

# CA Ground Squirrel Biology and Control



Photo: Wade Tregaskis

**Carolyn Whitesell, Ph.D.**

**Human-Wildlife Interactions Advisor**

# Ground Squirrels



Why can't we just move the animal causing problems?



## **465.5 (g)(1). Immediate Dispatch or Release**

- All furbearing and nongame mammals that are legal to trap must be immediately killed or released. Unless released, trapped animals shall be killed by shooting where local ordinances, landowners, and safety permit. This regulation does not prohibit employees of federal, state, or local government from using chemical euthanasia to dispatch trapped animals.....



- .....Trapped animals must be euthanized or released immediately on site. Relocation of trapped wildlife is prohibited.

**ANIMAL RELEASE PROHIBITED  
PROHIBIDO LIBERAR ANIMALES**

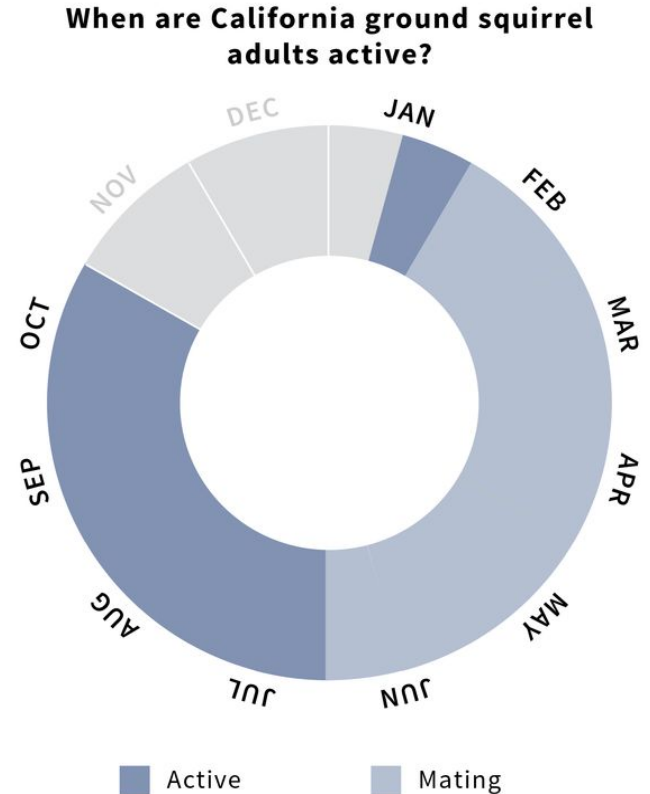
# Current Control Strategies

- Currently, we focus on an integrated approach that utilizes a number of strategies and tools for control
- Determine your threshold for management

