



# Burrowing Rodent Management

Niamh Quinn, PhD

Human-Wildlife Interactions Advisor

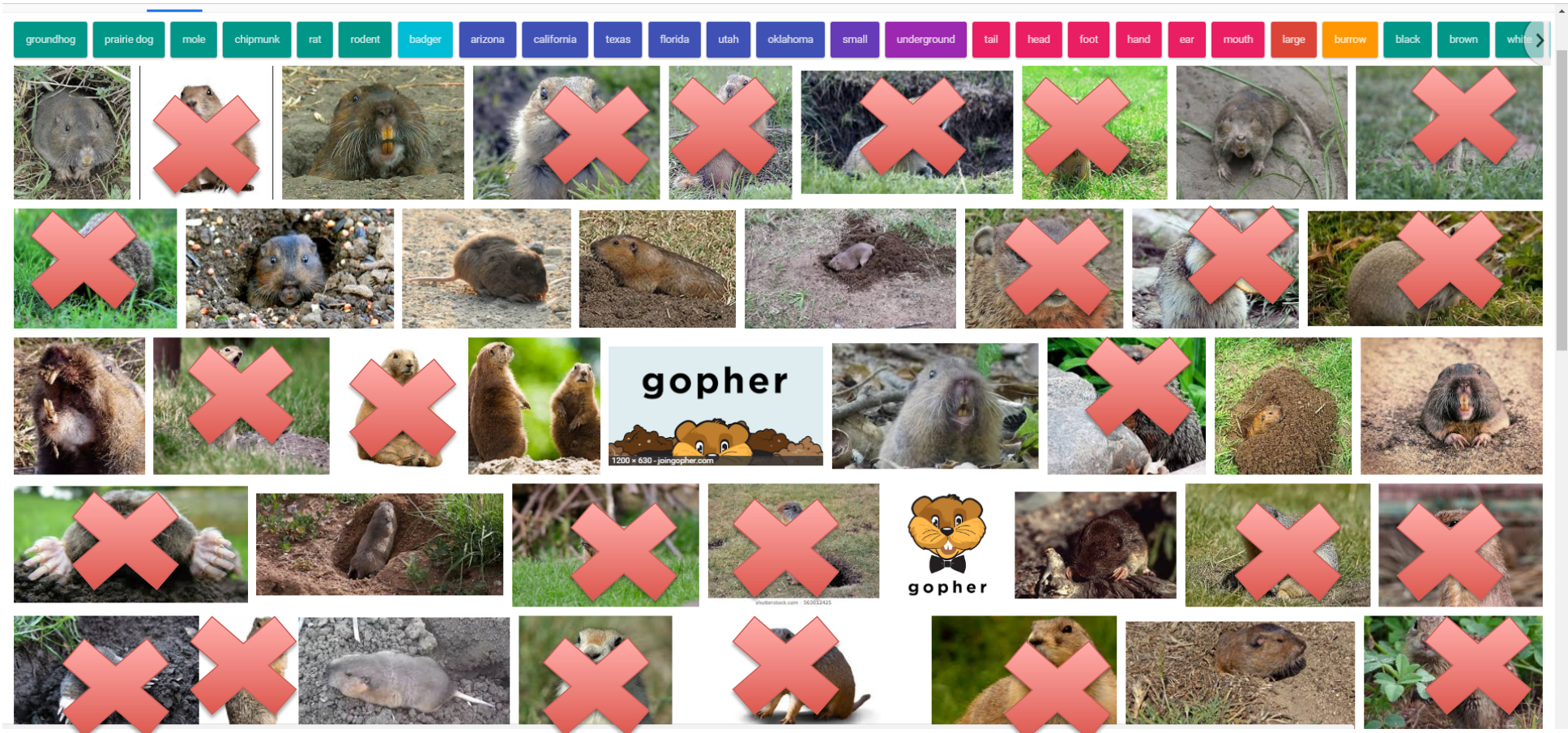
University of California Cooperative Extension



 **University of California**  
Agriculture and Natural Resources



Don't ever do a google image search for the word "gopher"



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## CALIFORNIA RESTRICTED MATERIALS REQUIREMENTS

### A FEDERAL RESTRICTED USE PESTICIDES

(Included by reference as California Restricted Materials)  
Pesticides display the RESTRICTED USE PESTICIDE (RUP) statement on the pesticide container similar to the statement shown here. RUPs require an RUP statement enclosed in a box, at the top of the front panel of the label.

#### RESTRICTED USE PESTICIDE

DUE TO (reason for restricted use classification)  
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

Some product labels require a Certified Applicator be "physically present" at the use site.

### B CALIFORNIA RESTRICTED MATERIALS

This section is written in a quick reference format; refer to Title 3, California Code of Regulations (3 CCR) section 6400 for complete text.

Acrolein, labeled for use as an aquatic herbicide	Dazomet, labeled for production of agricultural plant commodities	Methamidophos – unregistered	Propanil (3,4-dichloropropanilide)
Aldicarb – unregistered	Dicamba*	Methidathion	Sodium cyanide
All dust (except products containing only exempt pesticides)**	2,4-dichlorophenoxyacetic acid (2,4-D)*	Methomyl†	Sodium fluoroacetate (compound 1080) – unregistered
Aluminum phosphide	2,4-dichlorophenoxybutyric acid (2,4-DB)†	Methyl bromide	Sodium tetrathiocarbonate – unregistered
Any pesticide containing active ingredients listed under section 8800(a), labeled for agricultural, outdoor institutional, or outdoor industrial use <sup>1</sup>	2,4-dichlorophenoxypropionic acid (2,4-DP)*	2-methyl-4-chlorophenoxyacetic acid (MCPA)*	Strychnine**
Any pesticide pursuant to Section 18 of FIFRA (Emergency exemption)	1,3-Dichloropropene (1,3-D)	Methyl iodide – unregistered	Sulfotep – unregistered
4-Amino pyridine	Difenaacoum	Methyl isothiocyanate (MITC), labeled for the production of agricultural plant commodities	Sulfuryl fluoride
Azinphos-methyl – unregistered	Difethialone	Molinate – unregistered	Thiobencarb
Brodifacoum	Disulfoton** – unregistered	Oxydemeton-methyl	Tribufos
Bromadiolone	Endosulfan**	Paraquat	Tributyltin, organotin, or a tri-organotin compound formulated as an antifouling paint, coating, or compound and labeled for the control of fouling organisms in an aquatic environment
Calcium cyanide – unregistered	Ethoprop, labeled for turf	Parathion-methyl – unregistered	Zinc phosphide**
Carbaryl**	Fenamiphos – unregistered	Phorate	
Carbofuran – unregistered	Lindane** – unregistered	Phosphine gas	
Chloropirrin	Magnesium phosphide	Potassium n-methylthiocarbamate (metam-potassium), labeled for the production of agricultural plant commodities	
3-Chloro-p-toluidine hydrochloride	Metam sodium, labeled for the production of agricultural plant commodities		

#### EXCEPTIONS FROM RESTRICTION

\*\* Products labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, public agency vector control district use per Health and Safety Code section 116150.

<sup>1</sup> Carbaryl formulated as a bait or used directly on livestock or poultry; additional exceptions include those in \*\* above.

<sup>††</sup> Fly baits containing not more than 1% methomyl

\* 2,4-D labeled only for use as a plant growth regulator

For 2,4-D, 2,4-DB, 2,4-DP, Dicamba (Phenoxy), MCPA:

\* Liquid formulations packaged in containers of 1 quart or less

\* Liquid formulations packaged in containers of 1 gallon or less that contain 15% or less of the active ingredient

\* Liquid formulations labeled for use without further dilution

\* Dry formulations packaged in containers of 1 pound or less. (For dicamba/phenoxylabeled to be further diluted.)

\* Dry formulations packaged in containers of 50 pounds or less, containing 10% or less of the active ingredient, and labeled for use without further dilution

### APPLICATORS WHO HAVE MET THE CERTIFICATION REQUIREMENTS FOR RESTRICTED MATERIALS PURSUANT TO FOOD AND AGRICULTURAL CODE SECTION 14015

#### CERTIFIED COMMERCIAL APPLICATORS

(PERSONS OTHER THAN PRIVATE APPLICATORS USING RESTRICTED PESTICIDES)

- Journeyman Pilots
- Qualified Applicator Licensees
- Qualified Applicator Certificate Holders
- Structural Pest Control Field Representatives
- Structural Pest Control Operators
- Vector Control Technicians

**A** PESTICIDES ONLY IN "A" ABOVE – NO PERMIT REQUIRED

**B** PESTICIDES IN "B" ABOVE – PERMIT REQUIRED; EXCEPTIONS APPLY

#### CERTIFIED PRIVATE APPLICATORS

(GROWERS, NURSERMEN, AND OTHERS USING RESTRICTED PESTICIDES TO PRODUCE AGRICULTURAL COMMODITIES)

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#### EXCEPTIONS FROM PERMIT REQUIREMENT

- No permit required for pesticides used by persons licensed by the Structural Pest Control Board per Food and Agricultural Code section 14006.6(d)
- No permit required for antifouling paints or coatings containing tributyltin per 3 CCR section 6414(c)
- <sup>1</sup>No permit required for certified applicators using pesticides listed in 3 CCR section 8800(a) (*Potential to Pollute Ground Water*) outside of a Ground Water Protection Area: Atrazine Bentazon (Basagran®) Bromacil Diuron Norflurazon Prometon Simazine

# Rules and regs and burrowing rodents

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Agriculture and Natural Resources

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# Restricted Materials Permit

- This is the responsibility of the owner of the property or business operator
- However, it is your responsibility to check that before you apply a restricted use material that the owner of the property has the material listed on their permit
- You, not the property owner, will receive the violation



# Notice of Intent

- You must give a NOI to your County Ag Commissioner's Department at least 24 hours before the application of a restricted use material
- The applicator has up to four days after the planned date (the date on the notice) to begin the application.
- If the pesticide application is not started in four days, a new Notice of Intent must be filed.



## Written recommendation

- A written recommendation is required for the application of any pesticide on any production or non-production ag site
- One copy of each such written recommendation shall be signed and dated and shall be furnished to the operator of the property prior to the application.
- Where a pesticide use is recommended a copy shall also be furnished to the dealer and the applicator prior to the application.

# Non-production agriculture

- Cemeteries
- Ditches and ditch banks
- Drip lines
- Egg handling equipment (on farms)
- Farm roads
- Field borders and headlands
- Golf courses
- Greenbelts

- Greenhouse/nursery/mushroom operations (outside general weeds and pests, as well as pest control within alley ways and other interior areas)
- Ground water recharge ponds
- Highway medians
- Irrigation canals
- Irrigation systems (drip lines)
- Lakes, rivers, and streams
- Milk-handling equipment (on farms)
- Mushroom (post-harvest kill)
- Parks
- Railroad shoulders
- Recreation areas
- Research (commodity destroyed)
- Reservoirs
- Roadsides
- Rights-of-way
- Uncultivated (fallow) agricultural ground

# MUST have a copy of the label!

**SPECIMEN LABEL**

**Ramik® Green**  
Fish Flavored, Weather-Resistant Rodenticide  
For Control of Commensal Rats and Mice  
Indoors and Outdoors

**This product may only be used inside and within 100 feet of buildings or inside of transport vehicles (ships, trains, or aircraft).**

(Text For Individual Container: It is Illegal to Sell This Package Individually.)  
(Text For Container: This Product May Not Be Sold in Packaging that Holds Less Than 4 Pounds of Bait.)

