is to be done, a special metal probe may be constructed, being more effective, easier to use, and time saving.

Anticoagulant Bait Blocks: When using anticoagulant bait blocks, open the burrow system as if setting traps. Place bait blocks in two locations per gopher system. Close openings in system as above. Bait blocks are weather resistant and can provide control for some time.

Mechanical Burrow Builder Baiting: On extensive areas, use a "burrow builder" machine to make artificial burrows at the same depth as the natural burrows in areas where gophers are active. The machine drops bait automatically at 9-12 inch intervals in these tunnels. One to two pounds of strychnine bait will treat one acre by this method. Consult the machine operating manual for specific instructions such as rate of application and operations or adjustment procedures.

Until recently, two manufacturers dominated the market for building gopher machines; Rue R. Elston Co., Minneapolis, Minnesota, and Blackwelder Manufacturing Co., Rio Vista, California. Unfortunately, Blackwelder is no longer manufacturing gopher machines. The Elston machine is more popular in the Midwest but is also commonly used in the West.

REFERENCES AND ADDITIONAL READING

Borrecco, John E., H.C. Black, 1990. Animal Damage Problem and Control Activities on National Forest System Lands. Proc. 14th Vertebrate Pest Conf. (L.R. Davis and R.E. Marsh, Eds.) Published at Univ. of Calif., Davis. Pp. 192-198

Jackson, Jeffery J., 1990. Controlling Vertebrate Animal damage in Southern Pines. Proc. 14th Vertebrate Pest Conf. (L.R. Davis and R.E. Marsh, Eds.) Published at Univ. of Calif., Davis. Pp. 199-202.

Koehler, Ann E., R.E. Marsh, T.P. Salmon, 1990. Frightening Methods And Devices/Stimuli to Prevent Mammal Damage- A Review. Proc.14th Vertebrate Pest Conf. (L.R. Davis and R.E. Marsh, Eds.) Published at Univ. of Calif., Davis Pp. 168-173.

Marsh, Rex E., A.E. Kohler, T.P. Salmon, 1990. Exclusionary Methods And Materials To Protect Plants From Pest Mammals-A Review. Proc.14th Vertebrate Pest Conf. (L.R. Davis and R.E. Marsh, Eds.) Published at Univ. of Calif., Davis Pp. 174-180.

Marsh, R. E. 1992. Reflections on Current (1992) Pocket Gopher Control in California. pp. 289-295 In: Proc. Fifteenth Vertebrate Pest Conf., University of California, Davis.

Nolte, Dale L., D.L. Campbell, J.R. Mason, 1994. Potential Repellents to Reduce Damage by Herbivores. Proc. 16th Vertebrate Pest Conf. (W.S. Halverson & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. Pp. 228-232.

Pearson, A.Britt, W.P. Gorenzel, T.P. Salmon, 2000. Lesser-Known Vertebrate Pests of Almonds in California. Proc. 19th Vertebrate Pest Conf. (T.P. Salmon & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. Pp. 365-376

Schmidt, Robert H., 1992. Why Bad Things Happen to Good Animals. Proc. 15th Vertebrate Pest Conf. (J.E. Borrecco & R. E. Marsh, Eds.) Published at Univ. of Calif., Davis. Pp. 25-28.

Van Vuren, Dirk, 1998. Manipulating Habitat Quality to Manage Vertebrate Pests. Proc. 18th Vertebrate Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. Pp. 383-390.

Ziegltrum, Georg, D.L. Nolte, 1996. The Washington ADCP-A Private Collaboration Effort to Address Biological, Economical and Social Constraints to Reduce Wildlife Damage. Proc. 17th Vertebrate Pest Conf. (R.M. Timm & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. Pp. 158-159.