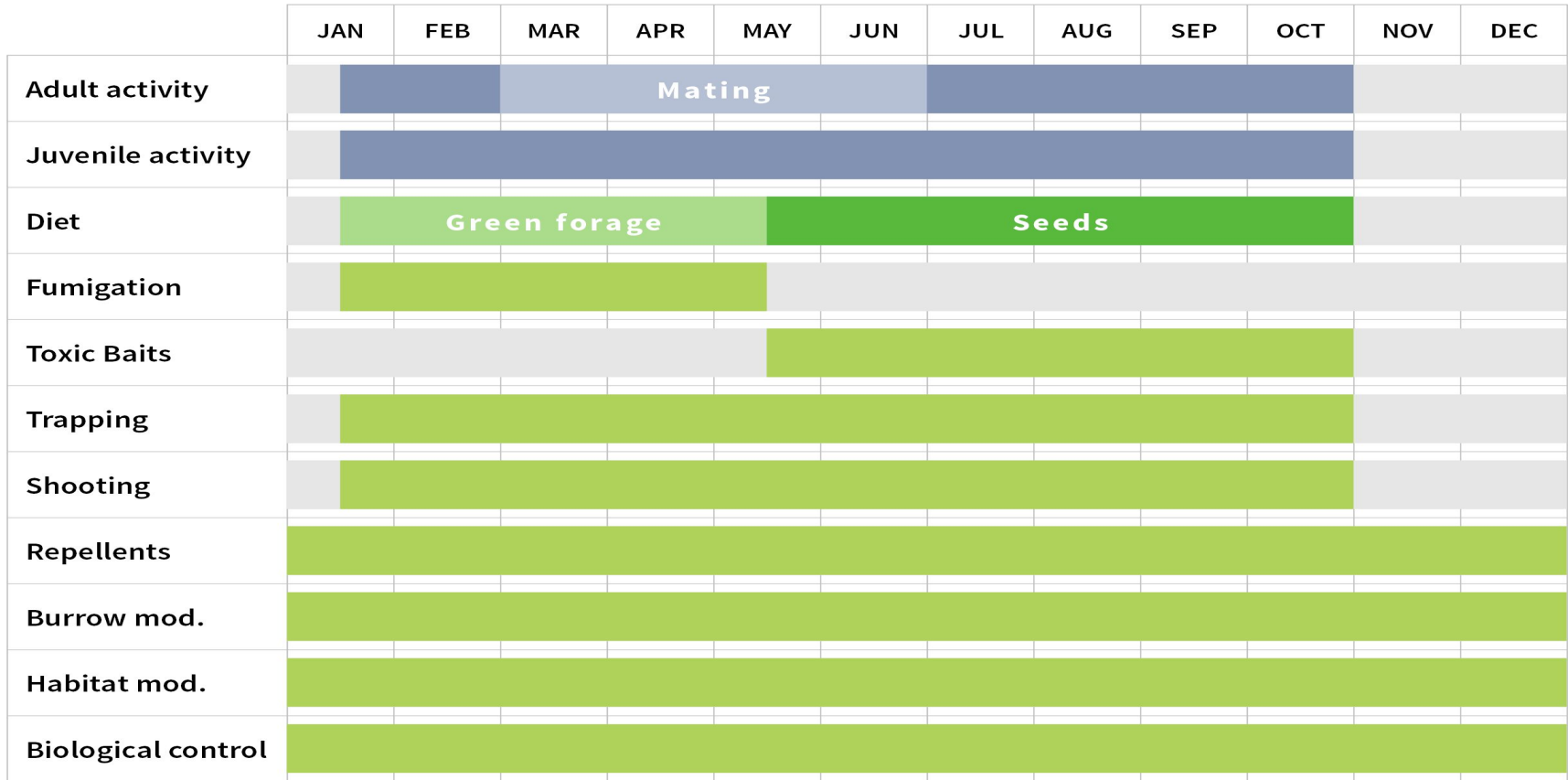


# Importance of Biology/Ecology

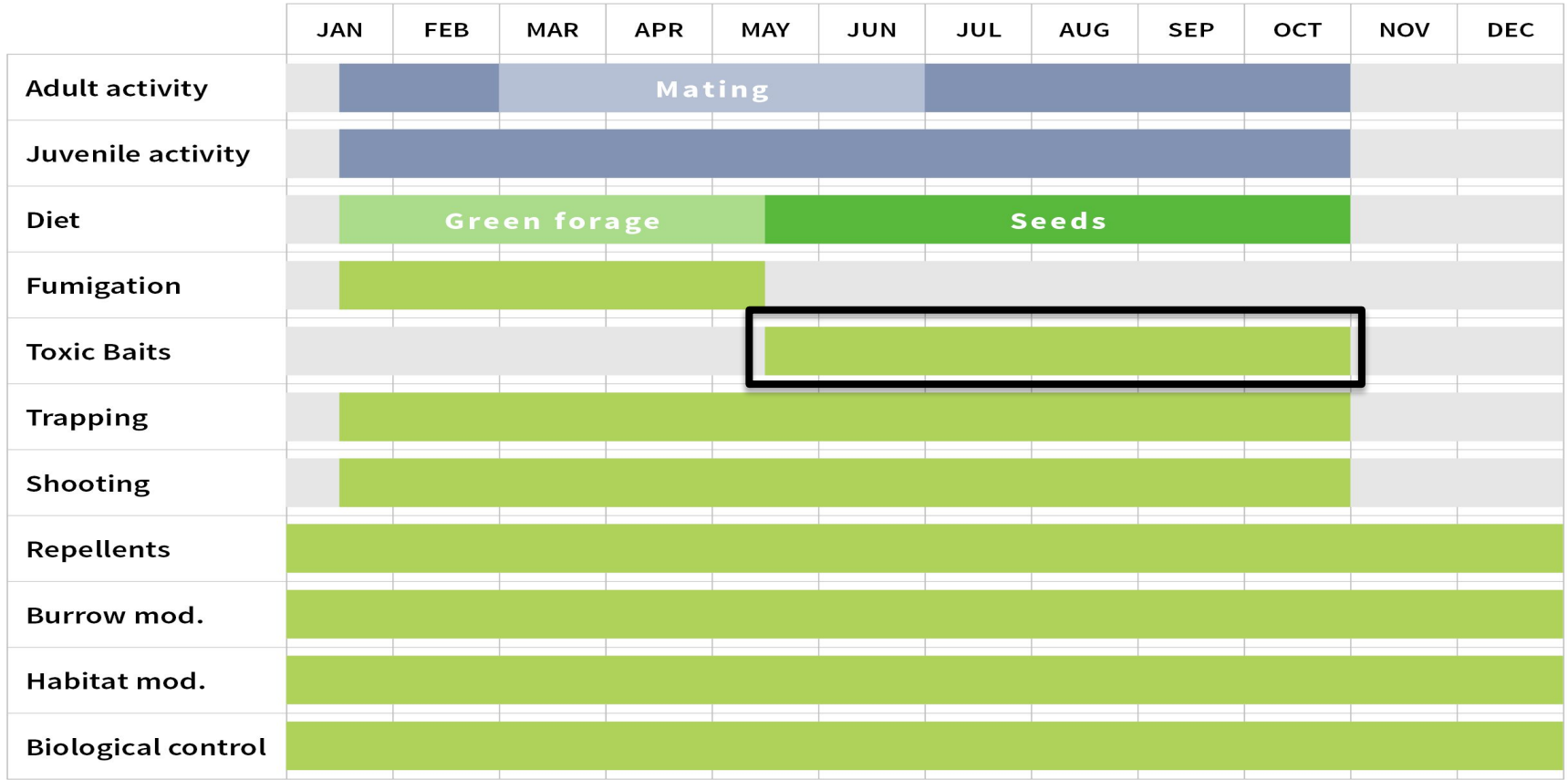
- Understanding the biology and ecology of vertebrate pests will guide management decisions.



