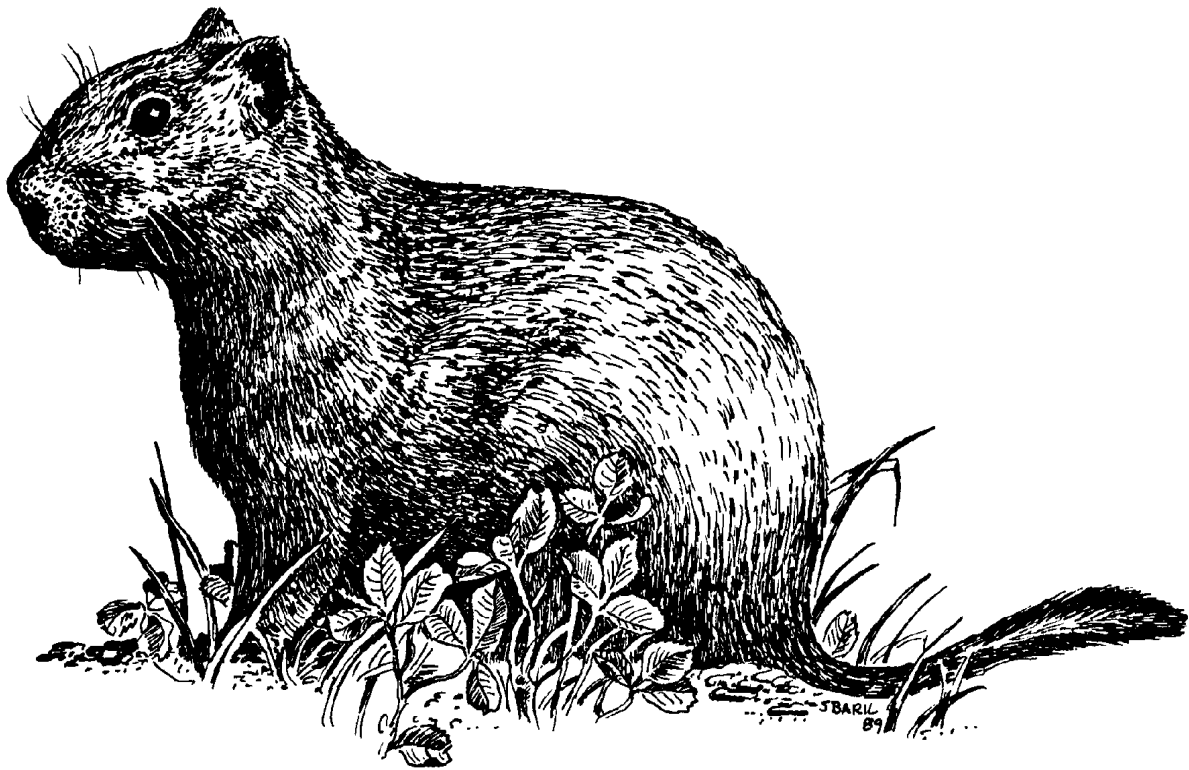


# **THE RICHARDSON'S GROUND SQUIRREL**

## **ITS BIOLOGY AND CONTROL**



**MONTANA DEPARTMENT OF AGRICULTURE**  
**302 North Roberts**  
**HELENA, MT 59601**

## BIOLOGY

The Richardson's ground squirrel (*Urocitellus richardsonii*, formerly known as *Spermophilus richardsoni*) is a medium-sized ground squirrel with coloration ranging from yellow-tan to gray (Fig. 1). The tail is black to buff with white hairs on the outer edges and is about  $\frac{1}{4}$  of the total body length. Adults are 7 to 9 inches long (not including the tail) and weigh 11 to 18 ounces.



Figure 1. Richardson's ground squirrel.

In Montana, the Richardson's ground squirrel lives in areas east of the Continental Divide; except for in the southeastern corner (Fig. 2). They prefer agricultural areas with open spaces and well drained fields and avoid high mountains and heavily forested habitats.

