
CALIFORNIA GROUND SQUIRREL

Integrated Pest Management for Home Gardeners and Landscape Professionals

The California ground squirrel, *Spermophilus beecheyi* (Fig. 1), is one of the most troublesome pests to homeowners and gardeners. It is found in nearly all regions of California except for the Owens Valley southward into the desert regions.

IDENTIFICATION

Ground squirrels are easily identified as they forage aboveground near their burrows. The ground squirrel's body measures 9 to 11 inches and its semi-bushy tail adds another 5 to 9 inches in length. The fur is brownish gray and speckled with off-white along the back; the sides of the head and shoulders are light gray to whitish. One subspecies that occupies most of northern California has a dark, triangular-shaped patch on its back between the shoulders; this patch is missing from other species. While ground squirrels are similar in appearance to tree squirrels and may climb trees, when frightened they will always retreat to a burrow, whereas tree squirrels will climb a tree or tall structure and never use a burrow.

BIOLOGY AND BEHAVIOR

Ground squirrels live in a wide variety of natural habitats but usually avoid thick chaparral, dense woods, and wet areas. Populations may be particularly high in grazed rangelands and in areas disturbed by humans such as road or ditchbanks, fence rows, around buildings, and in or bordering many crops.

Ground squirrels live in a burrow system where they sleep, rest, rear young, store food, and avoid danger. The burrow openings are about 4 inches in diameter, but can vary considerably.

The burrows may be 5 to 30 feet or more in length and may go 2 to 4 feet below the soil surface. Often there is more than one opening in a burrow system. Ground squirrels live in colonies that may include several dozen animals in a complex of burrows. More than one squirrel may live in a burrow.

Ground squirrels are active during the day, mainly from mid-morning through late afternoon, especially on warm, sunny days. Ground squirrels have two periods of dormancy during the year. During winter months most ground squirrels hibernate, but some young may be active at this time, especially in areas where winters are not severe. During the hottest times of the year most adults go into a period of inactivity, called estivation, that may last a few days to a week or more. During these periods, the burrow appears open at the entrance but the squirrel plugs it with soil near the nest.

Ground squirrels breed once a year, averaging seven to eight per litter. Timing of breeding varies with location: in southern California breeding begins in December, in the Central Valley in February through April, and somewhat later in the mountain ranges. Aboveground activity by adults is at a maximum at the height of the breeding season. The young are born in the burrow and grow rapidly; by about 6 weeks of age they usually emerge from the burrow. At 6 months of age they resemble adults.

Ground squirrels are primarily herbivorous. Their diet changes with the season. After emergence from hiberna-



Figure 1. California ground squirrels.

tion, they feed almost exclusively on green grasses and herbaceous plants. When annual plants begin to dry and produce seed, squirrels switch to seeds, grains, and nuts, and begin to store food. Ground squirrels usually forage close to their burrows. Their home range typically is within a 75-yard radius of their burrow.

DAMAGE

Ground squirrels damage many food-bearing and ornamental plants. Particularly vulnerable are grains and nut and fruit trees such as almond, apple, apricot, orange, peach, pistachio, prune, and walnut. Ground squirrels will enter gardens and devour vegetables in the seedling stage. They may damage young shrubs, vines, and trees by gnawing bark, girdling trunks, eating twigs and leaves, and burrowing

around roots. Ground squirrels will gnaw on plastic sprinkler heads and irrigation lines. They also eat the eggs of ground-nesting birds and may limit attempts to attract quail to the yard.

Burrowing can be quite destructive. Burrows and mounds make it difficult to mow, and they present hazards to machinery, pedestrians, and livestock. Burrows around trees and shrubs can damage and desiccate roots, and sometimes topple trees. Burrows beneath buildings and other structures sometimes necessitate repair.

Ground squirrels can harbor diseases harmful to humans, particularly when squirrel populations are dense. A major concern is bubonic plague transmitted to humans by fleas carried on the squirrels. Ground squirrels are susceptible to plague, which has wiped out entire colonies. If you find unusual numbers of squirrels or other rodents dead for no apparent reason, notify public health officials. Do not handle dead squirrels under these circumstances.