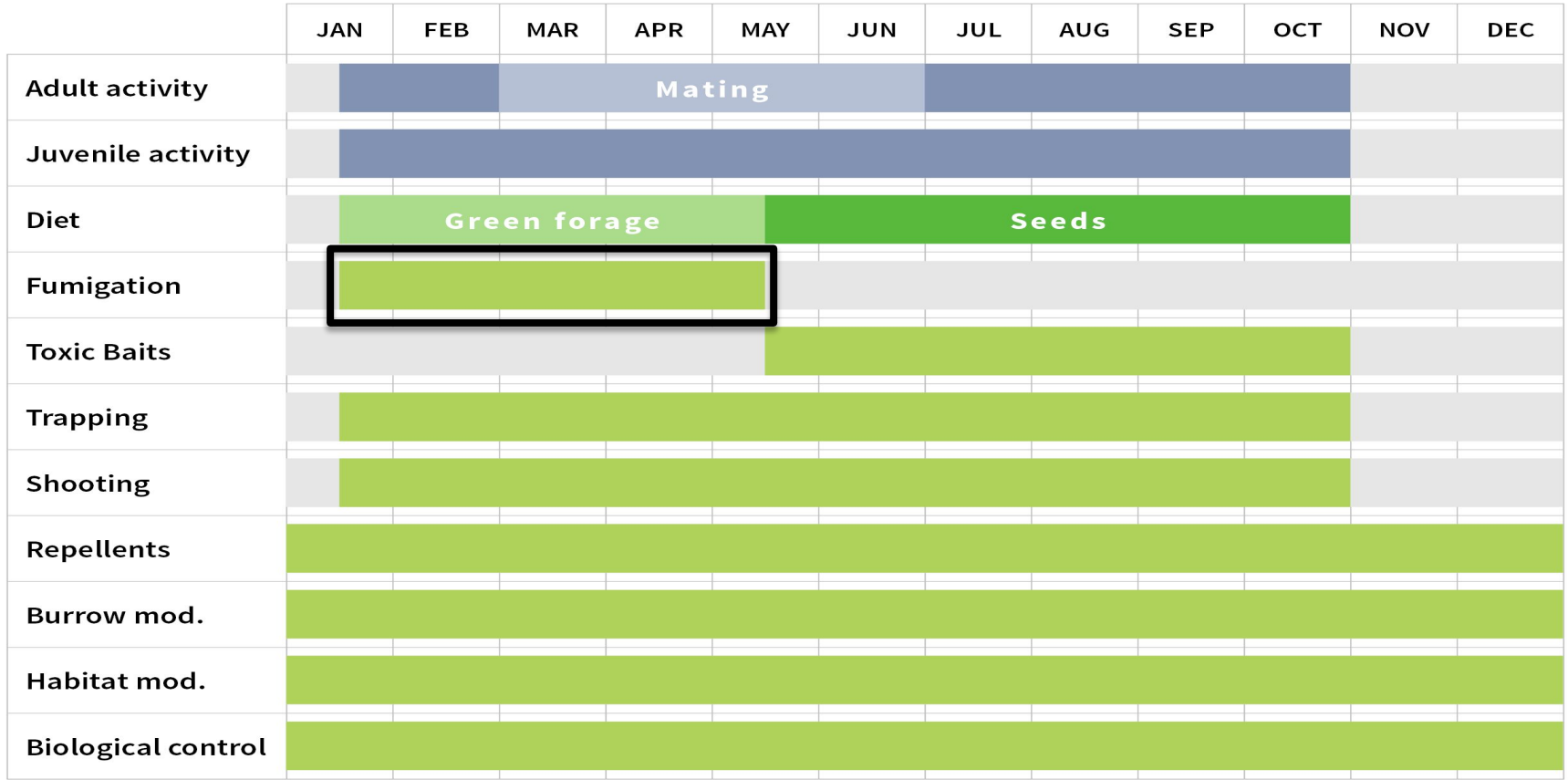
California ground squirrel hibernation may differ by region



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



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



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

# Ground squirrel best management practices website: [www.groundsquirrelbmp.com](http://www.groundsquirrelbmp.com)



Ground Squirrel BMPs

Biology

Identification

Management

Regulations

Resources

FAQs

## Ground squirrel management for California



Jack Kelly Clark / UC IPM

### What are BMPs?

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

### What is IPM?

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

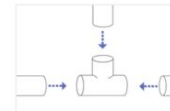


### Timing and Efficacy

Compare management methods for:

California Ground Squirrel

Belding's Ground Squirrel



### Step-by-Step Guides

Visual how-to's for:

