Another factor complicating economical analysis is the pocket gopher's benefits. Some of these are:

- increased soil fertility by adding organic matter such as buried vegetation and fecal wastes
- increased soil aeration and decreased soil compaction
- increased water infiltration and thus decreased runoff
- increased rate of soil formation by bringing sub-soil material to the surface of the ground, subjecting it to weathering

Decisions on whether or not to control gophers may be influenced by the animal's long-term benefits, which are not always readily recognized and obvious, and sometimes substantially damaging in the short-term.

Finally, a desirable approach to the control of pocket gophers is to manage populations without threatening the species. Management is preferred because it recognizes the values of gophers and the impossibility of eradication. Trying to eradicate any species upsets the integrity of ecosystems in a manner that we cannot possibly predict from our current knowledge of the structure and function of those ecosystems.

Acknowledgements

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OKLAHOMA COOPERATIVE EXTENSION SERVICE NREM-9001

Controlling Pocket Gophers

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Pocket gophers are stocky, short-legged, medium-sized rodents with bodies well-adapted for digging. They have broad heads with small eyes and ears; exposed yellowish, chisel-like, incisor teeth; a short, sparsley-haired tail; and front toes with long, stout claws used in digging. They get their name from the deep, fur-lined external cheek pouches, in which food, mostly tubers and roots, is carried. Coloration varies in individuals and in species from yellowish-tan to browns and blacks. Spotted and albino individuals are fairly common.

Two species of pocket gophers are found in Oklahoma. They are the plains pocket gopher (*Geomys bursarius*), which ranges over most of Oklahoma, and the Mexican pocket gopher (*Cratogeomys castanops*), which is found in the Oklahoma Panhandle.

Gophers should not be confused with moles although they sometimes construct similar tunnels. Moles have no external cheek pouches or external ears. They have a slender conical snout, tiny ears that are covered with skin, small needle-like teeth, and broad front feet with heavy claws.

Habits

Pocket gophers usually live in rangeland, alfalfa fields, roadsides, introduced pastures, railroad rights-of-way, and they often invade lawns and flowerbeds. They feed mostly on roots of trees, grasses, alfalfa, and dandelions. They also eat seeds, leaves, tender stems, tubers, and bulbs.

The gopher's home is an extensive system of underground tunnels, which are excavated four to 18 inches below the ground. A series of these tunnels made by one gopher may extend several hundred feet and cover an acre of ground. Areas of gopher activity are marked on the surface by numerous mounds of excavated soil. The characteristic fan-shaped mounds, which may be 18 to 24 inches in diameter and about six inches high are at the ends of short lateral tunnels branching off the main runway. The surface opening, through which soil is pushed from the tunnel, is finally plugged by soil pushed into it from below, leaving a small circular depression on one side of the mound. Generally, the entire lateral is then filled to the main tunnel.

The placement of these mounds often gives a clue to the position of the main tunnel, which usually does not lie directly under any mound. One pocket gopher may make as many as 200 soil mounds per year. The most active mound building time is during the spring. Pocket gophers do not hibernate.

Pocket gophers are active throughout the day with activity periods interspersed with rest. They seldom come above ground, though they may come out of their runnels at night and on cloudy days. Many gophers may have individual burrows in the same field, forming colonies. However, they are mostly solitary animals and except during the breeding season or when young are present, one gopher per tunnel is the rule.

Pocket gophers can be valuable because they contribute to the formation and conditioning of soil, and they provide food for some of our large predators. In areas where these rodents are not of economic significance, they should not be destroyed. Their control may be necessary when they become pests by eating garden crops, clover, roots of fruit trees, shrubs, alfalfa, or if their digging activities interfere with harvesting hay or grain.

Legal Status

Pocket gophers are currently not protected by federal or state law.

Control Methods

Gopher populations can be reduced or eliminated over a considerable area with persistent control efforts. Control is best conducted when gophers are most active near the surface, usually in the spring or fall. New activity is usually indicated by fresh mounds of soil. At other times, labor and material may be wasted in treating unoccupied runways.

Control methods include poisoning, trapping, flooding, gassing, encouraging natural enemies, and exclusion. The two most practical and efficient methods are using toxic baits and trapping. Over large and heavily infested areas, poisoning is the most economical control method. Gophers not killed by poisoning will throw up fresh mounds and these individuals can be trapped. On small areas, such as lawns or where only a few animals are involved, trapping is the most practical method.

