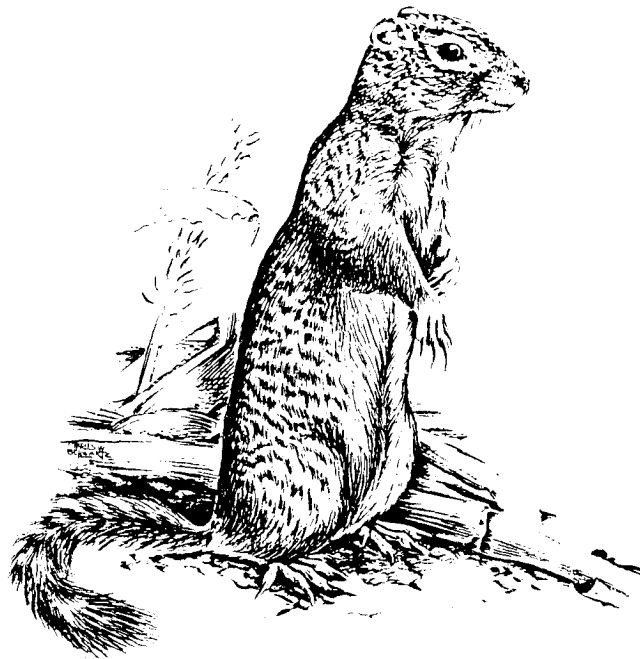


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FRANKLIN, RICHARDSON, COLUMBIAN, WASHINGTON, AND TOWNSEND GROUND SQUIRRELS

Fig. 1. Franklin ground squirrel, *Spermophilus franklinii*



Damage Prevention and Control Methods

Exclusion

Limited usefulness.

Cultural Methods

Flood irrigation, forage removal, crop rotation, and summer fallow may reduce populations and limit spread.

Repellents

None are registered.

Toxicants

Zinc phosphide.

Chlorophacinone.

Diphacinone.

Note: Not all toxicants are registered for use in every state. Check registration labels for limitations within each state.

Fumigants

Aluminum phosphide.

Gas cartridge.

Trapping

Box traps.

Burrow-entrance traps.

Leghold traps.

Shooting

Limited usefulness.



PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994

Cooperative Extension Division
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln

United States Department of Agriculture
Animal and Plant Health Inspection Service
Animal Damage Control

Great Plains Agricultural Council
Wildlife Committee

Identification

The Franklin ground squirrel (*Spermophilus franklinii*, Fig. 1) is a rather drab grayish brown. Black speckling gives a spotted or barred effect. Head and body average 10 inches (25.4 cm) with a 5- to 6-inch (12.7- to 15.2-cm) tail. Adults weigh from 10 to 25 ounces (280 to 700 g).

The Richardson ground squirrel (*S. richardsoni*) is smaller and lighter colored than the Franklin. Some are dappled on the back. The squirrel's body measures about 8 inches (20.3 cm) with a tail of from 2 to 4 inches (5 to 10 cm). Adults weigh from 11 to 18 ounces (308 to 504 g).

The Columbian ground squirrel (*S. columbianus*) is easily distinguished from others in its range by its distinctive coloration. Reddish brown (rufous) fur is quite evident on the nose, forelegs, and hindquarters. The head and body measure 10 to 12 inches (25.4 to 30.5 cm) in length with a 3- to 5-inch (7.6- to 12.7-cm) tail. An average adult weighs more than 16 ounces (454 g).

The Washington ground squirrel (*S. washingtoni*) has a small smoky-gray flecked body with dappled whitish spots. The tail is short with a blackish tip. This squirrel is similar to Townsend and Belding squirrels except the latter have no spots. Head and body are about 6 to 7 inches long (15.2 to 18 cm); the tail 1.3 to 2.5 inches long (3.4 to 6.4 cm); and adults weigh 6 to 10 ounces (168 to 280 g).

The Townsend ground squirrel's (*S. townsendi*) head and body range in length from 5.5 to 7 inches (14 to 18 cm). It has a short bicolored tail about 1.3 to 2.3 inches (3 to 6 cm) long, and weighs approximately 6 to 9 ounces (168 to 252 g). The body is smoky-gray washed with a pinkish-buff. The belly and flanks are whitish.