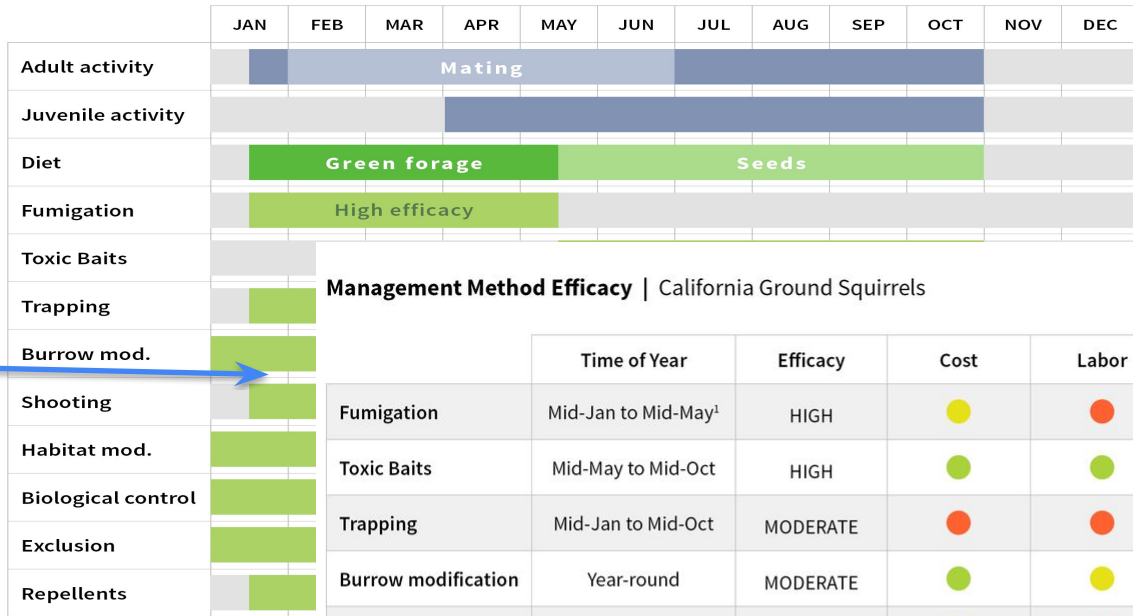
Bait Station Construction

Calculating CO2 Flow

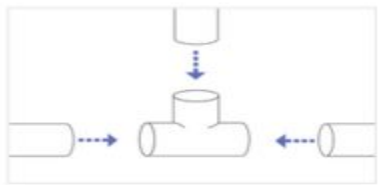
Spreader Calibration



## Timing Management Efforts | California Ground Squirrels



**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

## Management Method Efficacy | California Ground Squirrels

	Time of Year	Efficacy	Cost	Labor	Restrictions
Fumigation	Mid-Jan to Mid-May <sup>1</sup>	HIGH	●	●	● <sup>2</sup>
Toxic Baits	Mid-May to Mid-Oct	HIGH	●	●	● <sup>2</sup>
Trapping	Mid-Jan to Mid-Oct	MODERATE	●	●	●
Burrow modification	Year-round	MODERATE	●	●	●
Shooting	Mid-Jan to Mid-Oct	MODERATE	●	●	●
Repellents	Mid-Jan to Mid-Oct	LOW	●	●	●
Habitat modification	Year-round	LOW	●	●	●
Biological control	Mid-Jan to Mid-Oct	LOW	●	●	●
Exclusion	Mid-Jan to Mid-Oct	LOW	●	●	●

■ Active  
 Note: Ground sq

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

● = Low  
 ● = Moderate  
 ● = High

# 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.

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

### 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.

## 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.

Acroline, labeled for use as an aquatic herbicide	Dazomet, labeled for production of agricultural plant commodities	Methamidophos – unregistered	Propanil (3,4-dichloropropionanilide)
Aldicarb – unregistered	Dicamba <sup>1</sup>	Methidathion	Sodium cyanide
All dust (except products containing only exempt pesticides)**	2,4-dichlorophenoxyacetic acid (2,4-D) <sup>1</sup>	Methyl bromide	Sodium fluoroacetate (compound 1080) – unregistered
Aluminum phosphide	2,4-dichlorophenoxybutyric acid (2,4-DB) <sup>1</sup>	2-methyl-4-chlorophenoxyacetic acid (MCPA) <sup>1</sup>	Sodium tetrathiocarbonate – unregistered
Any pesticide containing active ingredients listed under section 6500(a), labeled for agricultural, outdoor institutional, or outdoor industrial use <sup>1</sup>	2,4-dichlorophenoxypropionic acid (2,4-DP) <sup>1</sup>	Methyl iodide – unregistered	Strychnine**
Any pesticide pursuant to Section 18 of FIFRA (Emergency exemption)	1,3-Dichloropropene (1,3-D)	Methyl isothiocyanate (MITC), labeled for the production of agricultural plant commodities	Sulfotepg – unregistered
4-Amino pyridine	Difenacoum	Mevinphos – unregistered	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	Phorate	Zinc phosphide <sup>1</sup>
Carbaryl <sup>1</sup> **	Fenamiphos – unregistered	Phosphine gas	
Carbofuran – unregistered	Lindane** – unregistered	Potassium n-methyldithiocarbamate (metam-potassium), labeled for the production of agricultural plant commodities	
Chloropirrin	Magnesium phosphide		
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.

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

<sup>1</sup> Liquid formulations packaged in containers of 1 quart or less

<sup>1</sup> Liquid formulations packaged in containers of 1 gallon or less that contain 15% or less of the active ingredient.

<sup>1</sup> Liquid formulations labeled for use without further dilution

<sup>1</sup> Dry formulations packaged in containers of 1 pound or less. (For dicamba(phenoxy) labeled to be further diluted.)

<sup>1</sup> 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

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

\*\* Fly baits containing not more than 1% methomyl

<sup>1</sup> 2,4-D labeled only for use as a plant growth regulator

## 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, NURSERYMEN, AND OTHERS USING RESTRICTED PESTICIDES TO PRODUCE AGRICULTURAL COMMODITIES)

- Private Applicator Certificate Holders

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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 8414(c)
- <sup>1</sup>No permit required for certified applicators using pesticides listed in 3 CCR section 6500(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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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)*	2-methyl-4-chlorophenoxyacetic acid (MCPA)*	Sodium tetrathiocarbonate – unregistered
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Bromadiolone	Ethoprop, labeled for turf	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
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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 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

- Ditches and ditch banks
- Drip lines
- Egg handling equipment (on farms)
- Farm roads
- Field borders and headlands
- 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
- Irrigation canals
- Irrigation systems (drip lines)
- Lakes, rivers, and streams
- Milk-handling equipment (on farms)



# MUST have a copy of the label!

## SPECIMEN LABEL

### Ramik<sup>®</sup> 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).

(Test For Individual Container: It is Illegal to Sell This Package Individually.)

(Test For Container: This Product May Not Be Sold in Packaging that Holds Less Than 4 Pounds of Bait.)

#### ACTIVE INGREDIENT:

Diphacinone ..... 0.005%  
(2-Diphenylacetyl)-1,3-Indandione

**OTHER INGREDIENTS:** ..... 99.995%

**TOTAL:** ..... 100.000%

EPA Reg. No. 61282-146

EPA Est. No. 61282-WI-01

### KEEP OUT OF REACH OF CHILDREN CAUTION

**PRECAUTIONARY STATEMENTS  
HAZARDS 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 ordinary 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

#### If on Skin or Clothing

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center, or doctor, or **1-800-498-5743** immediately for treatment advice.

#### 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, or **1-800-498-5743** immediately for treatment advice.

#### 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 animals eat 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 allow bait to be exposed on soil surface. Do not apply where runoff is likely to occur. Do not contaminate water when disposing of equipment wash water or rinsate.