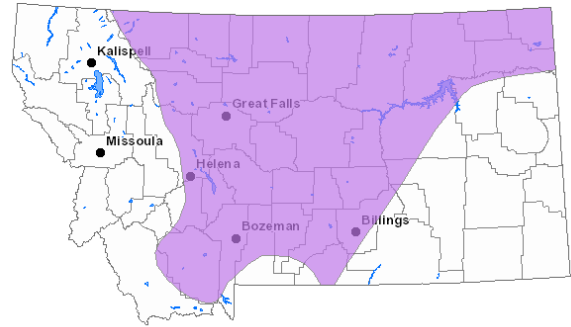


Figure 2. Range of Richardson's ground squirrels.

Richardson's ground squirrels emerge from hibernation between February and April; depending largely on elevation and local weather conditions. Males emerge first and establish breeding territories. Females emerge from hibernation about 10 to 14 days later. The breeding period is short and synchronous in a local area but may extend over several weeks from one part of the squirrel's range to another. After a 24-day gestation period, mated females give birth to a single litter in April or May. Litters average six to seven young. The young become active above ground about four weeks after birth. By the end of the summer, juveniles are nearly adult size.

Ground squirrels consume a wide variety of grasses, forbs, and seeds of natural and domesticated plants. Their preference for green, succulent vegetation is likely due to their quest for moisture as free water is not generally available in their habitat. They consume seeds for their high fat content and although primarily vegetarian, ground squirrels on occasion will consume insects and carrion.

As vegetation dries during mid- to late-summer, many ground squirrels enter hibernation. Some portions of the adult population may begin hibernation in late July, although the majority will wait until August. If necessary, young and some adults may continue activity into September and October to acquire sufficient fat reserves to carry them through hibernation. During mild autumns,

some ground squirrels may be active until November.

Ground squirrels are true hibernators. Respiration, heart rate and other metabolic functions drop significantly during hibernation. Squirrels are not known to eat or drink during hibernation but will slowly metabolize the fat reserves accumulated during the summer activity period.

## DAMAGE

The Richardson's ground squirrel's extensive distribution in Montana, its reproductive potential, and its ability to damage a wide variety of agricultural crops, makes it one of the most economically important rodent species in Montana. Ground squirrels damage grain crops by consuming and trampling the grain plants. Damage most often occurs when squirrels reside in uncultivated border areas and enter the crop edges to feed on the grain plants. Forage crops, such as alfalfa, pasture and range, often are inhabited by ground squirrels (Fig. 3).

Research has shown alfalfa production can fall by 25 percent or more in areas where Richardson's ground squirrels occur. In addition to crop damage, mounds can interfere, and damage machinery used to harvest forage crops. Mounds and burrow openings in sporting fields increase the potential for players to sustain twisted ankles and other injuries. The extent to which mounds and holes increase hazards to livestock is unclear. Burrowing activity may contribute to increased soil erosion, undermining dams, and providing sites for weed plants to grow. Ground squirrel burrows can range in size from 11 to 49 feet in length and be 2½ to 7 feet deep.



Figure 3. Damage by Richardson's ground squirrels.

## CONTROL

One rule of thumb says that producers should consider controlling ground squirrels when active burrows occur at a rate of one every four paces.

Several control methods are available for the management of Richardson's ground squirrels. It is important to select the method(s) that will be safe and effective in your situation. It is misguided to rely on population reduction alone to resolve conflicts with Richardson's ground squirrels. If population reduction fails to remove at least 90 percent or greater, their reproduction rate will quickly restore the population in a season or two.

## CULTURAL AND BIOLOGICAL

Cultural and biological control methods are an essential part of an effective long-term management plan. They can increase the effectiveness of techniques that directly reduce ground squirrel numbers.

Frequent crop rotations can discourage dense populations of ground squirrels by disrupting their food supply. Frequent flood irrigation also can reduce rodent problems; however, border areas can still be populated with ground squirrels and severe crop damage may occur along field edges. Coyotes, foxes, weasels,

owls, hawks, eagles, badgers, skunks, snakes, and other predators prey upon Richardson's ground squirrels and other rodent pests. While their predation is helpful in managing rodent populations, they will not eliminate rodents. Badgers, for example, tend to move to new hunting grounds when the ground squirrel population falls below 20 percent of previous levels. Nevertheless, landowners should encourage the presence of predators whenever possible. Installation of poles for raptors to perch on is an easy way to encourage their presence. Since raptors are territorial, place poles no closer than one every 10 acres. Additionally, raptors prefer tall poles so endeavor to install ones that will be at least 23 feet or higher.