<b>ACTIVE INGREDIENT:</b> Diphacinone (2-Diphenylacetyl-1,3-Indandione).....0.005%	
<b>OTHER INGREDIENTS:</b> .....99.995%	
<b>TOTAL:</b> .....100.000%	
EPA Reg. No. 61282-46	EPA Est. No. 61282-W1-01

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION**

**PRECAUTIONARY STATEMENTS**  
**HAZARD TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION:** Harmful if swallowed or absorbed through the skin. Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing. Keep away from children, domestic animals and pets.

**Personal Protective Equipment (PPE):**  
All handlers (including applicators) must wear long-sleeved shirt, long pants, shoes, socks and water-proof gloves. Any person who retrieves carcasses or unused bait following application of this product must wear waterproof gloves.

**User Safety Requirements**  
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after applying the bait and before eating, drinking, chewing gum, using tobacco or using the toilet and change into clean clothing.

**FIRST AID**

<p><b>If on Skin or Clothing</b></p> <ul style="list-style-type: none"> <li>Take off contaminated clothing.</li> <li>Rinse skin immediately with plenty of water for 15-20 minutes.</li> <li>Call a poison control center, or doctor, or <b>1-800-498-5743</b> immediately for treatment advice.</li> </ul>	<p><b>If in Eyes</b></p> <ul style="list-style-type: none"> <li>Hold eye open and rinse slowly and gently with water for 15-20 minutes.</li> <li>Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.</li> <li>Call a poison control center, or doctor, or <b>1-800-498-5743</b> immediately for treatment advice.</li> </ul>
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**NOTE TO PHYSICIAN**  
If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. If ingested, administer Vitamin K<sub>1</sub>, intramuscularly or orally. Repeat as necessary based on monitoring of prothrombin times.

**TREATMENT FOR PET POISONING**  
If animal eats bait, call veterinarian or **1-800-498-5743** at once.

**NOTE TO VETERINARIAN**  
**Anticoagulant Diphacinone:** For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), give Vitamin K<sub>1</sub>.

**For 24-hour emergency information on this product, call 1-800-498-5743 (US & Canada) or 1-651-523-0318 (all other areas).**

**ENVIRONMENTAL HAZARDS**  
This product is extremely toxic to mammals, birds and other wildlife. Dogs, cats and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten this bait. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of excess. Runoff also may be hazardous to aquatic organisms in water adjacent to treated areas.

**ENDANGERED SPECIES CONSIDERATIONS:** Do not use this product when species listed in the review of the black-footed ferret without first consulting endangered species specialists, U.S. Fish and Wildlife Service, Denver Regional Office. This pesticide should not be used within one-half of adjacent areas of the San Joaquin Kit Fox in the following California counties: Kern, Kings, Fresno, San Luis Obispo, Merced, Monterey, Santa Barbara, Ventura, Tulare, and San Benito. Prior to use, contact endangered species specialists at the California Department of Fish and Game or the U.S. Fish and Wildlife Service, Portland Regional Office, for recommendations.

**PRECAUTIONARY STATEMENTS**  
Hazard to Humans and Domestic Animals

**CAUTION:** May be harmful if swallowed or absorbed through the skin because this product reduces the clotting ability of blood and causes bleeding. Keep away from children, domestic animals and pets. Do not get in eyes, on skin, or on clothing. Any person who retrieves carcasses or unused bait following application of this product must wear gloves. All handlers (including applicators), must wear long sleeved shirt and long pants, shoes plus socks, and gloves.

**USER SAFETY REQUIREMENTS:** Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after applying bait and before eating, drinking, chewing gum, using tobacco or using the toilet and change into clean clothing.

**FIRST AID:** Have this label with you when obtaining treatment advice.

**If swallowed:** Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor.

**If in eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

**If on skin or clothing:** Take off contaminated clothing. Rinse skin with plenty of cool water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

**If inhaled:** Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice.

**NOTE TO PHYSICIAN:** Contains chlorophacinone, an anticoagulant. For humans that have ingested this product, or have obvious poisoning symptoms (bleeding or prolonged prothrombin times), give Vitamin K<sub>1</sub> by intramuscular or oral administration. Check prothrombin time every 3 days until values return to normal.

**TREATMENT FOR PET POISONING:** If animal eats bait, call veterinarian at once.

**NOTE TO VETERINARIAN:** Anticoagulant Chlorophacinone: For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), give Vitamin K<sub>1</sub>.

**ENVIRONMENTAL HAZARDS:** This product is toxic to fish and water. Dogs and other predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten the bait. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of excess. Runoff also may be hazardous to aquatic organisms in water adjacent to treated areas.

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**rozol®**  
POCKET GOPHER BAIT

**POCKET GOPHER BAIT**

**FOR THE CONTROL OF POCKET GOPHERS ONLY**

This product may only be used to control pocket gophers in main- and below-ground applications.

Active Ingredient: chlorophacinone . . . . .	0.005%
Inert Ingredients . . . . .	99.995%
<b>Total</b> . . . . .	<b>100.000%</b>

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION:** See side panel for additional precautionary statements.

**LIPHATECH®**  
Liphatech, Inc.  
3600 W. Elm Street  
Milwaukee, WI 53209  
(800) 351-1476

This product not registered for sale or use in  
Alaska, Hawaii, North Carolina or Pennsylvania.

**DIRECTIONS FOR USE**

It is a violation of Federal law to use this product in a manner inconsistent with the labeling. **READ THIS LABEL** and follow all use directions and use precautions.

**USE RESTRICTIONS:** Use only to control pocket gophers (Thomomys spp. and Geomys spp.) on lawns, golf courses, athletic fields, rangelands, orchards and groves, and non-crop areas. Bait must be applied directly into pocket gophers' burrow systems. Only apply bait underground. Apply only to the sites, pests and application methods specified on this label.

**Application Directions:** Burrowing pocket gophers throw out low, fan-shaped mounds on either side of their underground tunnel. These lateral tunnels coming to the surface are on the flat side of the fan and these holes plugged with loose soil. Treatment can be made in one or both of the following ways:

1. With a long-handled tablespoon, carefully remove the plug on the flat side of the fan. Carefully insert 1/2 cup of bait as far down into the hole as possible. Re-close the opening, using care not to cover the bait with soil.
2. Using a metal rod, probe 6-12 inches deep to locate the main tunnel. Consult diagram below for location to probe. Drop 1/2 cup of bait into the tunnel and cover the hole so light will not enter the tunnel system.

Consult Federal and State rodent control bulletins for a full discussion of pocket gopher burrowing habits. Make 2-3 treatments per burrow system. Wear safety glasses, immediately bury dead animals and spilled bait found on soil surface. Maintain a constant supply of bait in the burrow system for as long as there is gopher activity. Do not apply bait on surface of soil.



The right and the wrong ways to use a probe for poisoning gophers are shown above. Be sure that bait is in the main runway - not in the lateral or mounded in the bottom of the runway. (389)

**STORAGE AND DISPOSAL**

Do not contaminate water, food or feed by storage or disposal.

**Pesticide Storage:** Store in original container in a cool, dry place inaccessible to children and pets.

**Pesticide Disposal:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**Container Handling:** This is a nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or dispose of empty container in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

**WARRANTY:** To the extent consistent with applicable law, seller makes no warranty, expressed or implied, concerning use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of product when such use and/or handling is contrary to label instructions.

EPA Reg. No. 7172-1M  
EPA Est. No. 7172-W1-1

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# Gophers



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# Gophers

- Considerable research in the last 10 years on gopher research
- Much of it carried out in California



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# Typical gopher mounds





# Gopher mounds





# Mole mound



# Management options

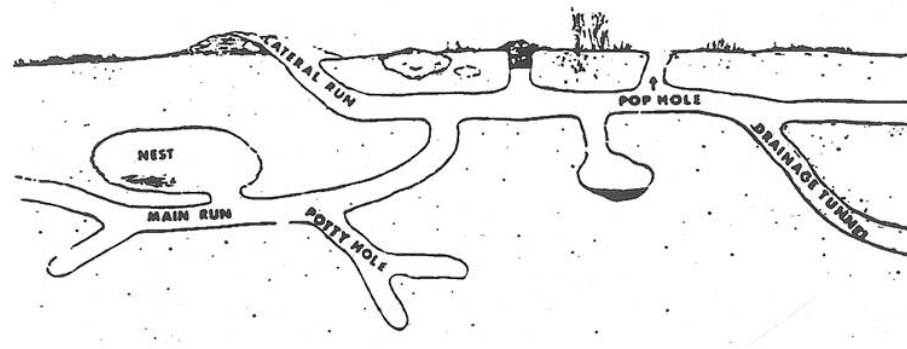


Habitat modification	Baiting	Burrow fumigation	Trapping	Exclusion	Repellent	Frightening	Shooting
✓	✓	✓	✓	✓	✗	✗	✗

Currently, we focus on an integrated approach that utilizes a number of strategies and tools to control vertebrate pests.

# Habitat modification

- Deep disking/ripping
- Not generally an option in urban California



# Baiting



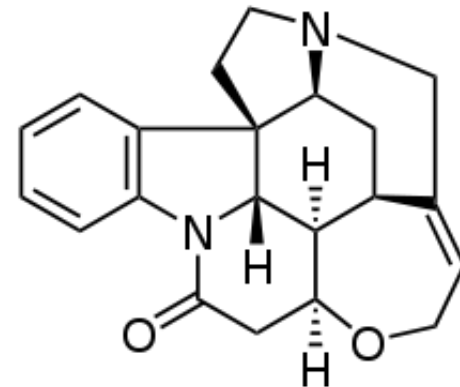
- Mostly restricted use in CA (unless used by homeowner)
  - Anticoagulants
  - Zinc phosphide
  - Strychnine



# Strychnine

Professional

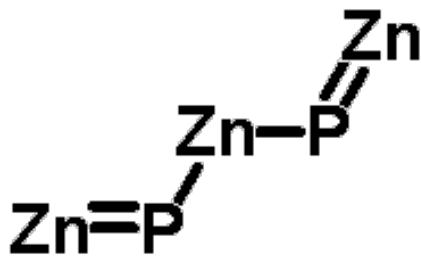
- Acute toxicant
- Preferred bait for controlling gophers given its acute toxicity
- More palatable flavor than zinc phosphide
- Very effective
- Behavioral resistance to strychnine baits
- Current shortage of strychnine baits in the United States



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# Zinc Phosphide

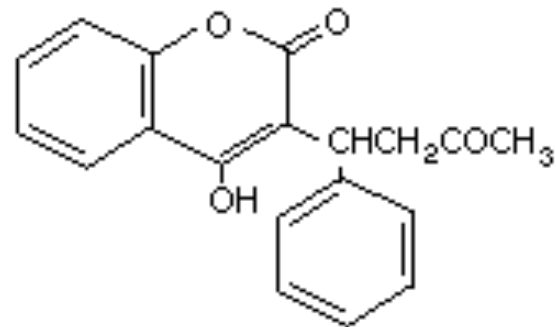
DIY



- Acute toxicant
- Can also be effective
- Gophers can develop bait shyness
- More readily available than Strychnine

## Anticoagulant rodenticides

- Diphacinone and Chlorophacinone
- First generation anticoagulant rodenticides
  - Multiple feeding
- Use when worried about primary toxicity from other products
- Risks of secondary toxicosis
  - Low



DIY

## Fumigation

Professional

- Gas cartridges
  - Effective for ground squirrels (62–86% control).
  - Not effective for gophers.
- Aluminum phosphide
  - Highly effective for gophers (90-100%).
  - Is a restricted use pesticide.