Other species not described here because they cause few economic problems are Idaho (*S. brunneus*), Uinta (*S. armatus*), Mexican (*S. mexicanus*), Spotted (*S. spilosoma*), Mohave (*S. mohavensis*), and roundtail (*S. tereticaudus*) ground squirrels.

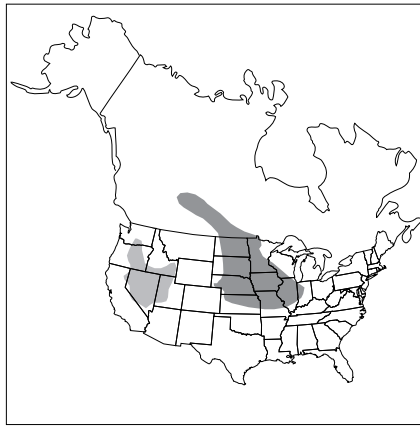


Fig. 2. Range of Franklin (dark) and Townsend ground squirrels (light) in North America.

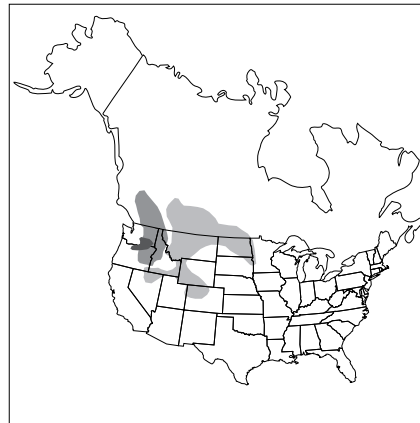


Fig. 3. Range of Richardson (light), Columbian (medium), and Washington ground squirrels (dark) in North America.

Range

Ground squirrels are common throughout the western two-thirds of the North American continent. Most are common to areas of open sagebrush and grasslands and are often found in and around dryland grain fields, meadows, hay land, and irrigated pastures. Details of each species range, which overlap occasionally, are shown in figures 2 and 3.

Food Habits

Ground squirrels eat a wide variety of food. Most prefer succulent green vegetation (grasses, forbs, and even brush) when available, switching to dry foods, such as seeds, later in the year. The relatively high nutrient and oil content of the seeds aids in the

deposition of fat necessary for hibernation. Most store large quantities of food in burrow caches. Some species, like the Franklin, eat a greater amount of animal matter, including ground-nesting bird eggs. Insects and other animal tissue may comprise up to one-fourth of their diet.

General Biology, Reproduction, and Behavior

Ground squirrels construct and live in extensive underground burrows, sometimes up to 6 feet (2 m) deep, with many entrances. They also use and improve on the abandoned burrows of other mammals such as prairie dogs and pocket gophers. Most return to their nests of dried vegetation within the burrows at night, during the warmest part of summer days, and when they are threatened by predators, such as snakes, coyotes, foxes, weasels, badgers, and raptors.

The squirrels generally enter their burrows to estivate, escaping the late summer heat. They hibernate during the coldest part of the winter. Males usually become active above ground 1 to 2 weeks before the females in the spring, sometimes as early as late February or early March. A few may be active above ground throughout the year. Breeding takes place immediately after emergence. The young are born after a 4- to 5-week gestation period with 2 to 10 young per litter. Generally only 1 litter is produced each year. Densities of the ground squirrel populations can range from 2 to 20 or more per acre (5 to 50/ha).

Damage and Damage Identification

High populations of ground squirrels may pose a serious pest problem. The squirrels compete with livestock for forage; destroy food crops, golf courses, and lawns; and can be reservoirs for diseases such as plague. Their burrow systems have been known to weaken and collapse ditch banks and

canals, undermine foundations, and alter irrigation systems. The mounds of soil excavated from their burrows not only cover and kill vegetation, but damage haying machinery. In addition, some ground squirrels prey on the eggs and young of ground-nesting birds or climb trees in the spring to feed on new shoots and buds in orchards.

Legal Status

Ground squirrels generally are unprotected. However, species associated with them, such as black-footed ferrets, weasels, wolves, eagles, and other carnivores may be protected. Local laws as well as specific label restrictions should be consulted before initiating lethal control measures.