#### PRECAUTIONARY STATEMENTS

Hazard to Humans and Domestic Animals

**CAUTION:** May be harmful if inhaled or absorbed through the skin. Avoid contact with the product instead the eating, drinking or using and avoid bleeding. Keep away from children, domestic animals and pets. Do not get on hands, on face, or on clothing. Any person who retrieves carcasses or unused bait following application of this product must wear gloves and change into clean clothing. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after handling this product.

**HAZARD TO HUMANS AND DOMESTIC ANIMALS:** 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.

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

**ENVIRONMENTAL HAZARDS:** This product is 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 allow bait to be exposed on soil surface. Do not apply where runoff is likely to occur. Do not contaminate water when disposing of equipment wash water or rinsate.



**ROZOFF<sup>®</sup>**  
POCKET GOPHER BAIT

**POCKET GOPHER BAIT**

**FOR THE CONTROL OF POCKET GOPHERS ONLY**

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

Active ingredient, chlorophacinone ... 0.0030%

Inert ingredients ... 99.9970%

**TOTAL ... 100.000%**

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION:** See label for additional precautionary statements.

**LIPHA TECH**

LiphaTech, Inc.  
3000 W. Elm Street  
Milwaukee, WI 53209  
(800) 353-1178

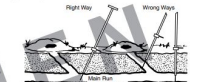
This product not registered for sale or use in Alaska, Hawaii, North Carolina or Pennsylvania.

#### DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. READ THIS LABEL and follow all use directions and use procedures. **READ INSTRUCTIONS.** Use only to control pocket gophers in marl and do not use on lawns, golf courses, athletic fields, playgrounds, and parks. Do not get on hands, on face, or on clothing. Any person who retrieves carcasses or unused bait following application of this product must wear gloves and change into clean clothing. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after handling this product.

**Application Directions:** Running pocket gophers drive out live, hand-sorted rodents on the sides of underground tunnels. These tunnel rodents coming to the surface are on the far side of the fur and freeze holes (plugged with loose soil). Treatment Can be made in one or more of the following ways:

1. Using a long-handle tampon, carefully remove the plug on the far side of the hole. Carefully insert 1 cup of bait so it occupies the hole as possible. Repeat the digging, using bait to cover the hole with soil.
2. Using a metal/rod probe to 1-2 inches deep to locate the main tunnel. Careful dig along lines for distance of 100 feet. One 100 lb. bag of bait will tunnel and cover the hole to 50 ft will not enter the tunnel system.
3. Carefully remove the plug on the far side of the hole. Carefully insert 1 cup of bait so it occupies the hole as possible. Repeat the digging, using bait to cover the hole with soil.



The Right Way Wrong Way

The Right and Wrong ways to use a probe for poisoning gophers are shown above. Do not put bait in the main runway, not in the lateral or intertidal in the system of the runway.

**STORAGE AND DISPOSAL:**

Do not contaminate water, food or feeding material or feedstock. Keep container in original container in a cool, dry place inaccessible to children and pets. Portable Chemical Restrooms: Mixing ratio may vary from the amount of bait or an approved waste disposal facility. Container Handling: This is a corrosive container. Do not reuse or use this container. Clean for recycling if available or dispose of empty container in a battery/recycle, or incineration, or allowed by state and local authorities, by burning/burial, away from water.

**WARNING:** To be water container with applicable law, solar makes to be securely, exposed or applied, concerning use of this product other than indicated on the label. Follow directions at the site of use and/or handling of product when such use and/or handling is contrary to label instructions.

EPA Reg. No. 7173-104

EPA Est. No. 7173-018

# Endangered species considerations

- These must always be considered, regardless of control method
- PRESCRIBE



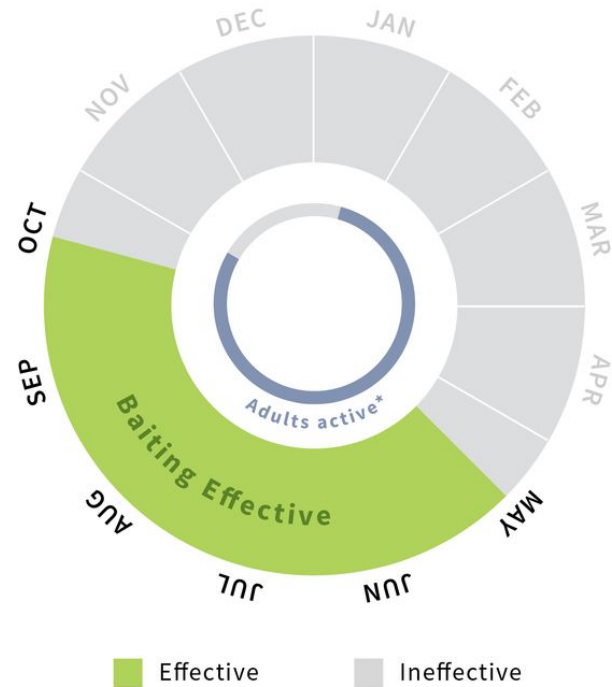
# Toxic Baiting

Two main kinds:

- Anticoagulants
- Acute toxicant (Zinc Phosphide)



## When is baiting effective?



\*California ground squirrel hibernation may differ by region

# Control Options—Baiting

- Two kinds of anticoagulants:
  - **first generation**
  - second generation
- For CA ground squirrels, only **first generation baits** are permitted
  - chlorophacinone
  - diphacinone





# First generation anticoagulants



- Used for spot treatments, broadcast, or in bait stations
- Require multiple feedings



- Antidote available
- Check for and collect carcasses

**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 gloves. Any person who removes carcasses or used bait following application of 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 or using the toilet and change 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 intertidal 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 spilled material immediately as indicated below.