# Fumigation

- Aluminum phosphide is a restricted material
- Requires a restricted use permit to purchase and use.
- You must also be a qualified applicator or be supervised by a qualified applicator to use this material.

- Aluminum phosphide must only be used out-of-doors for control of burrowing pests on
  - agricultural areas
  - orchards
  - non-crop areas
  - pastures
  - rangeland
  - golf courses
  - athletic fields
  - airports





- And.....
  - cemeteries
  - rights-of-ways
  - earthen dams
  - parks and recreational areas
  - other non-residential institutional or industrial sites and,
  - on residential or other commercial properties



- Aluminum phosphide cannot be applied on school grounds except on athletic fields
- Can only be applied in burrow systems that are more than 100 feet from a building that is, or may be, inhabited by people or domestic animals.
- May be applied in athletic fields or parks associated with schools.



February 5, 2010

## TRAGIC FATAL INCIDENT



PESTCON SYSTEMS, INC.  
3/5/19

# Fumigation Management Plan

**DANGER**

**POISON GAS  
KEEP AWAY**

**PHOSPHINE FUMIGATION IN PROGRESS**

Start date                      End date

Fumigation:

Ventilation:

Do not access this storage during fumigation and ventilation

Ventilation period: One day with aeration fan or five days without aeration fan  
Withholding period: Two days  
Place warning signs at all storage access points during fumigation  
Warning sign only - see label for use



www.planthealthcanada.com.au/gen/produktoscecuty/general\_insecticidy-information

DIY

Professional

## Carbon Monoxide



**University of California**  
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<b>Fumigant</b>	<b>Efficacy (%)</b>	<b>Study</b>
Aluminum phosphide	90	Baker 2004
Aluminum phosphide	81	Baldwin et al. 2016
Gas cartridge	17	Matschkte et al. 1995
PERC	56	Orloff 2012
PERC	56	Baldwin et al. 2016
PERC	68	Baldwin & Meinerz 2016

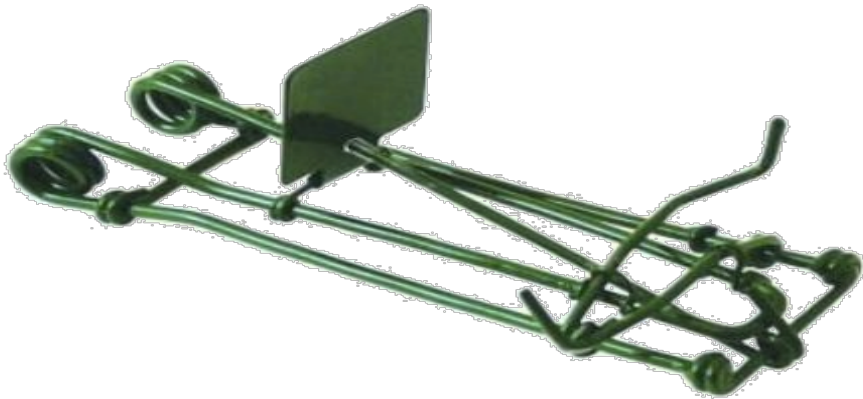
# Trapping

DIY

- Maccabee vs Gophinator
- Covered vs uncovered
- Attractant vs no attractant
- Trained vs untrained
- Gloves vs no gloves
- “Above” ground traps vs “in” tunnel traps

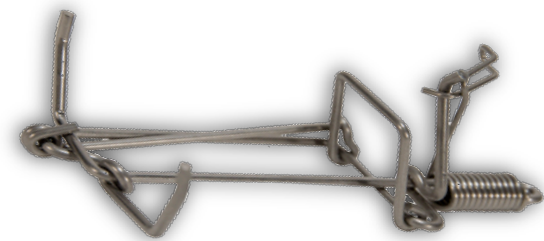


# Macabee\_vs Gophinator

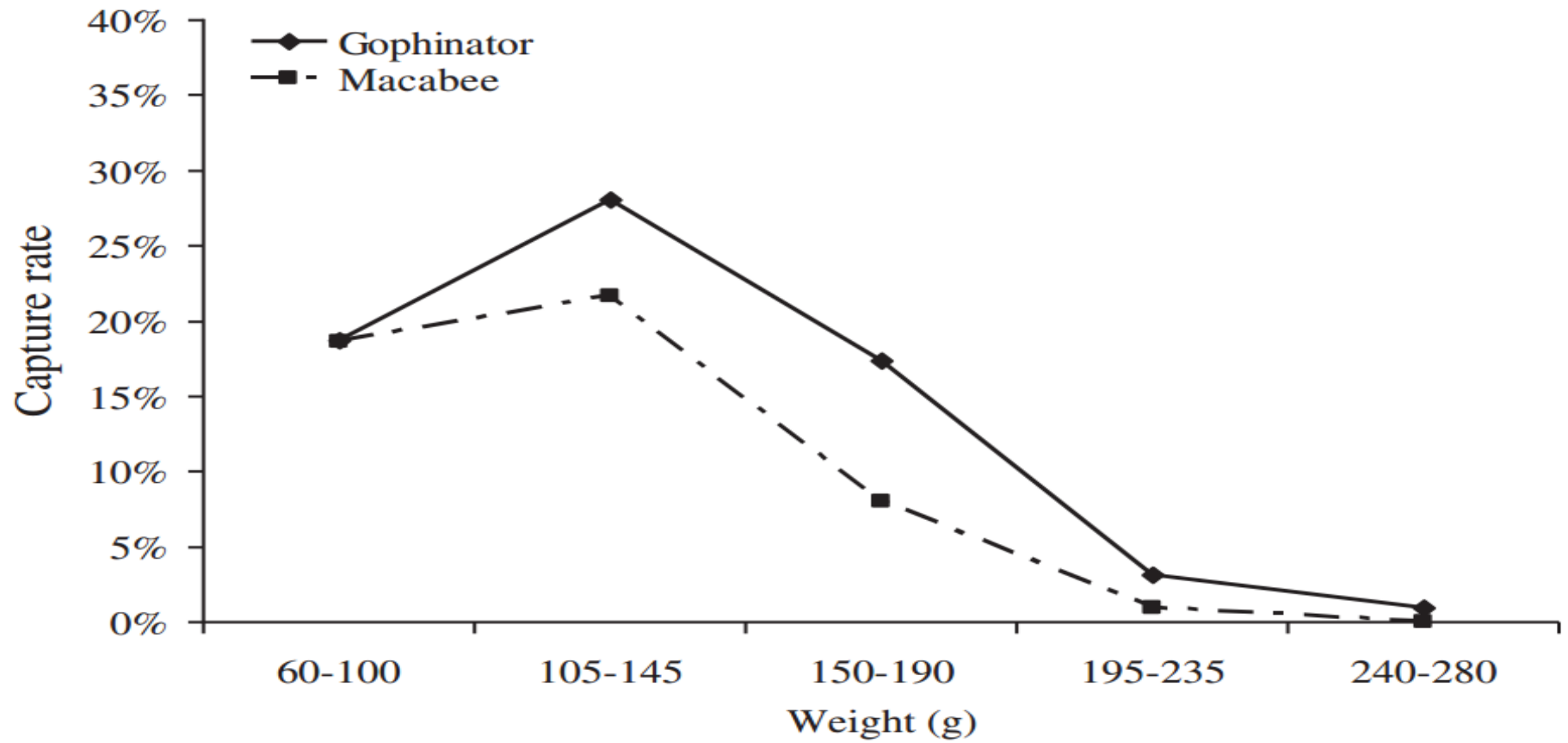


# Gophinator

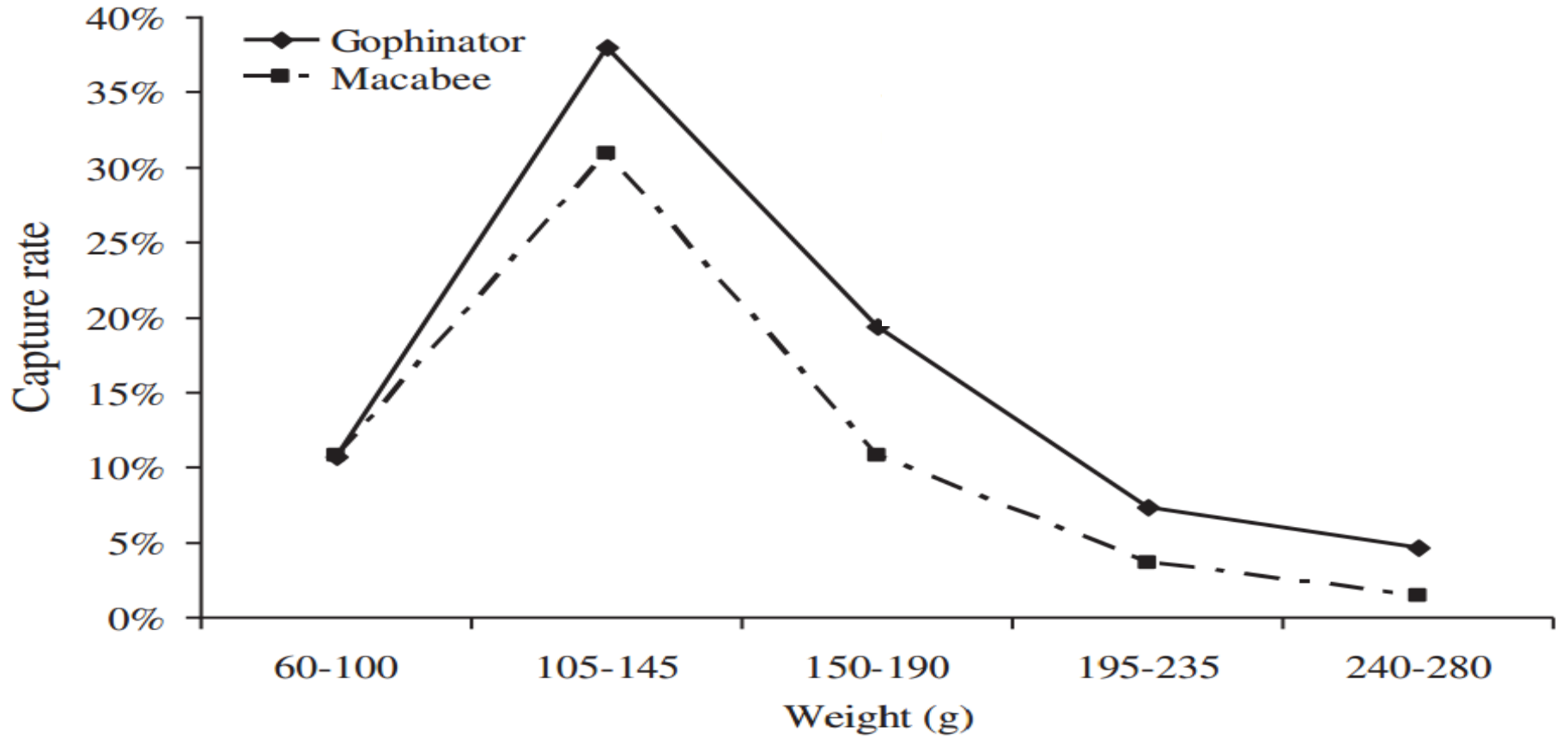
- Powerful trap
- Grips the animal high on the body
- Trigger arm offset to prevent upward pressure on gopher
- Rotating pincer arm that clamps to stationary arm
  - More secure capture