Destroy the dens of ground squirrels whenever practical. Research suggests that failures to control ground squirrel populations are largely due to neighboring ground squirrels immigrating and reoccupying empty dens. For best results, destroy dens down to at least 18 inches in depth. A device called the BurrowBlocker™ creates a slurry of water and masonry sand to fill burrows. The device is expensive and has not undergone rigorous scientific review, but anecdotal reports suggest it can substantially reduce reoccupation of abandoned burrows.

## **SHOOTING**

Shooting ground squirrels with a 410 shotgun, .22 cal., or pellet rifle can reduce damage in small acreages and reduce ground squirrels that remain after baiting operations. Use of steel shot or non-frangible bullets will reduce the risk of poisoning raptors and other carnivores that will feed on the carcasses. An alternative to changing bullet type, is to collect and dispose of carcasses by deep burial. Wear protective gloves and insect repellent when handling carcasses to reduce contact with fleas and other disease carrying insects. Always maintain safe shooting practices and be sure that shooting is legal in your locale. Shooting

is costly both in materials and time, however, costs are significantly lower if done soon after ground squirrel emergence from hibernation in February-March.

## **TRAPS**

Traps can be effective in areas where other control methods may be too hazardous. Place traps in areas where squirrels are active, such as the main burrow entrance which will be marked with a large soil plume in front of it. Anchor traps to the ground to prevent dogs or scavengers from carrying them away. Stable traps will not fire prematurely when encountered by the ground squirrel. State regulations suggest traps be checked every 48 hours, but you will have better success checking traps more frequently (e.g., midday and dusk); particularly in the early phase of your trapping activity. Traps must have a metal tag containing the name and address of the owner when trapping on land not owned or rented by the trapper. Several types of traps are available.

Use cage/box traps when trapping in residential or high traffic areas where the risk of capturing non-target animals is high. Use single, spring-loaded door traps with ½- x 1-inch mesh, size 5 x 5 x 18 inches, which are large enough to catch Richardson's ground squirrels. Models with guillotine rear doors allow for easier baiting but will be more expensive. Bait traps with grain, peanut butter, or fresh greens. For better results, condition the ground squirrels to feel comfortable around the traps by wiring the doors open and pre-baiting for several days. Squirrels can die of heat stress when caught in a trap exposed to the sun or excessive heat. For this reason, traps should be shaded. Shading also provides trappers with the ability to approach the trap without being seen if a skunk happens to be trapped. Make sure you know how to release a trapped skunk BEFORE using cage/box traps.



Richardson's can be caught in multiple-catch cage traps such as the Tomahawk M30H Multiple Catch Trap with three inch doors. Secure a sheet of ¼-inch plywood under the trap to prevent ground squirrels from accessing bait by digging under the trap. Obtain a water dispensing device and cloth cover for at least the top half of the trap. Wire the doors open, and bait the trap with sweet feed. Locate the trap in an area where ground squirrels are active. When they are feeding well, lower the door to ¼ the height. This will teach them to push through. When they are accustomed, lower the door completely. Check daily.

Captured squirrels should be humanely dispatched or euthanized. Translocation (transporting and releasing ground squirrels, or other wildlife, to new areas) is not legal unless permission is gained from the landowner. Nevertheless, translocation is not recommended on humane grounds as squirrels must find shelter and food while avoiding predators in an unfamiliar area. The potential for disease transmission is of concern also.

In isolated areas, body-gripping traps such as the 2.5-inch or 3.5-inch RBGs (round body grip) or Lee's gopher trap (GT2006) can be used effectively to control ground squirrels (Fig. 4). The 110 Conibear® trap is also effective but is more difficult to set over the hole due the square jaws.

Set these devices directly in front of, or over a burrow entrance so that the ground squirrel must pass through the trap. Baiting is discouraged and unnecessary as bait will encourage non-target animals to approach these traps and possibly become injured.