LEGAL STATUS AND LEGAL CONSIDERATIONS

Ground squirrels are classified as non-game mammals by the California Fish and Game Code. Nongame mammals injuring growing crops or other prop-

erty may be controlled in any legal manner by the owner or tenant; tree squirrels, on the other hand, are classified as game animals and have a hunting season.

Note that the Mohave ground squirrel (*S. mohavensis*) and the San Joaquin antelope squirrel (*Ammospermophilus nelsoni*) are classified as *threatened* by the U.S. Fish and Wildlife Service and are protected. Although neither of these relatively small squirrels is likely to be misidentified as the much larger California ground squirrel, their ranges could overlap in some areas. The endangered San Joaquin kit fox (*Vulpes macrotis mutica*), several endangered species of kangaroo rats, the riparian brush rabbit (*Sylvilagus bachmani riparius*), riparian wood rat (*Neotoma fuscipes riparia*), as well as some endangered amphibians and reptiles, are also found within California ground squirrels' range and could be impacted by some squirrel control techniques. Before using pesticides for ground squirrel control, *read the product label* to determine if any restrictions exist on rodent control within the ranges of these and other endangered and protected animals. Also, if the kit fox is found in your county (for a range map, see the California Department of Pesticide Regulation's Web site listed in

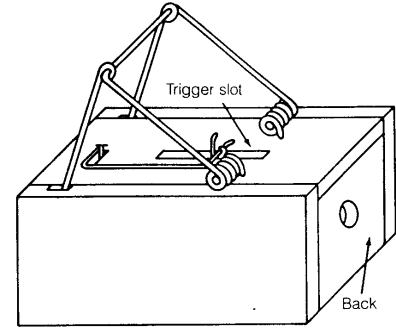


Figure 3. Box trap.

“References”), contact your county agricultural commissioner for additional information.

MANAGEMENT

The selection of control procedures is heavily influenced by the unique life cycle and behavior of the ground squirrel. For example, baiting with treated grain is effective in summer and fall because squirrels primarily feed on seeds during this period. Fumigation is most effective in spring when soil is moist, which helps seal gasses in the burrow system. Fumigating at this time also is more effective because squirrels are removed before they can reproduce. Figure 2 shows the yearly activities of the California ground squirrel and times when baiting, trapping, and fumigation are most effective.

Trapping

Traps are practical for control when squirrel numbers are low to moderate. Live-catch traps are not recommended because they present the problem of how to dispose of the live animals. Because ground squirrels carry diseases and are agricultural pests, the California Fish and Game Code specifies that it is illegal to release them elsewhere without a written permit.

There are several types of traps that kill ground squirrels, including box traps, Conibear traps, and tunnel traps. Box traps (Fig. 3) should be placed on the ground near squirrel burrows or

	winter	spring	summer	fall
Major activity periods				
adult reproduction		██████████	██████████	██████████
juveniles	██████████		██████████	██████████
Major food sources				
green forage		██████████	██████████	
seeds			██████████	██████████
best time for control				
fumigation		██████████	██████████	
baiting			██████████	██████████
trapping		██████████	██████████	██████████

Figure 2. The best time for a specific type of control depends on the activity periods and food sources of the ground squirrel.

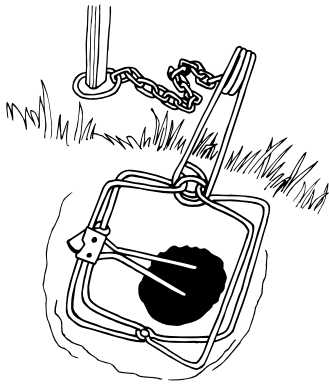


Figure 4. To use a Conibear trap, dig a slice of soil from the entrance so the trap will fit flush to the edges of the burrow entrance.

runways. Bait these traps with walnuts, almonds, oats, barley, or melon rinds. Place the bait well behind the trigger or tied to it. Bait the traps but do not set them for several days so the squirrels become accustomed to them. After the squirrels are used to taking the bait, rebait and set the traps.