Damage Prevention and Control Methods

Exclusion

Exclusion is impractical in most cases because ground squirrels are able to dig under or climb over most simple barriers. Structures truly able to exclude them are prohibitively expensive for most situations. Sheet metal collars are sometimes used around tree trunks to prevent damage to the base of the trees or to keep animals from climbing trees to eat fruit or nut crops.

Cultural Methods/Habitat Modification

Flood irrigation of hay and pasture lands and frequent tillage of other crops discourage ground squirrels somewhat. Squirrels, however, usually adapt by building the major part of their burrows at the margins of fields, where they have access to the crop. During the early part of the season they begin foraging from the existing burrow system into the field until their comfort escape zone is exceeded. When this zone is exceeded and as the litters mature in the colony, tunnels will be extended into the feeding area. Late in the summer or fall, tillage will destroy these tunnels but will not disturb or destroy the original system at the edge of the field.

Some research has been conducted on the effect of tall vegetation on ground squirrel populations and movements. The data, while sketchy, indicate that the squirrels may move out of tall vegetation stands to more open grass fields. The addition of raptor (hawk, owl, and kestrel) nest boxes and perches around the field border or throughout the colony may reduce colony growth, but is not a reliable damage control method.

Toxicants

Zinc phosphide and anticoagulants are currently registered for ground squirrel control. Since pesticide registrations vary from state to state, check with your local extension, USDA-APHIS-Animal Damage Control, or state department of agriculture for use limitations. Additional restrictions may be in effect for areas where endangered species have been identified.

Zinc phosphide has been used for several years to control ground squirrels. It is a single-dose toxicant which, when used properly, can result in mortality rates as high as 85% to 90%. If, however, the targeted animals do not consume enough bait for mortality to occur, they become sick, associate their illness with the food source they have just consumed, and are reluctant to return to the bait. This is called "bait shyness." Repeated baiting with the same bait formulations is generally unsuccessful, particularly when tried during the same year.

Prebaiting may increase bait acceptance with treated grain baits. Prebaiting means exposing squirrels to untreated grain bait several days before using toxic grain. Conditioning the squirrels to eating this new food improves the likelihood of their eating a lethal dose of toxic grain. Prebaiting often improves bait acceptance and, therefore, control. The major disadvantage is the cost of labor and materials for prebaiting.

Zinc phosphide is classified as a Restricted Use Pesticide and as such, can only be purchased or used with proper certification from the state. Certification information can be obtained

from your local Cooperative Extension or state department of agriculture office. Zinc phosphide can be absorbed in small amounts through the skin. Rubber gloves should be worn when handling the bait.

Use only fresh bait. Spoiled or contaminated baits will not be eaten by ground squirrels. Old bait may not be sufficiently toxic to be effective. If zinc phosphide baits are more than a few months old they should not be used, particularly if they have not been stored in air-tight, sealed containers, because they decompose with humidity in the air.

Chlorophacinone and diphacinone are two anticoagulant baits that have been registered in some states for ground squirrel control and have been found to be quite effective. Both are formulated under a number of trade names. Death will occur within 4 to 9 days if a continual supply of the bait is consumed. If baiting is interrupted or a sufficient amount is not maintained during the control period, the toxic effects of the chemicals wear off and the animal will recover.

Baiting should not begin until the entire population is active, 2 to 3 weeks after the first adults appear. If a portion of the population is in hibernation or estivation, only the active animals will be affected.

Bait selection should be based on the animal's feeding habits, time of year, and crop type. Ground squirrel feeding habits vary with the time of year. Grain baits may be more acceptable during the spring when the amount of green vegetation is limited. Pelletized baits using alfalfa or grass as a major constituent may be preferred later in the season.

It is important to test the acceptance of a bait before a formal baiting program begins. Place clean (untreated) grains by several active burrows. Use only grains acceptable to the animals as a bait carrier. If none of the grains are consumed, the same procedure can be repeated for pelletized baits. Several formulations may need to be tried before an acceptable bait is selected.

If control with one bait is unsuccessful, rebaiting with another toxicant may produce the desired results. This is particularly important when zinc phosphide is used. Follow-up treatments with an anticoagulant will often control the remaining animals.