Several body-gripping style traps are available for use with bait, such as peanut butter or seeds. For example, the wooden DK-2 Gopher Getter trap and similar versions may be baited to capture ground squirrels. Rat-sized snap traps also are effective but should be placed inside protective boxes with 2-inch wide holes

to prevent birds and other non-target animals from being attracted to the bait (Fig. 5). You may build your own boxes out of scrap wood or metal, or you may purchase them from pest control suppliers.



Figure 4. A GT2006 set at a Richardson's ground squirrel burrow.



Figure 5. A J.T. Eaton™ Rat size Snap Trap Station (open for viewing) holding a Victor® rat trap (expanded trigger; Left) and a Kness Snap-E® rat trap (Right).

While body-gripping traps are designed to kill, they do not always kill consistently, so use caution when approaching the traps to avoid a bite from an injured ground squirrel. To avoid scavengers from taking captures along with your traps, anchor traps securely or check traps prior to nightfall.

Trapping is an effective, generally safe control method for ground squirrels; no pesticide license is required. Wear protective gloves when trapping to protect yourself from cuts, scratches and other potential health threats related to vertebrate control. Be aware that trapping is labor intensive, and practical only for control of ground squirrels in small acreages.

## RODENTICIDES

Several chemicals labeled to control Richardson's ground squirrels are available. The pesticide applicator must follow the guidelines found on the label because failure to do so may result in poor results, injury to non-target animals and the environment, as well as injury to the applicator and other human beings. **THE LABEL IS THE LAW.**

**Burrow fumigants** are pesticidal products that release toxic gases into a burrow system. Labor and cost of materials usually restrict the use of fumigants to small populations. Fumigants are recommended as a cleanup method after the use of toxic bait, or in areas where it is considered unsafe to use toxic baits. Never apply fumigants to burrows or against non-target animals. Likewise, never use fumigants within 100 feet of a structure to reduce the risk of poisoning inhabitants and/or causing a structural fire.

Ignitable gas cartridges are general use pesticides containing the active ingredients carbon and sodium-nitrate (Fig. 6).



Figure 6. Ignitable gas cartridges.

When the fuse is lighted, the cartridge produces toxic gases, primarily carbon monoxide, while consuming available oxygen in the burrow system. Ensure that the cartridge will fit inside the burrow **BEFORE** lighting. After lighting the fuse, place the cartridge, fuse end first, down into the burrow. Plug the burrow opening with sod and soil; tamping it down lightly with a shovel. Avoid placing soil onto the cartridge as this may prevent it from burning completely. Secure adjacent burrow openings to prevent smoke from escaping. Employ great care when using gas cartridges during dry conditions to prevent accidental fires. Gas cartridges are most effective in moist soils because the water makes the soil less porous, which helps retain toxic gas in the tunnels. In addition, moist conditions reduce the risk of fire.

Aluminum phosphide tablets or pellets are restricted use pesticides due to the highly toxic nature of phosphine gas that is released in the presence of moisture (a tablet releases about five times as much gas as a pellet). In 2026, applicators will need to obtain a non-soil fumigation license category to use restricted use fumigants. Contact your county extension agent or the Montana Department of Agriculture for licensing information.

Since phosphine gas will react to skin moisture, as well as be absorbed through the skin, always wear cotton gloves and stand-up wind during applications (Fig. 7). Open

canisters only in well-ventilated areas, such as outdoors.



Figure 7. Cotton gloves with a container of phosphine-based fumigant.

Secure canister lids when not in use, and store in a dry area not accessible or inhabited by humans, pets or livestock. Follow label instructions carefully.

Place 1 to 2 tablets or 5 to 10 pellets into active burrows. Use the lower number when soils are moist and a higher number when soils are dry. Place tablets/pellets deep enough to prevent their being covered with soil when the entrance is sealed. You may find that using a length of 1- to 2-inch diameter plastic pipe is helpful in placing tablets/pellets deep into the burrows.

After removing the pipe, plug the burrow opening with crumpled newspaper or sod, cover with soil and tamp tightly with a shovel. Treat every opening of the active burrow.

**NOTE:** In 2012, the labels of all aluminum phosphide products underwent significant changes in regards to the fumigation of burrowing rodents. Some of these changes include:

- 1). Completion of a detailed written Fumigant Management Plan (FMP) is required prior

to fumigation. A template for a FMP can be obtained from fumigant manufacturers or the Montana Department of Agriculture website <https://agr.mt.gov/Vertebrate-Pests>.