**PESTICIDE DISPOSAL**

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

**CONTAINER DISPOSAL: Nonrefillable container**

DO NOT REUSE OR REFILL THIS 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

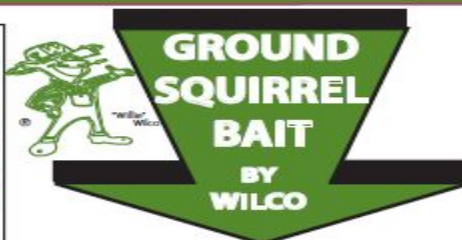
**NET WT. 4 LBS.**

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

UPC

0 91017 31004 6

220313



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.

<b>If swallowed:</b>	<ul style="list-style-type: none"> <li>Call a poison control center, doctor or 1-800-850-7378 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>
<b>If on skin or clothing</b>	<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>
<b>If in eyes:</b>	<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 1-800-222-1222 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 times), 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 assure 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.

**Requirements**  
manufacturer's instruction for cleaning/ use detergent and hot water. Keep PPE separately from other laundry. PE immediately after handling this Wash the outside of gloves before As soon as possible, wash hands after applying bait and before eating, using gum, using tobacco or using the hange into clean clothing.

**FIRST AID  
VE LABEL WHEN YOU WHEN  
AINING TREATMENT ADVICE**

- Call a poison control center, doctor, or 1-877-854-2494 immediately for treatment advice.
- Have a 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.

**NOTE TO PHYSICIAN**  
1, this material may reduce the clotting the blood and cause bleeding. If administer Vitamin K1 intramuscularly Repeat as necessary based on of prothrombin times.

**TREATMENT FOR PET POISONING**  
imal eats bait, call veterinarian or 1-877-854-2494 at once.  
**NOTE TO VETERINARIAN**  
nt Diphacinone: For animals ait and/or showing poisoning signs r elevated prothrombin times), give

**ENVIRONMENTAL HAZARDS**  
is extremely toxic to mammals and birds. Dogs, cats and other predatory gny mammals and birds might be h they feed upon animals that have eaten not apply directly to water or to areas a water is present or to intertidal areas an high water mark. Do not contaminate disposing of equipment wash water or



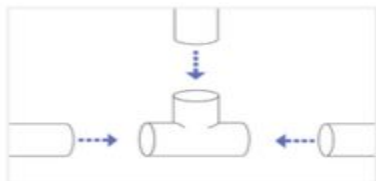


## Timing and Efficacy

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

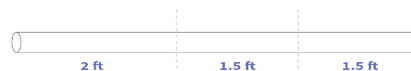
### Traditional T-type

#### Materials

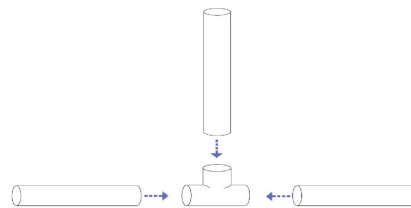
- Five feet of 4-inch PVC/NDS drainage pipe
- One T-junction
- Two 4-inch to 3-inch reducers
- One end cap
- PVC tape, PVC cement, or silicon glue
- Label

#### Assembly

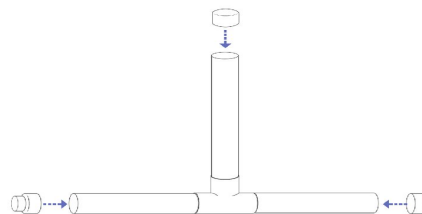
1. Cut the PVC pipe into one 2-foot section and two 1.5-foot sections.



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.





# Acute toxin--Zinc phosphide

- Must be licensed professional
- Potential bait shyness
- Can be used for spot treatments and broadcast baiting
- No bait stations!
- Not permitted for use in or around buildings.
- Label is very species-specific for many locations



## LAWNS, ORNAMENTALS, GOLF COURSES, PARKS AND NURSERIES

**USE RESTRICTIONS:** For control of meadow voles, prairie voles, pine voles, California voles, long-tailed voles, Oregon voles, mountain voles and Townsend's voles (Microtus spp.), Columbian ground squirrels (Spermophilus columbianus), Richardson's ground squirrels (S. richardsonii), thirteen-lined ground squirrels (S. tridecemlineatus), and California ground squirrels (S. beecheyi) in lawns, ornamentals, golf courses, parks, and nurseries. Bait must not be applied on roads, over water or where plants are grown for food or feed.

**PREBAITING:** Prebait by placing one teaspoon (4 grams) of untreated steamed crimped oats around each active burrow opening or in each active runway 2 or 3 days prior to using ZP AG OATS to enhance acceptance by ground squirrels or voles.

**HAND BAITING:** Place 4 grams (one teaspoon) of bait around each active burrow opening or in each active runway. Allow bait to fall through to the ground surface but do not apply bait to bare ground. Do not place bait in heaps or piles.

	<b>FGARs</b>	<b>Zinc phosphide</b>
<b>Efficacy</b>	Highly efficacious	Precipitation and other factors may influence efficacy
<b>Bait acceptance</b>	Good bait acceptance	Bait acceptance variable
<b>Antidote</b>	Antidote available	No antidote
<b>Primary toxicity</b>	Lower nontarget risk	Acutely toxic; risks can be high
<b>Secondary Toxicity</b>	Some potential for risk	Essentially no risk
<b>Cost</b>	Requires larger amount of bait, thus more expensive	Less expensive than anticoagulants
<b>Time to death</b>	Slower time to death than other toxicants	Short time from consumption to death provides quick control
<b>Restrictions</b>	<ul style="list-style-type: none"> <li>• Available for residential use without restriction</li> <li>• Field use is restricted</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot generally be used in residential areas</li> <li>• Only one application allowed per year</li> </ul>