Toxicants

Pocket gophers can be killed in large numbers with poisoned bait. Strychnine, either alkaloid or sulfate, is quite effective. Root vegetables, such as carrots or sweet potatoes, cut to conveniently small sizes and dusted with strychnine are excellent baits. Grain baits, such as corn, oats, wheat, and grain sorghum are readily eaten in some localities and often give better results in fall when pocket gophers are storing much of their food. These prepared baits can often be obtained from local garden supply stores or from pest control operators.

Two baiting methods are effective. The first involves dropping baits by hand into underground runways. This procedure is easier if a probe is used to find the tunnel and to make a hole through which bait can be inserted. Probes can be bluntly pointed brooms, shovel handles, or pipes. A good probe (Figure 3) can be made of three-fourths inch gas pipe welded to a blunt point and cut 34 inches long. A "T" joint which slips over the main probe makes a movable foot-rest.

To locate the main runway, probe into the soil four to ten inches from the base of the mound, usually on the side nearest the circular depression, or probe between two fresh mounds (Figure 3). Enlarge the opening by rotating the probe so that poisoned baits may be dropped into the burrow. Use two to three pieces of vegetable bait or one level tablespoon of grain bait. Close the opening with grass and cover with dirt to keep out light and air. Make one application for every four to six fresh mounds.

Place the baits in the main runways with as little disturbance as possible. Toxic baits left on the surface will not be found by gophers, but they may endanger other wild or domestic animals. If the mounds are leveled as you work the area, gophers that escape treatment will make new mounds you can easily detect. Additional baits or traps may then be placed where needed.

The second baiting method uses a tractor-drawn machine called a "burrow-builder." This machine make artificial burrows and automatically drops toxic baits into them. The "burrow builder," developed by the U.S. Fish and Wildlife Service, is especially useful for large areas. It is recommended for use when soil moisture permits good compaction so burrows will not collapse. In most areas, soil conditions are best in the spring or fall.

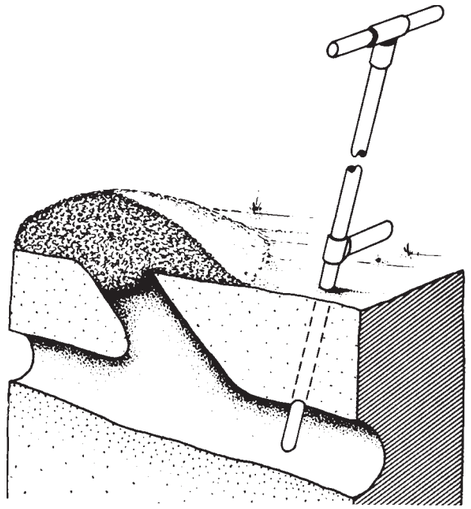


Figure 3. Home made probe.

The effectiveness of the machine depends upon the gophers finding the artificial runways and the poisoned bait. Hence, the machine must be set so artificial burrows will intercept the greatest possible number of natural gopher tunnels. Under average conditions, ten acres of land can be treated per hour using one and a half to three pounds of treated grain.

Strychnine-treated grain baits consisting of mixtures of whole oats and cracked corn, cracked corn and grain sorghum (maize), or 100 percent grain sorghum have been used with excellent results.

Materials used for poisoning gophers are dangerous to man and other animals. So, extreme caution should be used when handling, storing, or applying these toxic substances. All labels on toxicants should be read and followed closely.

Trapping

Special traps are required for trapping pocket gophers. Small spring traps of varying sizes, similar to the one shown in Figure 4, are widely used. Another popular type is a box trap with a choker loop.

Two traps of appropriate size should be placed in the main runway, one set in each direction. This makes a trap-set (Figure 5). Using a stout garden trowel or a lightweight shovel, find the freshest mound and follow a lateral from the mound to the main runway. Clear a place in the main runway large enough for two traps, disturbing the surrounding area as little as possible. Set the pan or treadle so that traps can be easily sprung. Insert the traps, jaws forward, into the hole facing in opposite directions and press them down firmly. Cover the opening in the burrow with a clod or a handful of grass to cut off most of the light.