- 2). Prior to applying aluminum phosphide to rodent burrows, the applicator must provide the customer with a copy of the completed Fumigant Management Plan.
- 3). Aluminum phosphide fumigants use is strictly prohibited for fumigating rodent burrows on single or multi-family residential properties as well as nursing homes, schools (except athletic fields), day care facilities and hospitals.
- 4). Aluminum phosphide fumigants cannot be applied to a rodent burrow system that is within 100 feet of a building that is, or may be, occupied by humans and/or domestic animals.
- 5). A phosphine gas monitor must be used when handling and applying aluminum phosphide burrow fumigants. Ensure that exposure to phosphine gas does not exceed 0.3 ppm for the eight-hour time weighted average (TWA) or the 15-minute short term exposure limit (STEL) of 1.0 ppm. If these limits are exceeded, vacate the treated area until phosphine gas is reduced below these levels.

Other restrictions and regulations are presented in the updated aluminum phosphide labels. Be sure to read and follow the entire label, which consists of the container label and the Supplemental Applicator's Manual.

#### **Unregulated Gas Treatment Methods.**

Carbon-monoxide injectors and propane-oxygen exploders are not regulated and do not require a license to use. Applicators are advised to avoid using either method to treat burrows within 20 feet of structures. Using a wider no treatment zone is highly recommended.



Carbon-monoxide is a highly toxic gas that kills animals by preventing the bonding of oxygen with hemoglobin. Carbon-monoxide is created by a motor which also generates the pressure needed to force the gas into the burrow system via a probe. Research by MDA found that the method has an efficacy of rate of 86% with a one-minute injection time. Applicators should use this device cautiously to avoid exposing oneself or others to carbon-monoxide gas.

Propane-oxygen exploders apply a mixture of propane and oxygen into the burrow system, which is then ignited. The ground squirrel is killed by the concussive force of the explosion. Users have suggested limiting the injection time to no more than 15 seconds. We suggest starting at 10 seconds and evaluate efficacy and safety. Always consult Montana 811 to identify the location of any underground utilities as the explosion from this device can damage underground utilities. Caution also is required as the fiery concussion can start fires and injure applicators and bystanders. We encourage readers to carefully evaluate these products before purchasing.

**Toxicants** are poisonous items designed to kill animals that eat them. At the time of publication, only zinc phosphide and chlorophacinone are registered for the control of Richardson's ground squirrels. Montana does register some rodenticides due to special local needs or SLNs (also known as 24c labels). Applicators using pesticides registered under special local needs must have the federal pesticide label (if available) and the special local needs label in their possession (i.e., on site) when applying. Special Local Needs (SLN) pesticides and their labels may be found at <https://agr.mt.gov/Vertebrate-Pests>

Availability of certain rodenticides is sometimes uncertain because of changing registration status. Also, different labels have different restrictions. You can look up different zinc phosphide labels by visiting

[http://npirspublic.ceris.purdue.edu/state/state\\_menu.aspx?state=MT](http://npirspublic.ceris.purdue.edu/state/state_menu.aspx?state=MT) and inserting zinc phosphide in the active ingredient search box. Presently, all zinc phosphide baits for Richardson's ground squirrels are restricted use pesticides.

Additional support can be obtained through your local county extension agent, pesticide dealer, or the Montana Department of Agriculture representatives listed at the end of this bulletin.

Zinc phosphide treated bait is most effective when applied early in the spring, shortly after the squirrels emerge from hibernation, and prior to spring green-up. Do not apply the bait if weather conditions forecast moisture within two days of application.

Zinc phosphide treated bait may be applied by hand baiting (application of toxicant to individual burrows) or broadcast baiting (application of toxicant to an area containing burrows). When hand baiting, apply one teaspoon of bait with a dipper or bait dispenser on bare soil near each active burrow (Fig. 8).

Do not place bait in piles or down the entrances of burrows. Do not apply treated grain if ground squirrels are not feeding on the pre-bait. Hand baiting may be used to control ground squirrels to non-crop areas, rangeland, pasture, alfalfa, wheat, oats, and barley.