To reduce hazards to children, pets, poultry, and nontarget wildlife, place box-type traps in a covered box with a 3-inch diameter entrance. Put the box near active burrows with signs of recent diggings. Inactive burrows will be filled with leaves, old straw, or have cobwebs across the entrance.

The Conibear trap (No. 110) with a 4½-by-4½-inch jaw spread is also an effective kill trap (Fig. 4). The wire trigger can be baited but is usually left unbaited. Place the trap directly in the burrow opening so the squirrel must pass through it, tripping the trigger. It may be necessary to partially fill in the burrow entrance around the outer edges of the trap with soil to prevent the squirrel from slipping around the outside of the trap. Closing all other burrows with soil may hasten success by directing the squirrel to the remaining open burrow with the trap. Attach the Conibear trap to a stake to prevent a scavenger from carrying off the trap

and squirrel. With this type of trap, leaving the trap baited but unset has little effect on trapping success.

Inspect traps at least once a day and remove dead squirrels. Do not handle the carcasses without protective gear. Use a plastic bag slipped over each hand and arm as a glove. Once the squirrel is removed from the trap, hold the animal with one hand and turn the bag inside out while slipping it off your arm and hand. If possible, keep small children and pets out of the area while traps are in use. In kit fox areas, spring all Conibear traps before nightfall and reset them the following morning.

Fumigation

Fumigation is a relatively safe method of control. As with any pesticide, *read and follow label instructions* with particular regard for nontarget species and safety factors. With some fumigants, flames may be produced, creating a fire danger. Do not use such fumigants where a significant fire hazard exists, such as near buildings, dry grass, or other flammable materials. To avoid the accumulation of fumes in enclosed areas, never fumigate beneath buildings or in burrows that may open under occupied buildings.

Be aware of the signs of nontarget species inhabiting inactive ground squirrel burrows. Kit foxes will use an old burrow, enlarging the opening, often creating a keyhole-shaped entrance. Active pupping dens may be littered with prey remains, droppings, and matted vegetation, and show signs of fresh paw prints. The burrowing owl (*Athene cunicularia*) is another potential occupant of abandoned ground squirrel burrows. Only fumigate active ground squirrel burrows; county agricultural commissioners can provide additional information on how to recognize these. Do not treat a burrow if you suspect a nontarget animal is present.

Many county agricultural commissioners' offices sell USDA gas cartridges,

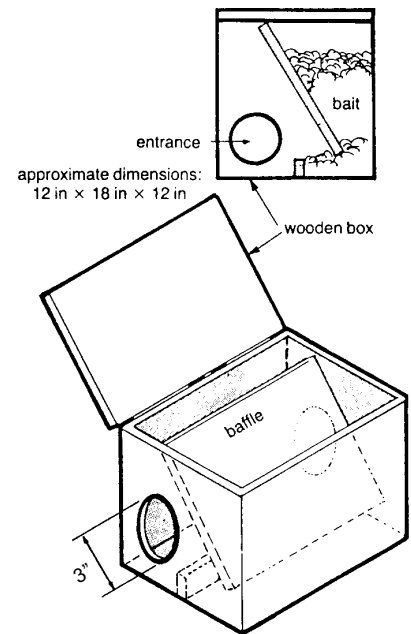


Figure 5. A bait box.

which are designed for fumigating burrowing rodents. Other types of fumigation cartridges are also available at retail outlets. Fumigation is most effective in spring or other times when soil moisture is high, which helps to contain the gas within the burrow system. Do not fumigate in summer or when the soil is dry because the gas more readily diffuses into small cracks present in dry soil. Do not fumigate during hibernation because the squirrel plugs its burrow with soil, preventing fumes from reaching the nest chamber. The plug cannot be seen by examining the burrow entrance.