Gophers instinctively cover open burrows to keep out enemies. Each trap should be fastened to a stake with a light

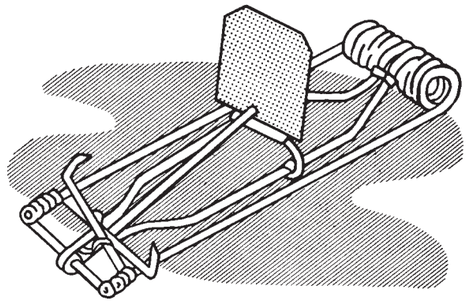


Figure 4. Macabre spring trap.

wire. After traps are set, tramp down the tops of all mounds so that mounds made by the gophers you miss will be evident on your next visit. For efficient use of traps and for best results, visit trap-sets morning and evening.

Damage Prevention

Exclusion

Excluding pocket gophers from an area is logistically difficult and often not particle because of the expense. Fencing valuable ornamental shrubs and landscape trees may be cost effective. Fencing should be buried at least 18 inches below ground. The mesh should be buried at least enough to exclude gophers (0.25 or 0.50 inch). Plastic netting placed around the entire seedling, including the root, can reduce damage to newly planted seedlings.

Cultural Methods and Habitat Modification

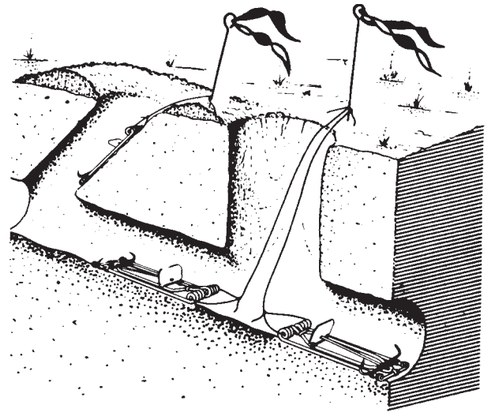
These methods take advantage of knowledge of the habitat requirements of pocket gophers or their feeding behavior to reduce or maybe even eliminate damage.

Crop varieties. In alfalfa, large taprooted plants may be killed or the vigor of the plant greatly reduced by pocket gophers feeding on the roots. Varieties with several large roots rather than a single taproot suffer less when gophers feed on them.

Crop rotation. There are many good reasons for using a crop rotation scheme, not the least of which is minimizing problems with pocket gophers. When alfalfa is rotated with grain crops, the habitat is incapable of supporting pocket gophers. The annual grains do not establish large underground storage structures and thus there is insufficient food for pocket gophers to survive year round.

Grain buffer strips. Planting buffer strips of grains around hay fields provides unsuitable habitat around the fields and can minimize immigration of gophers.

Flood irrigation. This can affect gophers in a least two ways. The soil may be so damp that it becomes sticky. This will foul the pocket gopher's fur and accumulate on its claws and generally be undesirable habitat. Secondly, as the soil becomes saturated with water it can effectively stop the diffusion of gases into and out of the gopher's burrow and form an inhospitable environment. The efficiency of this method can be enhanced by removing high spots in fields that may serve as refuges during irrigation.



Other Methods

Buried utility cables and irrigation lines can be protected by enclosing them in various materials, as long as the outside diameter exceeds 2.1 inches. The cables can be protected in this manner whether they are armored or not. Soft metals such as lead and aluminum used for armoring cables are readily damaged by pocket gophers if the diameters are less than the suggested size.

Economics of Damage and Control

It is relatively easy to determine the value of lost forage due to the presence of pocket gophers. Southern pocket gophers at a density of 32 per acre decreased the forage yield by 25 percent on foothill rangelands in California, where the plant composition was nearly all annual plants. Plains pocket gophers reduced forage yield on rangeland in western Nebraska by 21 to 49 percent on different range sites, and reduced alfalfa yield in eastern Nebraska by 35 percent.

It is only slightly more complicated to calculate the cost of control operations. However, the benefit-cost analysis of control is still not straightforward. More research data is needed on how to manage for forage recovery. For example, should rangeland be rested or lightly grazed? Should gopher mounds on alfalfa fields be lightly harrowed? A study on northern pocket gopher control on range in southern Alberta indicated that forage yield increased 16 percent three months after treatment.

Other problems with the economic analysis are: determining the cost of control, the speed of pocket gopher reinfestation, and the costs associated with dulled or plugged mowing machinery or mechanical breakdowns caused by the mounds.

An economic analysis could be made for damages to buried cable, irrigation pipe, trees, and so on.