Broadcast baiting may be used in rangelands, pastures, non-crop areas, orchards, and crop areas including, barley, wheat, and alfalfa. In 2018, a 24c special local needs label MT 18-0005 was granted for the broadcast application of ZP® Ag Pellets EPA Reg. No. 12455-17-3240 in fallow ground without prebaiting. Applications must occur between March 1 and July 31. Broadcast applications may require applicators to wear more safety equipment, such as respirators and eye protection. Read labels carefully to ensure you are following all safety recommendations. Unfortunately, the 24c is not available at this time.





Figure 8. A long-handled bait dispenser can be constructed easily with a copper end cap, rivet, and ¼-inch rod. Compare the end-cap's capacity against a teaspoon cooking measurer to confirm correct volume.

Applications must be timed to prevent entry of toxicant into the food supply. Check label for appropriate restrictions. Livestock also must be kept out of application areas. Not all labels require pre-baiting, but research has shown that pre-baiting substantially improves baiting efficacy. Pre-bait the areas suitable for treatment two to three days prior to the planned application. Only apply toxic bait if ground squirrels are feeding on the pre-bait.

Rozol® is the only anticoagulant registered for control of Richardson's ground squirrels in Montana. Anticoagulants are chemicals that inhibit the blood's ability to clot. Animals receiving a lethal dose, die from internal hemorrhaging and external cuts that continue to bleed. Since ground squirrels must feed multiple times to obtain a lethal dose, it is essential that sufficient bait is available. Always read and follow the label. Presently, no pesticides are registered for the control of ground squirrels on residential lawns.

### **Ramik® Green**

Ramik® Green, active ingredient diphacinone, (Neogen Ramik Green EPA# 61282-46) is a general use product whose Special Local Needs Label (SLN) has expired and is no longer registered for the control of ground squirrels.

Two Rozol® baits, active ingredient, chlorophacinone, are available, Liphatech, No.

7173-305 and Liphatech; No. 7173-184; MT SLN #00-0007). Both are restricted use pesticides. However, the differences between the labels are quite significant. For example, when spot baiting the 7173-305 label requires application of ¼-cup per burrow while the SLN 00-007 label requires only 1 tablespoon. Applicators should read and compare the two labels prior to purchasing to ensure that the right product is used.

Rozol products can be used in rat-sized tamper-resistant bait stations, capable of preventing children (up to 6 years of age) and larger animals from accessing the bait (Figs. 9-10).

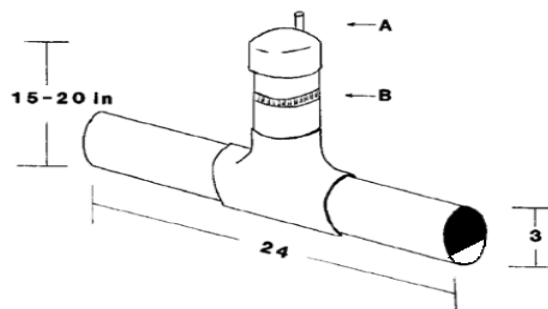


Figure 9. Top. "T" Style PVC Bait Station. typically used in agricultural areas. A. Re-bar stake. B. Adjustable pipe clamp. Note the half-moon end cap to prevent bait from spilling out of the pipe.



Figure 10. This Protecta® Tamper-resistant rat-sized rodent bait station is just one of the many different brands and types of bait stations suitable for holding toxic bait or rat-sized snap traps.

Stations must be constructed to prevent spillage of bait. They must be anchored to

prevent being overturned by wind, livestock, pets, and wildlife. Stations must be positioned where ground squirrels can access them readily, preferably near burrows. Bait stations must be maintained regularly to ensure a constant supply of bait for at least 30 days.

For details on building and using bait stations, download our bulletin on bait stations at <https://agr.mt.gov/Vertebrate-Pests>.

Each bait station will control ground squirrels up to 100 feet away from the device. Place bait stations in areas with active burrows. Use multiple stations in areas with high numbers but do not exceed pounds per acre listed on the label. While the initial set up with bait stations is high in both time and investment, the ease of refilling and the longevity of the bait in poor weather conditions provide excellent advantages, particularly over the long term. Failure to maintain bait stations may result in ground squirrels not achieving a lethal dose.