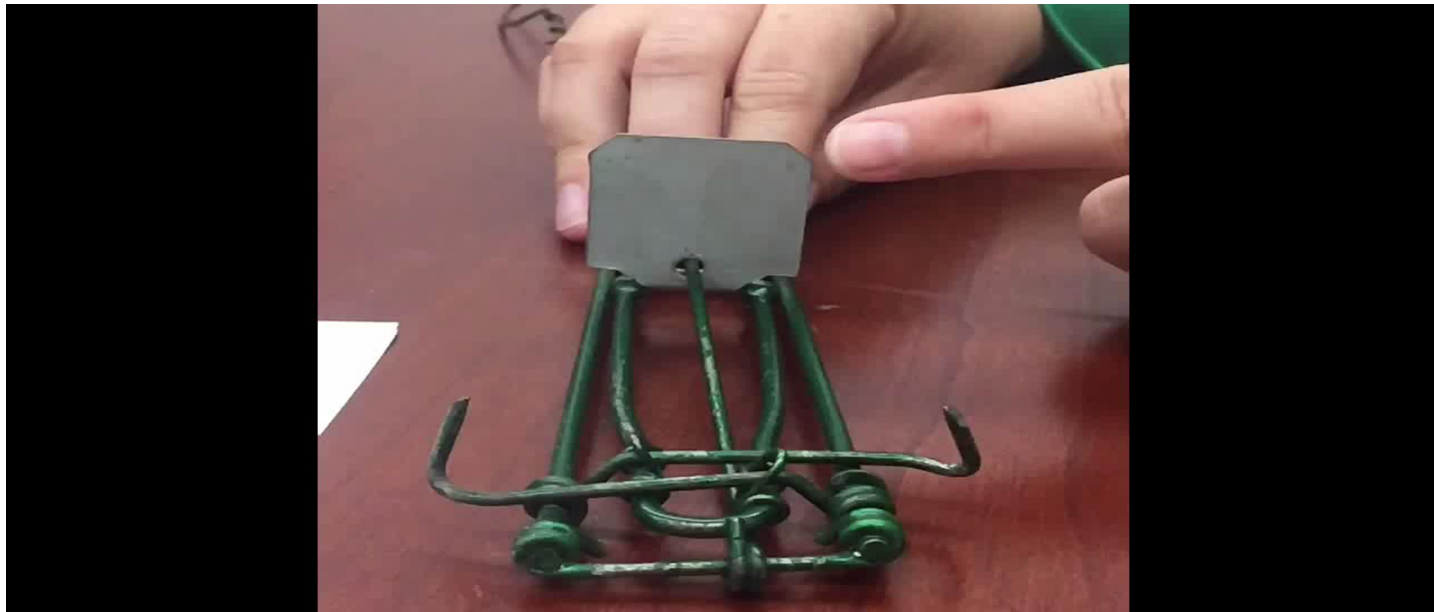


### Spring--Trap Type

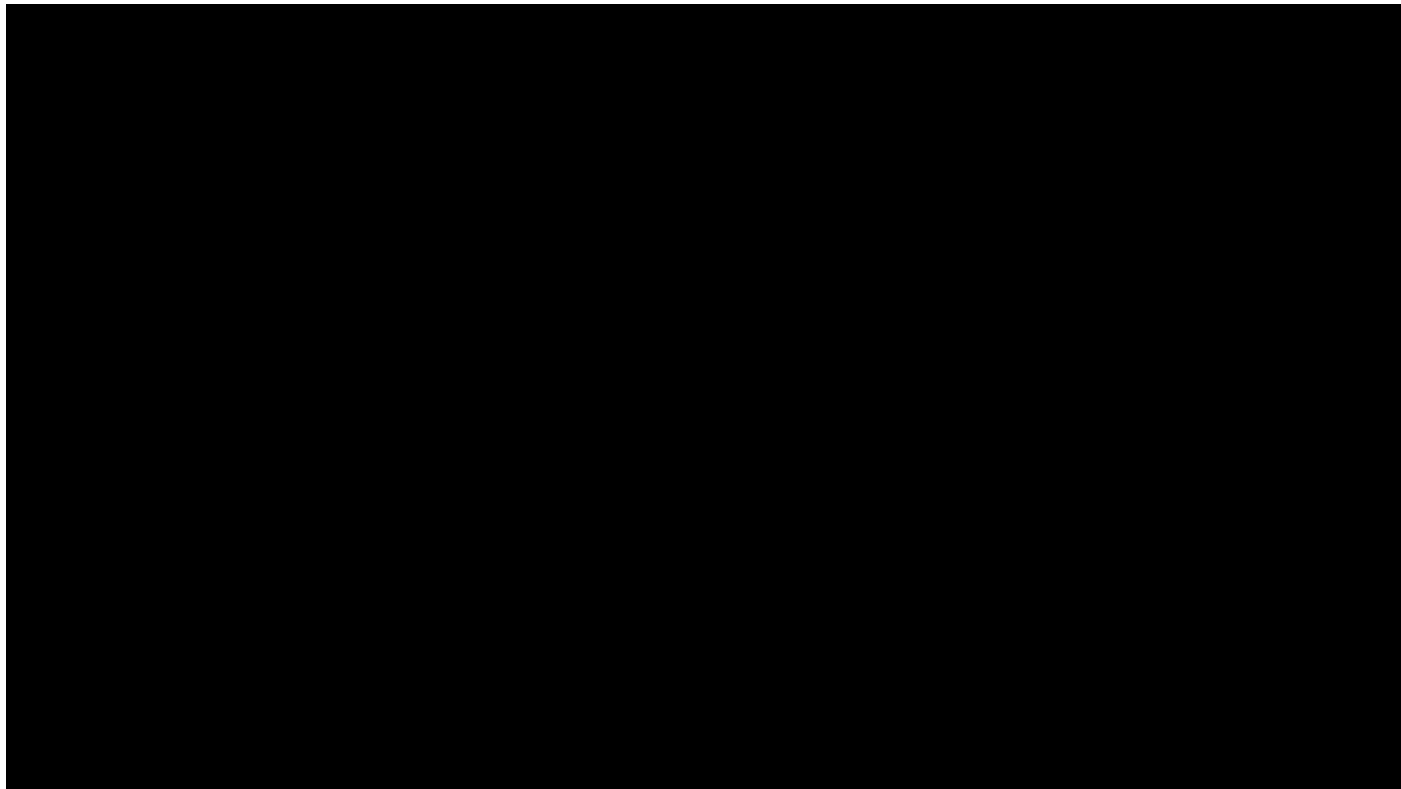


### Autumn--Trap Type





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# Types of trap

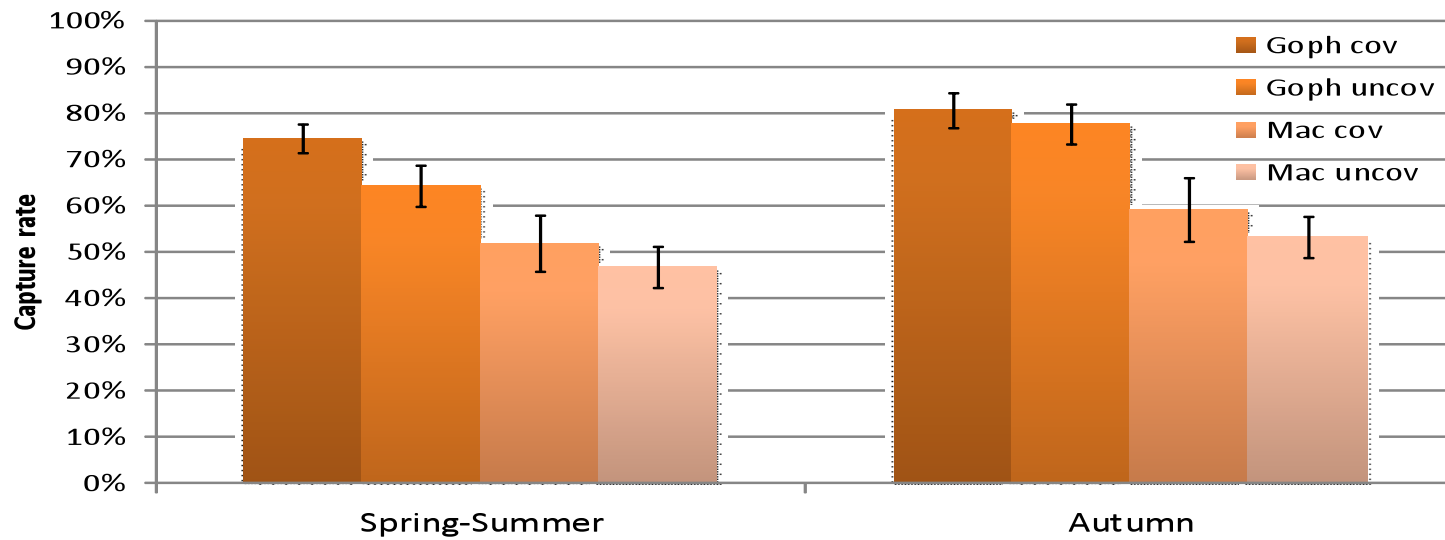
- Turf damage
  - Gophinator
  - Maccabee
  - Black hole and box
- Less turf damage
  - Cinch trap
  - Gopher Hawk





# Covered vs uncovered

Trap type and cover type comparisons





# Refinement of a trapping method increases its utility for pocket gopher management

Roger A. Baldwin <sup>a,\*</sup>, Angela Chapman <sup>b</sup>, Christopher P. Kofron <sup>c</sup>, Ryan Meinerz <sup>a</sup>, Steve B. Orloff <sup>d</sup>, Niamh Quinn <sup>e</sup>

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<sup>d</sup> University of California Cooperative Extension, 1655 South Main Street, Yreka, CA 96097, United States