Bait placement is critical. Bait should be scattered adjacent to each active burrow in the amount and manner specified on the label. It should not be placed in the burrow, because it will either be covered with soil or pushed out of the hole by the squirrels. Ground squirrels are accustomed to foraging above ground for their food and are suspicious of anything placed in their tunnel systems. All active burrows must be baited. Incomplete coverage of the colony will result in poor control success.

Where broadcast applications are not allowed, baits can be placed in spill-proof containers. Old tires have been extensively used in the past but are bulky, heavy, and time-consuming to cut apart and move. Furthermore, bait can easily be pushed out by the animals and the tires can ruin a good sickle bar or header if not removed from a field before harvest. Corrugated plastic drain pipe of different diameters cut into 18- to 24-inch (46- to 61-cm) lengths provide an inexpensive, light-weight, and easy-to-use alternative.

Bait stations should be placed in the field at about 50-foot (15-m) intervals a week or so before treatments are to begin. Once the animals use the stations frequently, baiting can begin. Not all bait stations will be used by the squirrels at the same time or with the same frequency. Each station should be checked every 24 hours and consumed or contaminated baits replaced until feeding stops. When the desired level of control has been achieved, the bait stations should be removed from the field and the old bait returned to the original container or properly disposed.

Fumigants

Fumigants are best suited to small acreages of light squirrel infestations.

Most are only effective in tight, compact, moist soils over 60° F (15° C). The gas dissipates too rapidly in loose dry soils to be effective in any extensive burrow system. Ground squirrel burrow systems are often complex with several openings and numerous interconnecting tunnels. The cost of using gas cartridges may be more than eight times the cost of using toxic baits.

Fumigants registered for ground squirrel control include aluminum phosphide and gas cartridges. Cartridges may contain several combustible ingredients.

When using aluminum phosphide, place tablets at multiple entrances at the same time. Insert the tablets as far back into the burrows as possible. Water may be added to the soil to improve activity. Never allow aluminum phosphide to come into direct contact with water, because the two together can be explosive. Crumpled paper should be placed in the hole to prevent the fumigant from being pushed out of the hole by the animals or being covered by loose soil. Plug the burrow opening with soil to form an air-tight seal. Monitor the area for escaping gas and plug holes as needed.

When using gas cartridges, punch five or six holes in one end of each gas cartridge and loosen the contents for more complete combustion before use. Insert and light a fuse. Gently slide the cartridge, fuse end first, as far back into the burrow opening as possible and immediately seal the hole with soil. Do not cover or smother the cartridge. Follow all label instructions.

Phosphine gas is toxic to all forms of animal life. Inhalation can produce a sensation of pressure in the chest, dizziness, nausea, vomiting, and a rapid onset of stupor. Affected people or animals should be exposed to fresh air and receive immediate medical attention. Never carry a container of aluminum phosphide in an enclosed vehicle.

Trapping

Traps are best suited for removal of small populations of ground squirrels where other control methods are

unsatisfactory or undesirable. Jaw traps (No. 1 or No. 0), box or cage traps, and burrow entrance traps may be used.

Place leghold traps where squirrels will travel over them when entering and leaving their burrows. Conceal the trap by placing it in a shallow excavation and covering it with 1/8 to 1/4 inch (0.3 to 0.6 cm) of soil. Be certain that there is no soil beneath the trap pan to impede its action. No bait is necessary.

Box or cage traps may be set in any areas frequented by ground squirrels. Place them solidly on the ground so that they will not tip or rock when the squirrel enters. Never place the trap directly over a hole or on a mound. Cover the floor of the trap with soil and bait it with fresh fruit, vegetables, greens, peanut butter, or grain. Experiment to find the best bait or combination of baits for your area and time of year. Wire the door of the trap open for 2 to 3 days and replenish the bait daily to help overcome the squirrel's trap shyness and increase trapping success.

Burrow entrance traps may also be useful. See **Thirteen-lined Ground Squirrels** for a description of this type of trap.

Shooting

Shooting may provide relief from ground squirrel depredation where very small colonies are under constant shooting pressure. It is, however, an expensive and time-consuming practice. Hunting licenses may be required in some states.