The use of bait stations is ideal for creating a buffer zone to control ground squirrels migrating into an area where resident ground squirrels have been removed. Ground squirrels can travel considerable distances, although most probably disperse less than 250 yards in a year. Treatment areas adjacent to nearby squirrel populations can be quickly reoccupied by dispersing squirrels and may return to pretreatment levels by the following season. In some cases, use of a buffer zone around the treatment area may give two to three years of protection before re-treatment is necessary.

**Timing.** The use of toxic grain baits is the most cost-effective method for controlling Richardson's ground squirrel populations over large acreages. Apply bait only when the entire squirrel population is active and readily accepting grain. For example, males emerge from hibernation about two weeks prior to females, so applying toxicants too soon will only result in controlling males. The breeding period is often an ideal time for control operations. Appropriate timing of control will

eliminate adults and potential young as well as insuring minimal crop damage. However, this period of time is relatively short in duration. Once vegetation begins to green-up, the ground squirrels' acceptance of grain bait is reduced. If bait is not applied during the breeding season, control should be postponed until the young appear above ground and are feeding independently. Once the females begin bearing and rearing young, their activity is reduced and baiting is not as effective. Baiting is not recommended after mid-July since activity declines and squirrels enter hibernation.

To help determine correct timing for early spring bait applications, collect a sample of 12 to 20 ground squirrels by shooting or trapping. The specimens should be sexed and internally inspected. Sexing Richardson's ground squirrels often requires measuring the distance between the anus and genitals (the distance is longer for males than females). During mating season, the scrotum sac of the males should be clearly visible and after mating, the mammary glands of females will be visible for two months. Samples containing at least 50 percent females indicate good activity by both sexes. A sex ratio heavily favoring males indicates that female activity is minimal, and baiting will be less effective. Postpone baiting if the sampled females are bearing or nursing young. Such sampling is not necessary for summer baiting.

**Acceptance testing.** After concluding that the entire population is active, evaluate bait acceptance levels. Failure to test ground squirrel acceptance of bait may result in a wasted application, as well as expose non-target animals to the toxic bait. The pre-baiting information that follows is critical for use of zinc phosphide treated baits. It can be helpful when using anticoagulant baits but is not necessary.

Perform a pretest by scattering a teaspoon of untreated rolled or crimped oats in a 6-inch

circle near 25 or more active burrows. Active burrows will have a clean and well-maintained appearance. Space these test spots apart by at least 25 feet. Mark each spot so they can be monitored for one to two days. If the bait is consumed, then a similar response can be expected when the poison bait is applied. If the whole oats are poorly accepted, application of the poison bait should be delayed until bait acceptance improves.

**Principles of good toxicant use include** using good quality bait that is fresh and recently manufactured. Potency of the bait usually does not degrade but it may dry out or be contaminated during storage. Since bait must compete with the ground squirrels' traditional foods, fresh uncontaminated bait has the best chance of being consumed. If bait must be carried over to the following season, store in cool to moderate temperatures to reduce dehydration. Store bait in a separate, mouse proof area away from other chemicals to prevent contamination.

Avoid frequent baiting. If initial control yields poor results, re-baiting will likely give poor control as well. Squirrels surviving the first bait treatment may have eaten a sub-lethal dose of the bait and learned to avoid re-applications. This avoidance is known as "bait shyness." For this reason, time the bait application only when tests show good bait acceptance.

**Safety is essential when using toxic baits.** Toxic baits present two types of hazards to non-target animals. Primary poisoning occurs when a non-target animal consumes the toxicant directly. Secondary poisoning occurs when a predator or scavenger feeds on the carcasses of poisoned animals.