# Nontarget impacts of rodenticides

1. Nontargets may eat bait



2. Secondary exposure

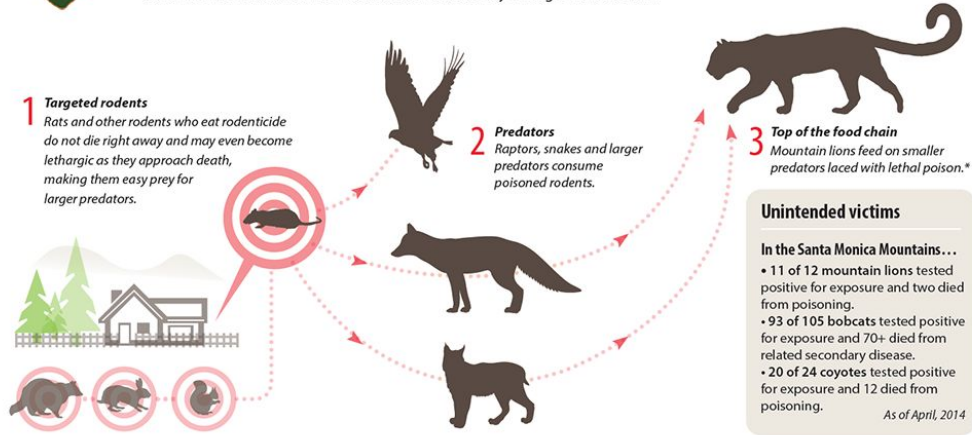






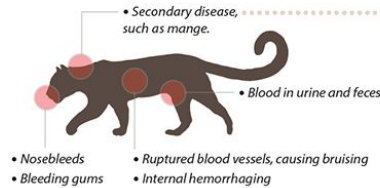
# Lethal Dose: Rat Poison & Local Wildlife

Local residents may inadvertently be poisoning wildlife. National Park Service researchers have found a direct link between exposure to anticoagulant rodenticides, commonly known as rat poison, and the deaths of wildlife in and around the Santa Monica Mountains. How rodenticide works its way through the food chain:



## How anticoagulant rodenticide kills

These compounds interrupt blood-clotting, which leads to uncontrolled bleeding and death. They may also suppress the animal's immune system, making it susceptible to other diseases. **Symptoms include:**



## What is mange?

A microscopic mite that burrows into the skin and causes...

1. Extreme itchiness and skin lesions.
2. Fluid and nutrient loss through the skin.
3. Infection, starvation, hypothermia or other complications, eventually leading to death.



### Check the label

Here are the most common anticoagulant compounds:

- Bromadiolone
- Brodifacoum
- Diphacinone
- Difethialone



# Nontarget impacts of pesticides

Research on mountain lions by CDFW in 2016: **FGARs detected in 73%** of sampled mountain lions; **SGARs detected in 92%**

SGARs have been widely detected in birds of prey (up to **92% of raptors** in San Diego, in one study)

AR exposure in nontarget mammals, reptiles, invertebrates and birds

Adverse impacts of **sublethal exposure remain largely unknown**

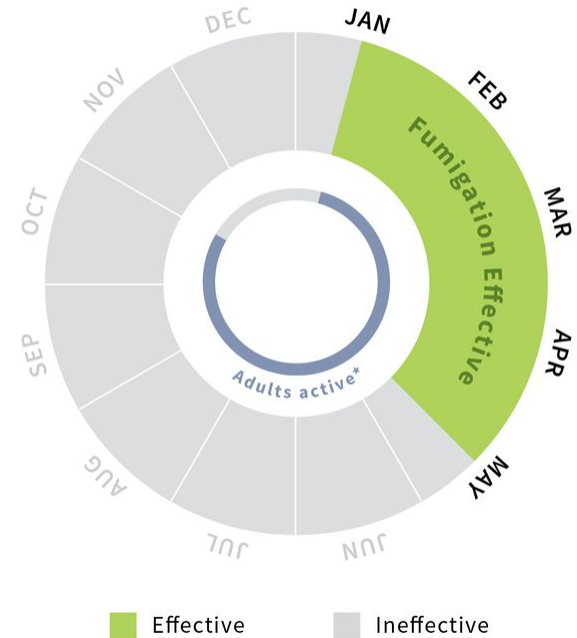
# Fumigation

Involves use of poison gas in burrows to control ground squirrels.

Works best when soil moisture is high (after ground squirrels emerge in spring).



## When is fumigation effective?



\*California ground squirrel hibernation may differ by region



# Fumigation

Gas cartridges

Aluminum Phosphide

Carbon Monoxide

Carbon Dioxide

Pressure (Rodenator)

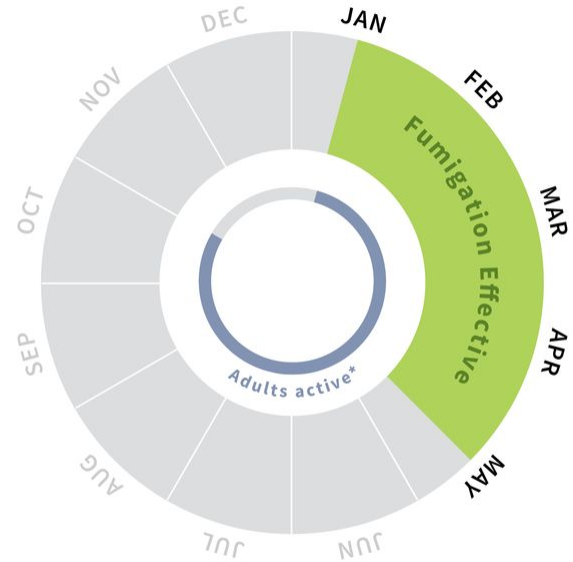
**DANGER - PELIGRO**  
AREA UNDER FUMIGATION



FIELD NOT FOR USE  
**DO NOT ENTER - NO ENTRE**

FUMIGANT: \_\_\_\_\_  
REGISTRATION NO: \_\_\_\_\_  
IN CASE OF EMERGENCY, PLEASE CALL: \_\_\_\_\_  
(24-HOUR RESPONSE)

When is fumigation effective?