Treat all active burrow systems when fumigating. When using a USDA gas cartridge, puncture the end with a nail or screwdriver at the points marked and rotate the nail to loosen the material inside. Insert the fuse into the center hole. Place the cartridge in the burrow as far as possible and light the fuse. With a shovel handle or stick, push the lighted cartridge down the burrow and quickly seal the opening with soil, tamping it down. Fill in connected burrows if smoke is seen escap-

ing. Larger burrow systems usually require two or more cartridges placed in the same or connecting burrow openings. After 24 hours, check for reopened burrows and re-treat as needed.

Toxic Baits

Anticoagulant baits, available at county agricultural commissioners' offices, are recommended for controlling ground squirrels. To be effective, anticoagulants must be consumed in several feedings over a period of 5 or more days. These features, as well as an antidote (vitamin K₁), make anticoagulant baits relatively safe for humans and pets. Keep pets out of treated areas, check the areas daily, and remove and dispose of any carcasses. Dogs are more likely to consume the pelletized cereal-based baits than the loose grain baits. Pelletized baits are prohibited in kit fox areas.

Anticoagulant baits can be used in bait boxes or by repeated spot baiting. Bait boxes are small structures that the squirrel must enter to eat the bait. Boxes contain sufficient bait for repeated feedings. They are the preferred baiting method around homes and other areas where children, pets, and poultry are present.

Unless a bait label specifies otherwise, bait boxes can be constructed from any durable material and in a variety of designs. If you design a bait box, make the entrance hole(s) about 3 inches across to allow access to squirrels but not to larger animals (Fig. 5). Construct a lip to prevent bait from spilling out of the box when squirrels exit. Provide a lock on the box or devise some other method that will make it difficult for children to open. Secure the bait box so it cannot be turned over or easily removed. A self-feeding arrangement insures that the pest gets a continuous supply of bait. Never fill a bait box with more than 5 pounds of bait.

Place bait boxes near runways or burrows. If squirrels are present over a large area, space the boxes at 100-

200-foot intervals. Initially, inspect bait stations daily and add bait as needed. Increase the amount of bait if all is eaten by the end of the day. Fresh bait is important; replace moldy or old bait. Do not use old, leftover bait. It may take a number of days before squirrels become accustomed to the bait box and enter it. Anticoagulant bait generally requires 2 to 4 weeks or more to be effective. Continue baiting until all feeding ceases and no squirrels are observed. While few ground squirrels will die aboveground, those that do should be picked up and disposed of as described in the section above on *Trapping* and in accordance with label directions. Also, pick up and dispose of unused bait (according to label instructions) upon completion of the control program.

Habitat Modification

Ground squirrels generally are found in open areas, although they sometimes use available cover. Remove brush piles and debris to make an area less desirable to ground squirrels. This also aids in detection of squirrels and their burrows, and improves access during control operations.

Ground squirrels can reinvade a site by moving into vacant burrows. Destroy old burrows by deep ripping them to a depth of at least 20 inches, using a tractor and ripping bar(s). Simply filling in the burrows with soil does not prevent reinvasion as ground squirrels easily find and reopen old burrows.

Other Control Techniques

Shooting squirrels with a .22 rifle may provide some control but is very time-consuming. Shooting is recommended only when it can be safely done in rural locations where squirrel numbers are very low. There are no effective frightening devices or repellents that will cause ground squirrels to leave their burrows or avoid an area or crop.

Natural Control

Many predators, including hawks, eagles, rattlesnakes, and coyotes, eat ground squirrels. In most cases, preda-

tors are not able to keep ground squirrel populations below the level at which they become pests for the home gardener. Dogs may prevent squirrels from entering small areas, but they cannot control established squirrel populations.

Follow-up

For those who live next to wildlands or other areas where squirrels are common, an ongoing control program will be necessary. Squirrels will reinvade over time. Once ground squirrels have been controlled, periodically monitor the area for reinfestation. Check for new burrows. Start control actions as soon as new squirrels are noticed. It is easier and less expensive to control a small population.

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For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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