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## ARTICLE INFO

### Article history:

Received 15 June 2015

Received in revised form

5 August 2015

Accepted 7 August 2015

Available online xxx

### Keywords:

California

Gophinator

Modified Macabee

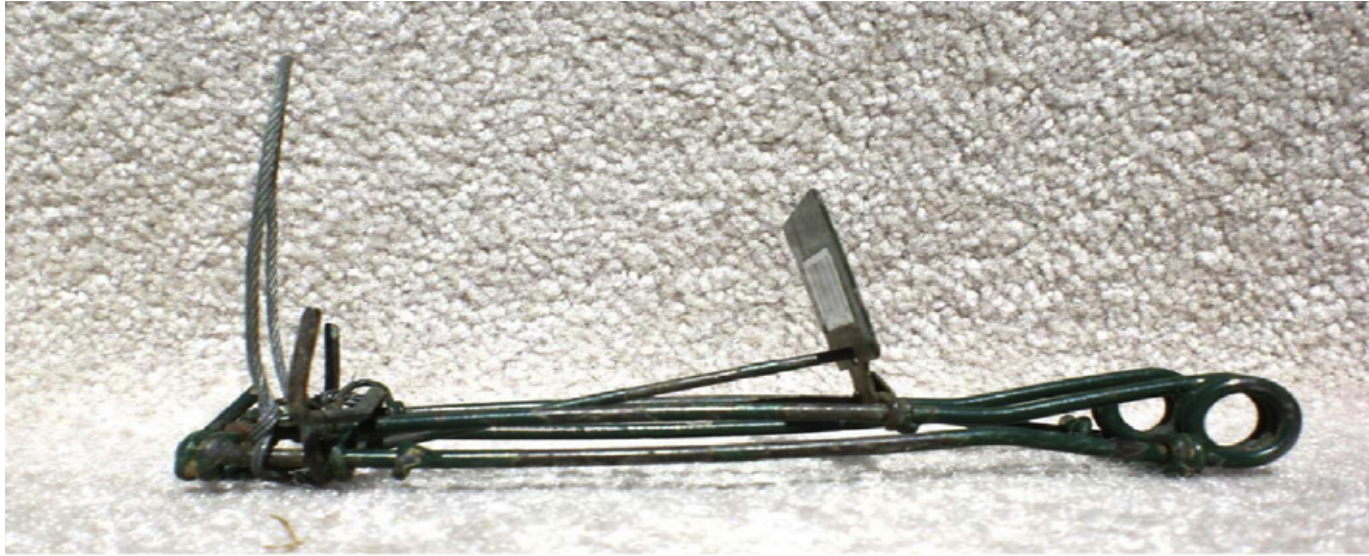
Pocket gopher

Scent

Trap

## ABSTRACT

Trapping is a useful and effective tool for managing detrimental pocket gopher populations, and traps that are easy to use and to increase its effectiveness are in high demand. The Gophinator trap previously proved more effective than the Macabee trap, primarily because of its ability to capture larger pocket gophers. However, the Macabee is still widely used given large stockpiles of these traps by land managers and pest control operators. The addition of a cable restraint to the front of the Macabee may be sufficient to prevent larger individuals from escaping capture, thereby allowing trappers to more effectively use this common trap design. Human scent may also impact trap success by deterring pocket gophers from entering traps. Therefore, we tested the capture efficiency and visitation rate of trap sets when using both the Gophinator and modified Macabee traps to determine the potential utility of these trap designs. We compared our results to a previous investigation to better define the potential usefulness of the cable restraint on the modified Macabee. We also tested the impact of human scent on capture efficiency and visitation rate to determine the potential relevance of eliminating human scent from trap sets. Gender and weight of captured individuals were used to determine their potential impacts on capture efficiency and visitation rate. We found that the Gophinator was a more effective trap than the modified Macabee because of its ability to capture larger pocket gophers more efficiently. However, the modification did appear to increase the capture efficiency of larger individuals when compared to the standard Macabee, suggesting that the addition of a cable restraint could be used to increase the effectiveness of trapping programs when Gophinator traps are used.



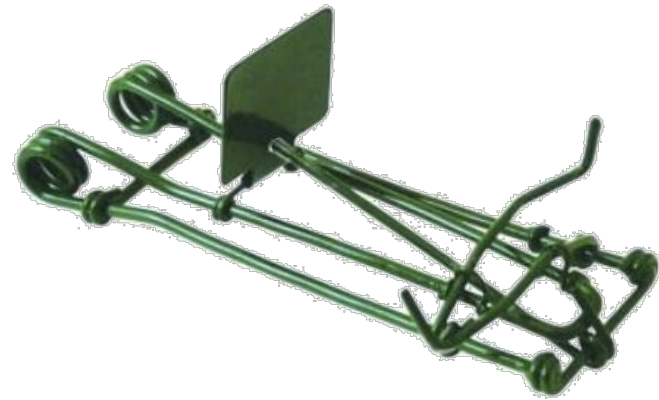


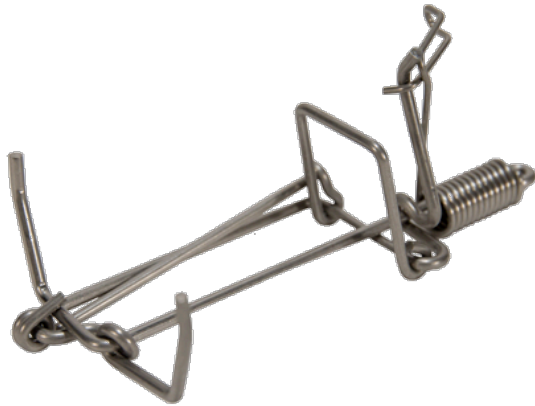


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# Trapping

- Materials
  - Traps
  - Probe
  - Gloves
  - Wire
  - Flags
  - Kneepads





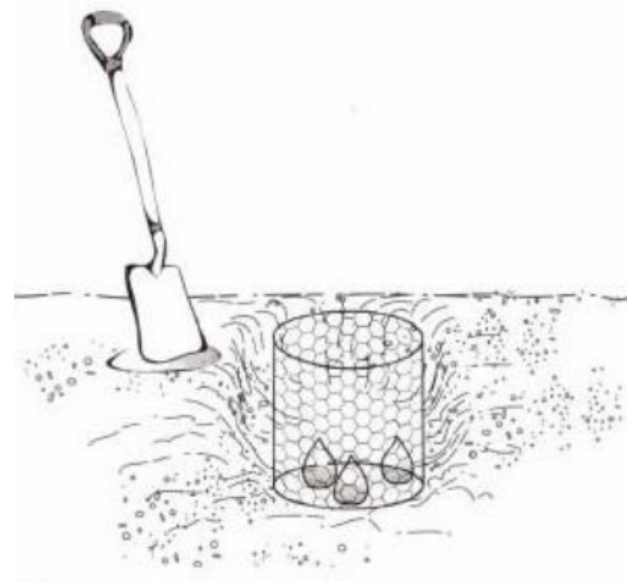
- Active mounds
- Probe for tunnel
  - Watch out for back-filled tunnels
- Leave probe in mound
- With hori-hori, dig hole
- Examine burrows for
  - Size
  - Turns
  - Divides

# Exclusion

- Underground fencing might be justified for valuable ornamental shrubs or landscape trees
- Bury hardware cloth or 3/4-inch mesh poultry wire at least 2 feet deep with an additional 6 inches of mesh or wire bent at a 90-degree angle away from the planting.
- Also extend the fencing at least 1 foot aboveground to deter gophers moving overland..



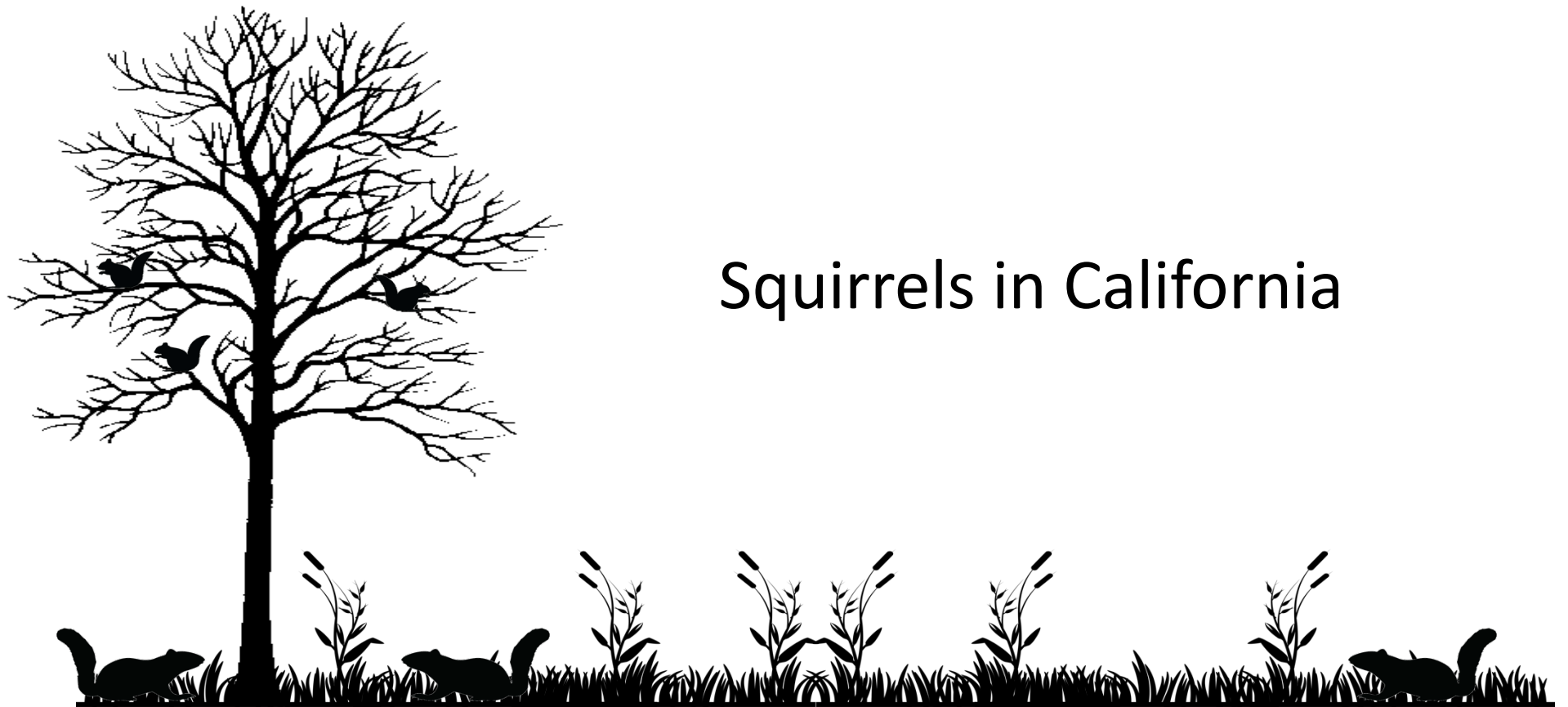
- You can protect small areas such as flower beds by complete underground screening of the bed's sides and bottoms
- To protect individual plants, install wire baskets, which you can make at home or buy commercially, at the same time you are putting the plants into the ground
- Six to 8 inches of coarse gravel 1 inch or more in diameter around underground sprinkler lines or utility cables also can deter gophers