Other Methods

Gas exploding devices for controlling burrowing rodents have not proven to be effective. Propane/oxygen mixtures injected for 45 seconds and then ignited only reduced the population by about 40%. Vacuum devices that suck rodents out of their burrows are currently being developed and tested. No reliable data, however, exist at this time to confirm or deny their efficacy.

Economics of Damage and Control

Very little is known about the economic consequences of ground squirrels foraging in agriculture. A single pair and their offspring can remove about 1/4 acre (0.1 ha) of wheat or alfalfa during one season. Water lost from one canal can flood thousands of acres or cause irrigation failures. The crop loss and cost of repair can be very expensive. Prevention, by incorporating a rodent management plan into the total operation of an enterprise, far outweighs the cost of added management practices.

Acknowledgments

Figure 1 from Schwartz and Schwartz (1981).

Figures 2 and 3 adapted from Burt and Grossenheider (1976) by David Thornhill.

Some of the material included in this draft was written by C. Ray Record in the 1983 edition of *Prevention and Control of Wildlife Damage*.

For Additional Information

- Albert, S. W., and C.R. Record. 1982. Efficacy and cost of four rodenticides for controlling Columbian ground squirrel in western Montana. Great Plains Wildl. Damage Control Workshop. 5:218-230.
- Andelt, W. F., and T. M. Race. 1991. Managing Wyoming (Richardson's) ground squirrels in Colorado. Coop. Ext. Bull. 6.505, Colorado State Univ. 3 pp.
- Askham, L. R. 1985. Effectiveness of two anticoagulant rodenticides (chlorophacinone and bromadiolone) for Columbian ground squirrel (*Spermophilus columbianus*) control in eastern Washington. Crop Protect. 4(3):365-371.
- Askham, L. R. 1990. Effect of artificial perches and nests in attracting raptors to orchards. Proc. Vertebr. Pest. Conf. 14:144-148.
- Askham, L. R., and R. M. Poché. 1992. Biodeterioration of chlorophacinone in voles, hawks and an owl. Mammalia 56(1):145-150.
- Burt, W. H., and R. P. Grossenheider. 1976. A field guide to the mammals, 3d ed. Houghton Mifflin Co., Boston. 289 pp.
- Edge, W. D., and S. L. Olson-Edge. 1990. A comparison of three traps for removal of Columbian ground squirrels. Proc. Vertebr. Pest Conf. 14:104-106.
- Fagerstone, K. A. 1988. The annual cycle of Wyoming ground squirrels in Colorado. J. Mamm. 69:678-687.
- Lewis, S. R., and J. M. O'Brien. 1990. Survey of rodent and rabbit damage to alfalfa hay in Nevada. Proc. Vertebr. Pest Conf. 14:116-119.
- Matschke, G. H., and K. A. Fagerstone. 1982. Population reduction of Richardson's ground squirrels with zinc phosphide. J. Wildl. Manage. 46:671-677.
- Matschke, G. H., M. P. Marsh, and D. L. Otis. 1983. Efficacy of zinc phosphide broadcast baiting for controlling Richardson's ground squirrels on rangeland. J. Range. Manage. 36:504-506.
- Pfeifer, S. 1980. Aerial predation of Wyoming ground squirrels. J. Mamm. 61:371-372.
- Schmutz, J. K., and D. J. Hungle. 1989. Populations of ferruginous and Swainson's hawks increase in synchrony with ground squirrels. Can. J. Zool. 67:2596-2601.
- Schwartz, C. W., and E. R. Schwartz. 1981. The wild mammals of Missouri, rev. ed. Univ. Missouri Press, Columbia. 356 pp.
- Sullins, M., and D. Sullivan. 1992. Observations of a gas exploding device for controlling burrowing rodents. Proc. Vertebr. Pest Conf. 15:308-311.
- Tomich, P. Q. 1992. Ground squirrels. Pages 192-208 in J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America. The Johns Hopkins Univ. Press., Baltimore, Maryland.
- Wobeser, G. A., and F. A. Weighton. 1979. A simple burrow entrance live trap for ground squirrels. J. Wildl. Manage. 43:571-572.

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