Non-target animals most at risk from primary poisoning are domestic livestock, poultry, and certain seed-eating wildlife species, including waterfowl, grouse, and some songbirds. Reduce the risk of primary poisoning by carefully following pesticide label directions

and by implementing safety practices such as those listed below:

- 1) Keep baits in original labeled containers and store in locked, weather tight, rodent proof storage when not in use.
- 2) Store excess bait in locked or latched storage to prevent access by livestock or children.
- 3) Use calibrated dippers or spoons for applying bait. Apply only the label recommended amount. Scatter the bait over a 2 to 3 square foot area near each active burrow. Piling the bait increases the hazard to livestock and wildlife and it is not a natural food placement for squirrels.
- 4) Remove livestock from treatment areas. In addition to reducing risk to livestock, ground squirrel control will improve if livestock are not trampling on bait placements.
- 5) Implement, whenever possible, additional precautions, such as patrolling the area or using scare devices after bait application in areas known to be frequented by waterfowl or other seed eating birds. Consider the use of alternative methods, such as burrow fumigants or bait stations in high-risk areas.
- 6) Pick-up and bury any spilled bait and remove dead and dying ground squirrels.

Note that the potential for secondary poisoning from zinc phosphide is very low because zinc phosphide converts to phosphine gas when it contacts moisture, such as from stomach acid. Thus, the phosphine gas dissipates from the carcass quickly after death leaving little residue to cause secondary poisoning. Anticoagulants, like Rozol, do not dissipate from carcasses as rapidly. Anticoagulants remain in the liver and are thus available to harm scavengers that feed upon the carcass. Wild and domestic canine and feline species are especially susceptible to poisoning from anticoagulant rodenticides. Reduce the danger to non-target animals by burying ground squirrel carcasses.

Secondary poisoning from rodent bait applications is most significant for animals that consume the entire carcass such as dogs, coyotes, badgers, and owls. In warm weather, carcasses decompose rapidly and present little hazard after 5 to 10 days. Notify neighbors of your bait applications. Suggest confinement of dogs, cats, or other animals for two weeks after bait application.

## DISEASE SAFETY

Though rare, *Yersenia pestis*, the disease that causes plague and the fleas associated with transmitting the disease, have been found in Richardson's ground squirrels.

Outbreaks of plague can occur without warning; however, the risk is greater in areas where plague has occurred in the past. Individuals involved in the control of Richardson's ground squirrels should wear insect repellent with the active ingredient DEET and always wear gloves when handling ground squirrels or working near their dens. Fleas can jump up to 13 inches; one only has to come in close proximity to be at risk (Fig. 11). Individuals should monitor their health for at least a week as the symptoms of plague usually begin within 6 days of exposure. If flu-like symptoms occur, inform medical professionals that you have been working around ground squirrels. Readers should be aware that free-ranging pets, such as cats, can transport fleas back to residences, and thereby provide another potential avenue for exposure.

## DEPARTMENT SERVICES

As with most programs, rodent control will be most effective when all affected landowners work together. The Montana Department of Agriculture vertebrate pest specialist program will work with county commissioners, extension agents and landowners to establish a program suited to local and county needs. Field demonstrations are provided to inform landowners how, when, and where to control Richardson's ground squirrels and other field

rodent pests. Interested individuals should contact the Montana Department of Agriculture.



Figure 11. A view of a flea via an electron microscope.

In Lewistown:

Stephen M. Vantassel, ACE

Vertebrate Pest Specialist

Phone (406) 431-7720 [svantassel@mt.gov](mailto:svantassel@mt.gov)

Additional printed information on the control of ground squirrels and other vertebrates is available from the Montana Department of Agriculture website  
<https://agr.mt.gov/Vertebrate-Pests>

**MONTANA POISON CONTROL**  
**(Emergencies) 1-800-222-1222**

Always attempt to contact your county/local health department before reaching out to the state office.

**MONTANA DEPARTMENT OF PUBLIC  
HEALTH & HUMAN SERVICES**  
**1-406-444-5622**  
<https://dphhs.mt.gov/>

Disclaimer: Reference to commercial products or trade names is made with the understanding that no



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## CREDITS

Cover. J. Baril.

Fig. 1. Canada Hky; [www.wikimedia.org](http://www.wikimedia.org)

Fig. 2. Montana Field Guide.

<http://fieldguide.mt.gov/>

Figs. 3-8. Stephen M. Vantassel; Montana

Department of Agriculture

Fig. 9. Montana Department of Agriculture

Figure 10. Stephen M. Vantassel

Fig. 11. Janice Haney Carr; Centers for Disease  
Control.