# Squirrels



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# Squirrels in California

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- Tree squirrels
  - Northern flying squirrel
  - Douglas squirrel
    - *Tamiasciurus douglasii*
  - Western gray squirrel
    - *Sciurus griseus*
  - Eastern gray squirrel
    - *Sciurus carolinensis*
  - Eastern fox squirrel
    - *Sciurus niger*

- Ground squirrels
  - Chipmunk
    - *Eutamias spp*
  - Marmot
    - *Marmota flaviventris*
  - Golden mantle ground squirrel
    - *Spermophilus lateralis*
  - Belding's ground squirrel
    - *Spermophilus beldingi*
  - California ground squirrel
    - *Otospermophilus beecheyi*

# Identification

- Tree squirrel



- Ground squirrel

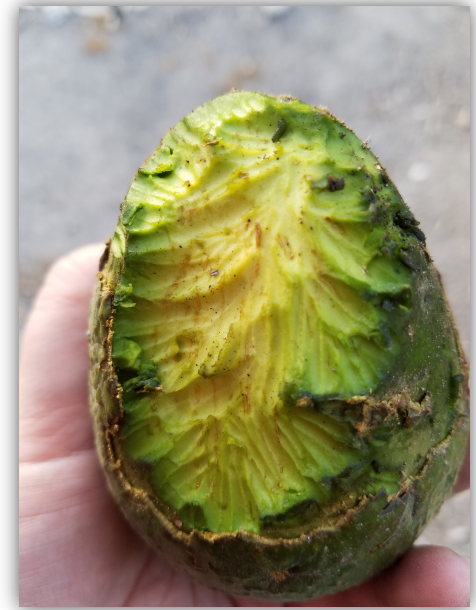






	Bio-control	Habitat modification	Baiting	Burrow fumigation	Trapping	Exclusion	Repellent	Frightening	Shooting
	✗	✓	✗	✗	✓	✗	✗	✗	✓
	✗	✓	✓	✓	✓	✓	✗	✗	✓

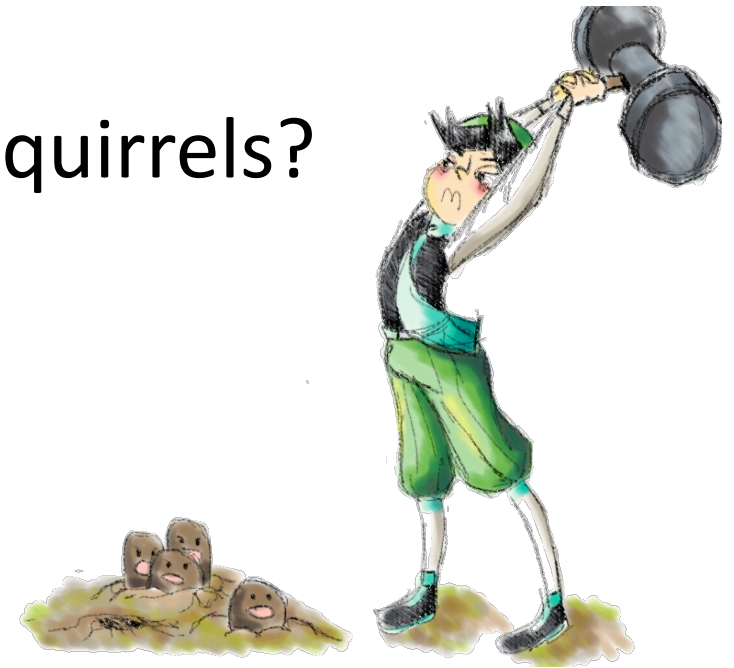
# Ground Squirrels



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# Why manage ground squirrels?

- Mounds are a tripping hazard
- Chew irrigation lines (if you have them)
- Can damage valuable turf and landscapes plants
- Vectors of disease
- Soil erosion



# Biocontrol

- Natural predators have been used to control vertebrate pests
- Owl boxes are not appropriate for ground squirrels



DIY

# Habitat modification

DIY

- Ground squirrels generally like to inhabit the edge of crops, fields etc
- These areas are generally quite bare
- This allows squirrels to identify both ground and aerial risks of predation
- Do not recommend vegetation manipulation as it may encourage the encroachment of other wildlife pests
- If community abuts a flood control channel and you have a ground squirrel issue, please communicate with County Ag. Dept. and flood control divisions

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## Baiting options

Hire a pro

- Anticoagulant rodenticide
- Zinc



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**PRECAUTIONARY STATEMENTS  
HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**CAUTION:** Harmful if swallowed or absorbed through the skin. Causes moderate eye irritation. Keep away from humans, domestic animals, and pets.

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**  
All handlers (including applicators) must wear long-sleeved shirt, long pants, shoes, socks, and waterproof gloves. Any person who retrieves carcasses or pieces of bait containing this product must wear waterproof gloves.

**USER SAFETY REQUIREMENTS**  
Follow manufacturer's instruction for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after applying bait and before eating, drinking, chewing gum, using tobacco products, or changing into clean clothing.

**ENVIRONMENTAL HAZARDS**  
This product is extremely toxic to mammals and birds. Dogs, cats and other predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten the bait. Do not apply directly to water, or to areas where surface water is present or to terrestrial areas below the mean high water mark. Do not contaminate water when disposing of equipment wash water or rinsate.

**STORAGE AND DISPOSAL**  
Do not contaminate water, food or feed by storage or disposal.

**PESTICIDE STORAGE:** Store only in original closed container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals. Sweep up spillage carefully and dispose of as indicated below.

**PESTICIDE DISPOSAL:**  
Wastes resulting from the use of this product may be disposed of at on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Nonrefillable container (Plastic). Offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.

**NOTICE:** Seller makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when such use and/or handling is contrary to label instructions.

KEEP AWAY FROM FEED AND FOODSTUFFS

**WILCO DISTRIBUTORS, INC.**  
P O BOX 291 - LOMPOC CA 93438  
PH# 805-735-2476

**NET WT. 4 LBS.**

EPA ESTB. NO: 36029-CA-01  
EPA REG NO: 36029-20

UPC

0 91017 31004 6

220313



**GROUND  
SQUIRREL  
BAIT  
BY  
WILCO**

This product may only be used within 50 feet of buildings to control California and Townsend Ground Squirrels in California, Nevada, Oregon, Washington, Idaho, Arizona, New Mexico and Utah only. Ground Squirrel Bait by Wilco is actually impregnated by the toxicant.

Active ingredient:  
Diphacinone (CAS# 82868)..... 0.005%  
Other ingredients..... 99.995%  
Total..... 100.00%

**KEEP OUT OF REACH OF CHILDREN  
CAUTION  
FIRST AID**

Have label with you when obtaining treatment advice.

If swallowed:	<ul style="list-style-type: none"> <li>Call a poison control center, doctor or 1-800-555-7378 immediately for treatment advice.</li> <li>Have person sip a glass of water if able to swallow.</li> <li>Do not induce vomiting unless told to do so by a poison control center or doctor.</li> </ul>
If on skin or clothing	<ul style="list-style-type: none"> <li>Take off contaminated clothing.</li> <li>Rinse skin immediately with plenty of water for 15-20 minutes.</li> <li>Call a poison control center or doctor immediately for treatment advice.</li> </ul>
If in eyes	<ul style="list-style-type: none"> <li>Hold eye open and rinse slowly and gently with water for 15-20 minutes.</li> <li>Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.</li> <li>Call a poison control center or doctor immediately for treatment advice.</li> </ul>

**TREATMENT FOR PET POISONING**

If animal eats bait, call a veterinarian or 1-800-522-1222 at once.

NOTE TO PHYSICIAN OR VETERINARIAN

Contains the anticoagulant Diphacinone. If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. For humans or animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin time), give vitamin K1 intramuscularly or orally.

**DIRECTIONS FOR USE**

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

**READ THIS LABEL:** Read this entire label and follow all use directions and use precautions. Use only for the sites, pets, and application directions described on this label.

**IMPORTANT:** Do not expose children, pets, or other nontarget animals to rodenticides. To help prevent accidents.

1. Store product not in use in a location out of reach of children, pets, and livestock.
2. Apply this product in secured, tamper-resistant bait stations, (like Wilco Ground Squirrel Bait Stations). These stations must be resistant to destruction by dogs and by children under six years of age, and must be constructed and used in ways which prevent such children from reaching into bait compartments and obtaining bait. Stations must be secured so that they cannot be overturned by young children, pets, or winds. Stations used in areas open to livestock and/or nontarget wildlife must be secured so that the units cannot be readily overturned by any nontarget animals that have access to them.
3. Dispose of product container, and unused, spoiled, and unconsumed bait as specified on this label.

**USE RESTRICTIONS:** For use only around buildings (including yards and flower gardens) in secured, tamper-resistant bait stations (like Wilco Ground Squirrel Bait Stations) to control the California Ground Squirrel (*Spermophilus beecheyi*) and Townsend Ground Squirrel (*Spermophilus townsendi*) in California, Nevada, Oregon, Washington, Idaho, and New Mexico, Utah only.

Do not apply this product by any method not specified on this label. This product may not be broadcast. Do not sell this product in individual containers holding less than 4 pounds of bait.

**APPLICATION DIRECTIONS:** Secure bait stations at locations where they will be readily accessible to target ground squirrels, preferably near active burrows. Secure stations 20 to 100 feet apart, depending upon density of the population. Wear waterproof gloves and scooping device (preferably long-handled) to transfer bait from the container to the station. Use 2 to 4 pounds of bait per bait station. Check bait stations frequently to insure that an uninterrupted supply of bait is always available for at least 15 days or until signs of feeding have stopped.

**POST-APPLICATION DIRECTIONS:** Wearing waterproof gloves, collect and bury dead rodents. Dispose of leftover bait according to "Pesticide Disposal". With detergent and hot water, wash all implements used for applying bait. Do not use these implements for mixing, holding, or transferring foods or feed.

# Fumigation

Hire a pro



Rodenator





# Gas cartridges

DIY

Studies show 62–86% control for CA GS



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# New technologies



Species	Device	Author	Efficacy
Belding's Ground Squirrel	PERC	Orloff	76%
California Gound Squirrel	Cheetah	Baldwin	-7%

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Treatment	Site	Efficacy based on sq counts (%)	Efficacy based on burrow counts (%)
PERC (Dry)	Control	0	
	Treatment1	54	48
	Treatment 2	77	100
	Mean	66	74
PERC (Moist)	Treatment1	100	100
	Treatment 2	100	97
	Mean	100	98
Cheetah	Control 1	-16	
	Control 2	-18	
	Treatment1	-17	-57
	Treatment 2	-29	-12
	Treatment 3	0	-269
	Mean	-15	-113



# Burrow Blocker system



Ground Squirrel Hole being filled by the Burrow Blocker.



Former Ground Squirrel Hole 1 year after being filled by the Burrow Blocker.



Diagram of how the Burrow Blocker effectively fills ground squirrel holes and burrows.

[www.BurrowBlocker.com](http://www.BurrowBlocker.com)

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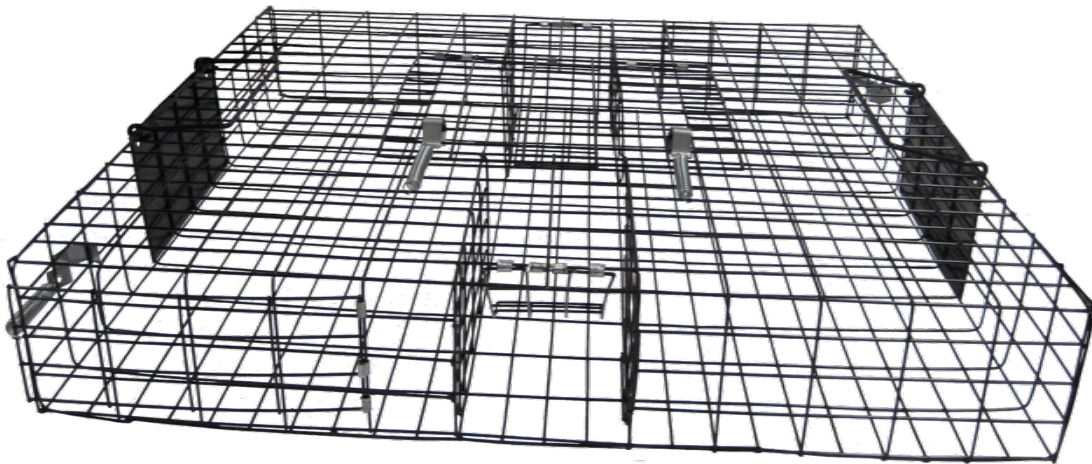


- Cost
- Logistics (other equipment)
- Limited site suitability

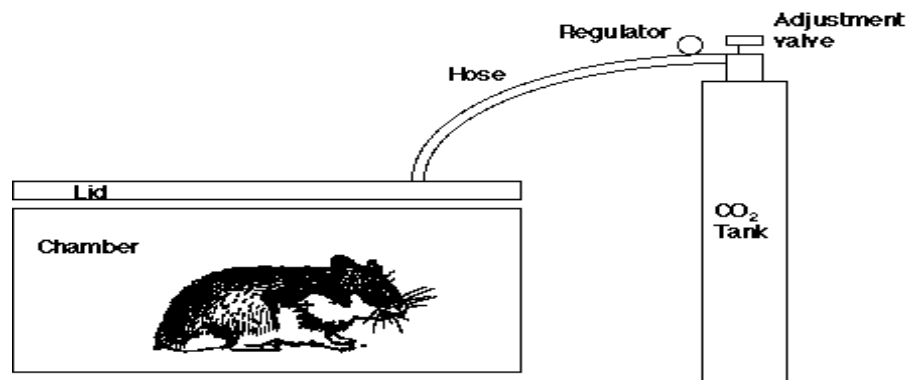


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# Trapping



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## AB 789, Williams

- Prohibits killing any trapped mammal by intentional drowning, injection with any chemical not sold for the purpose of euthanizing animals, or thoracic compression.

## How to Calculate CO<sub>2</sub> flow

1. Measure the euthanasia chamber's size in inches:  $16 \text{ in} \times 17 \text{ in} \times 35 \text{ in}$
2. Convert each measurement into feet. Divide each dimension by 12:  
 $16 \div 12 = 1.3 \text{ ft}$   
 $17 \div 12 = 1.4 \text{ ft}$   
 $35 \div 12 = 2.9 \text{ ft}$   
  
Multiply the three measurements together to determine the chamber's volume in cubic feet:  $2.9 \times 1.4 \times 1.3 = 5 \text{ ft}^3$   
The chamber size is **5** cubic ft.

---

Next, find the optimal flow rate range (10 to 30% of chamber volume per minute).

---

3. Find the lower limit of 10%.  
Multiply the chamber size (in cubic feet) by 10. Then divide by 100:  $\frac{(5 \text{ ft}^3 \times 10)}{100} = 0.5 \text{ ft}^3$   
  
Find the upper limit of 30%.  
Multiply the chamber size (in cubic feet) by 30. Then divide by 100:  $\frac{(5 \text{ ft}^3 \times 30)}{100} = 1.5 \text{ ft}^3$

---

The CO<sub>2</sub> flow rate for a **5 ft<sup>3</sup> chamber** should be between **0.5 and 1.5 ft<sup>3</sup> per minute.**

Visit [www.groundsquirrelbmps.com](http://www.groundsquirrelbmps.com) for more information about ground squirrel management.



# Ground squirrel best management practices website



Biology Identification Management Regulations Resources FAQs Search

## Ground squirrel management for California



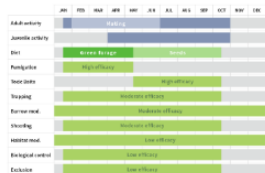
### What are BMPs?

Best Management Practices (BMPs) are the most efficient, cost effective, and environmentally-friendly management methods that can achieve successful ground squirrel management

### What is IPM?

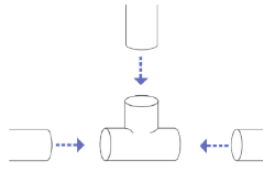
Integrated Pest Management (IPM) is a multi-faceted, long-term approach to pest management that minimizes risks to people and the environment

www.groundsquirrel  
BMP.com



### Timing and Efficacy

Compare management methods for:  
California Ground Squirrel  
Belding's Ground Squirrel



### Step-by-Step Guides

Visual how-to's for:  
Bait Station Construction  
Calculating CO2 Flow  
Spreader Calibration



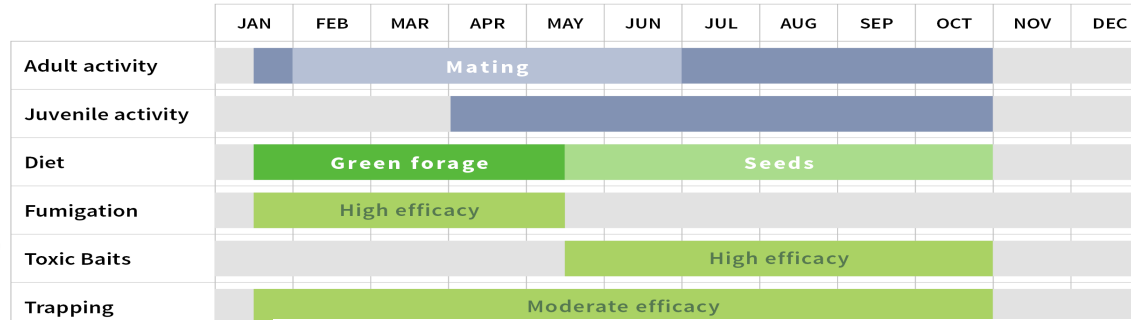
### Protecting Wildlife

Avoid harm to non-target wildlife:  
Range Maps for Endangered Species  
Range Maps for Non-Pest Ground Squirrels  
Legislation and Best Baiting Practices

Resources

FAQs

**Timing Management Efforts | California Ground Squirrels**

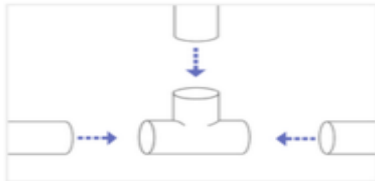


**Timing and Efficacy**

Compare management methods for:

California Ground Squirrel

Belding's Ground Squirrel



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**Management Method Efficacy | Belding's Ground Squirrels**

Management Method	Time of Year	Efficacy	Cost	Labor	Restrictions
Fumigation	February to April <sup>1</sup>	HIGH	●	●	● <sup>2</sup>
Toxic Baits	February to May	MODERATE	●	●	●
Burrow modification	February to August	MODERATE	●	●	●
Exclusion	February to August	MODERATE	●	●	●
Shooting	February to August	MODERATE	●	●	●
Habitat modification	February to August	LOW	●	●	●
Biological control	February to August	LOW	●	●	●
Trapping	February to August	LOW	●	●	●
Repellents	February to August	LOW	●	●	●

■ Active  
Note: Group

<sup>1</sup> Management window may be longer if high soil moisture persists, particularly following substantial irrigation.  
<sup>2</sup> Dependent on which fumigant is used.

● = Low  
● = Moderate  
● = High

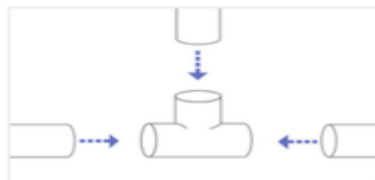


## Timing and Efficacy

Compare management methods for:

California Ground Squirrel

Belding's Ground Squirrel



## Step-by-Step Guides

Visual how-to's for:

Bait Station Construction

Calculating CO<sub>2</sub> Flow

Spreader Calibration

## How to Construct a Bait Station

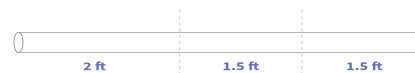
### Traditional T-type

#### Materials

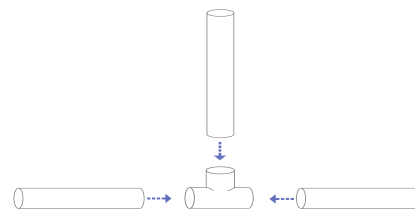
- Five feet of 4-inch PVC/NDS drainage pipe
- One T-junction
- Two 4-inch to 3-inch reducers
- One end cap
- PVC tape, PVC cement, or silicon glue
- Label

#### Assembly

1. Cut the PVC pipe into one 2-foot section and two 1.5-foot sections.

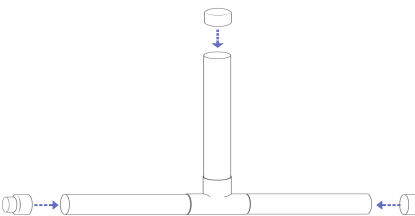


2. Attach the T-junction to the 2-foot pipe.



3. Attach the two 1.5-foot sections into opposite ends of the T-junction.

4. Place the reducers on the base legs (1.5-foot sections) and the end cap on top of the 2-foot section.



5. Attach a service container label near the top of the bait station.

Visit [www.groundsquirrelbmps.com](http://www.groundsquirrelbmps.com) for more information about ground squirrel management.

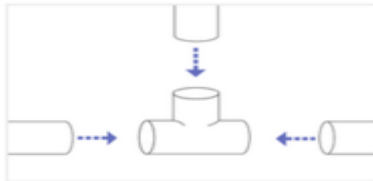


### Timing and Efficacy

Compare management methods for:

California Ground Squirrel

Belding's Ground Squirrel



### Step-by-Step Guides

Visual how-to's for:

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Multiply the three measurements together to determine the chamber's volume in cubic feet:

$$2.9 \times 1.4 \times 1.3 = 5 \text{ ft}^3$$

The chamber size is **5** cubic ft.

---

Next, find the optimal flow rate range (10 to 30% of chamber volume per minute).

---

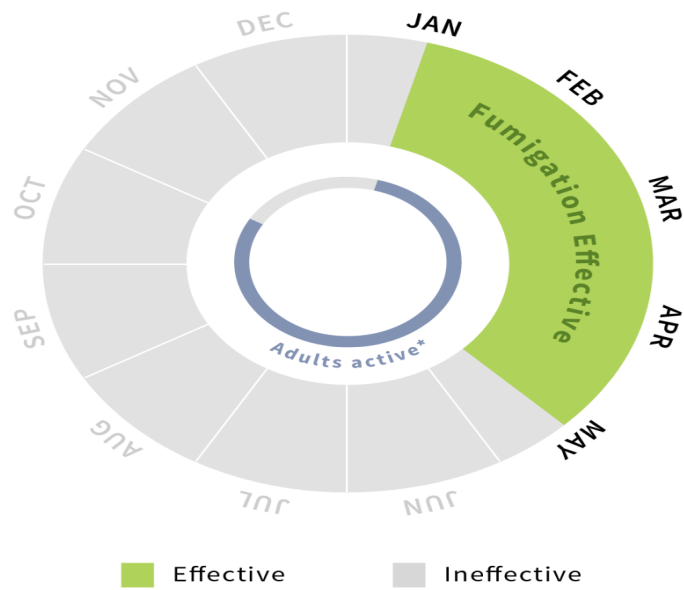
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Multiply the chamber size (in cubic feet) by 10. Then divide by 100:
 
$$\frac{(5 \text{ ft}^3 \times 10)}{100} = 0.5 \text{ ft}^3$$
- Find the upper limit of 30%.  
Multiply the chamber size (in cubic feet) by 30. Then divide by 100:
- $$\frac{(5 \text{ ft}^3 \times 30)}{100} = 1.5 \text{ ft}^3$$

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The CO<sub>2</sub> flow rate for a **5 ft<sup>3</sup> chamber** should be between **0.5 and 1.5 ft<sup>3</sup> per minute**.

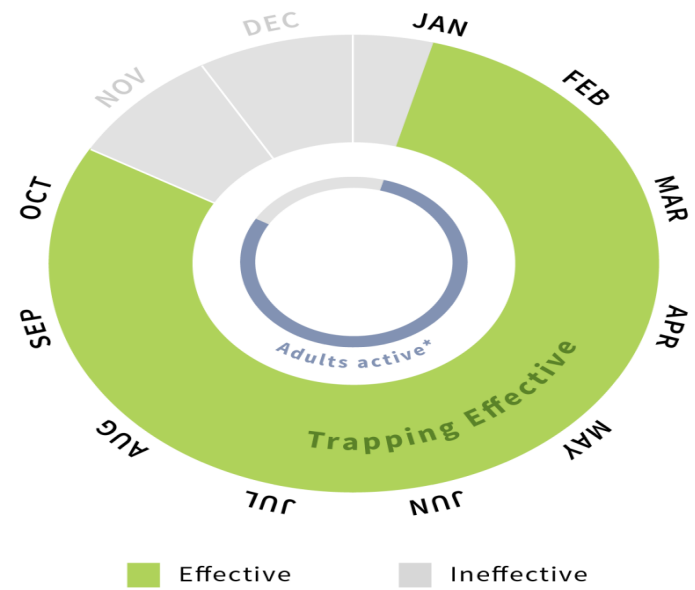
Visit [www.groundsquirrelbmps.com](http://www.groundsquirrelbmps.com) for more information about ground squirrel management.

**When is fumigation effective?**

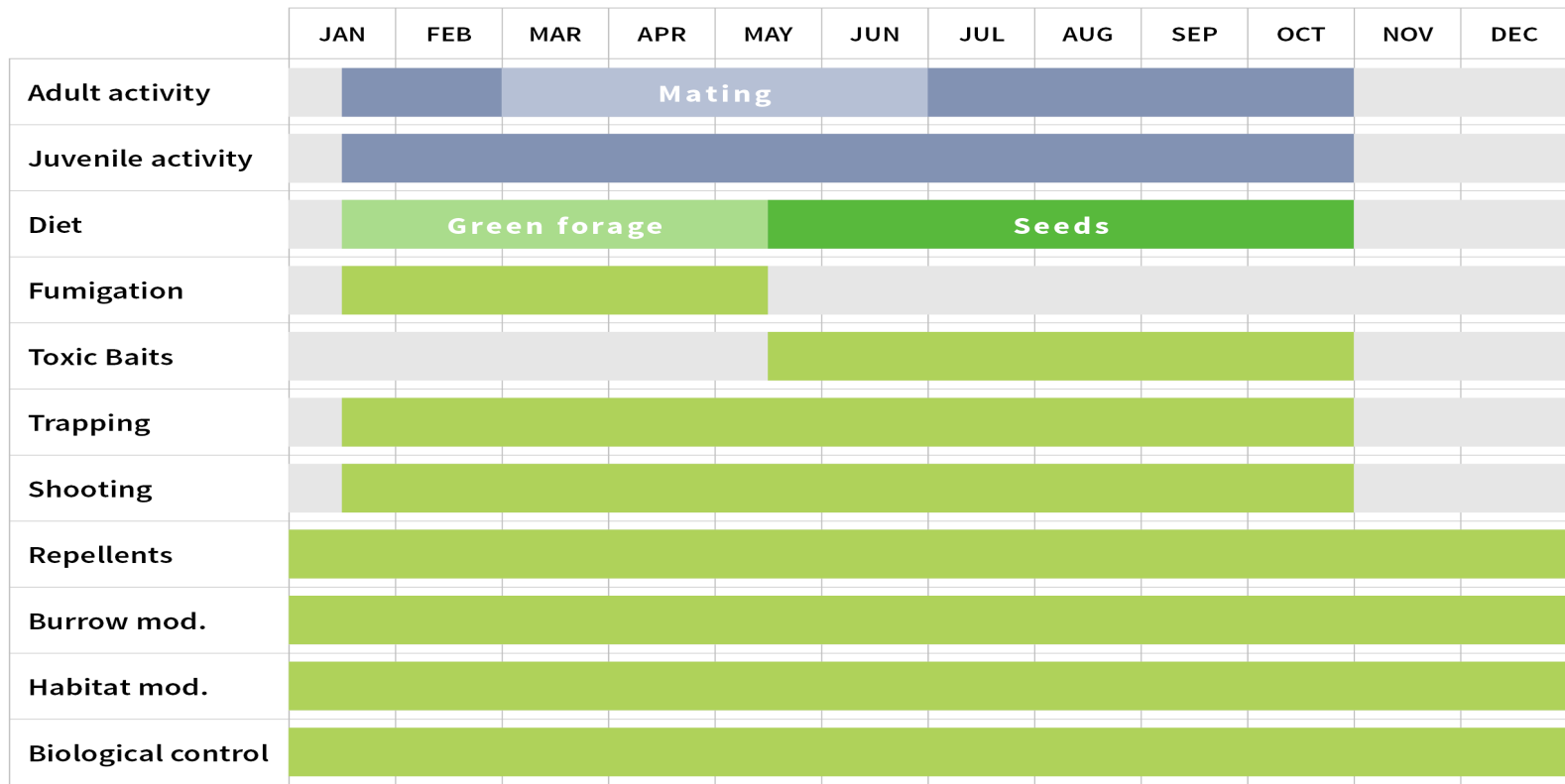


\*California ground squirrel hibernation may differ by region

**When is trapping effective?**

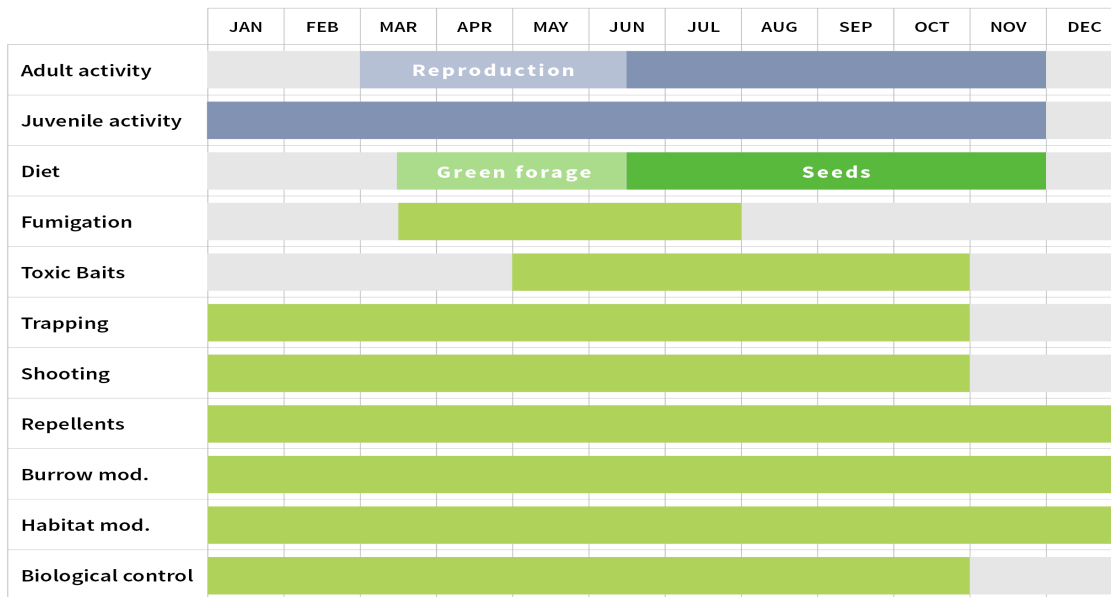


\*California ground squirrel hibernation may differ by region

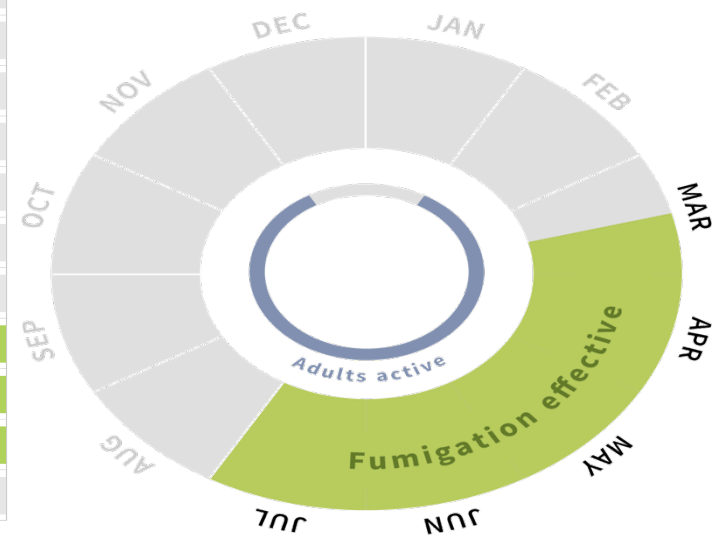


■ Active period   
 ■ Feeding period   
 ■ Method effective   
 ■ Hibernation/Method ineffective






### When is fumigation effective?





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