Effective Ineffective

\*California ground squirrel hibernation may differ by region

# Gas cartridges

Studies show 62–86% control for CA GS



# Aluminum phosphide



- 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



# Aluminum Phosphide

- 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.

# Texas 2017

# Utah 2010

## A reminder on the dangers when using aluminium phosphide – two USA child deaths

« Back

### How Water Poured on Rodenticide Caused 4 Deaths in a Texas Home

By GILLIAN MOHNEY · Jan 3, 2017, 3:41 PM ET

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If any reminder is needed as to the dangers associated with the incorrect use of these gassing products, look no further than the USA where two children were killed.

A former pest control technician in Salt Lake City, Utah admitted his actions led to the deaths of two young girls following incorrect usage of aluminium phosphide pellets (trade name Fumitoxin) following treatment to eliminate voles in their garden.

Nocks admitted he placed the pesticide too close to the house, exceeded dosage requirements and did not provide the Toone family with the Material Safety Data Sheet and other information as required by Fumitoxin's labelling.

The treatment was carried out on 5 February 2010. The Toone family began to get ill that night. Four-year-old Rebecca Toone died the following day and her 15-month-old sister Rachel died three days later. Rebecca and Rachel had been exposed to phosphine gas, which was given off by the aluminum phosphide pesticide pellets.

An April 2010 report from the Utah State Medical Examiner's Office said the Toone sisters had high levels of phosphorous in their bodies and had sustained extensive lung damage as a result of their exposure to the gas.

In early January 2012 the technician, Coleman Nocks, 64, was given a sentence of 36 months probation after he pleaded guilty to a misdemeanour count of unlawful use of a registered pesticide. His employer, Bugman Pest and Lawn, was also placed on probation for 36 months and was ordered to pay \$3,000 in fines.

As UK readers will be well aware, as from January 2015 all users of aluminium phosphide will need to hold the Level 2 Award in the Safe Use of Aluminium Phosphide for Vertebrate Control.

To read about the training requirements for this Award click [here](#).



The two children killed

# Fumigation Management Plan

<b>DANGER</b>	
<b>POISON GAS KEEP AWAY</b>	
<b>PHOSPHINE FUMIGATION IN PROGRESS</b>	
Fumigation:	Start date      End date
Ventilation:	
<hr/>	
Do not access this storage during fumigation and ventilation	
<b>Ventilation period:</b> One day with aeration fan or five days without aeration fan	
<b>Withholding period:</b> Two days	
Place warning signs at all storage access points during fumigation	
<small>Warning sign only - see label for use</small>	



This warning sign template can also be downloaded from [www.planthealthaustralia.com.au/gov/pest/biosecurity/general-biosecurity-information](http://www.planthealthaustralia.com.au/gov/pest/biosecurity/general-biosecurity-information)



# Carbon Monoxide Machines

- Potential advantages for CO:
  - Safer for use
  - Multiple applications
- Proposed regulations
  - Min distance to structures varies by target species
  - Device needs EPA establishment number
  - Not used on burrows with nontarget species (only gophers, GS, and field mice)
  - Protective eyewear
  - Retain records



# Carbon monoxide machines

---

<u>Species</u>	<u>Device</u>	<u>Authors</u>	<u># of fields</u>	<u>Efficacy</u>
Belding's GS	PERC	Orloff	2	76%
California GS	PERC	Baldwin	2	66%
California GS	PERC	Baldwin	2	100%
California GS	Cheetah	Baldwin	3	-7%
California GS	Eliminator	Baldwin	2	44%

---

# Carbon Dioxide Machines

- Recently registered for burrowing rodents
- Donahue et al. 2018 found the Eliminator system caused 84.3-93.6% reduction in GS numbers

# Other strategies—Rodenator (Gas explosive device)



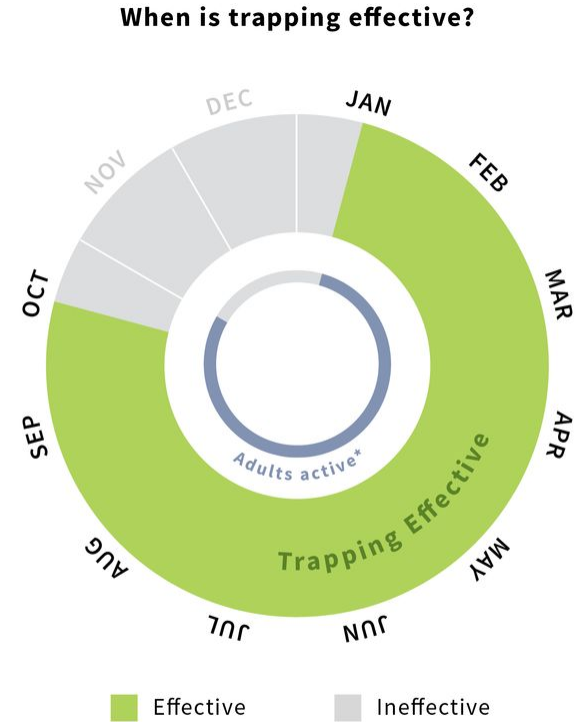
# Rodenator



# Trapping

Control of small to medium populations of ground squirrels is possible with traps

Is effective during times of year when ground squirrels are not hibernating (winter)



\*California ground squirrel hibernation may differ by region

# Who can trap damaging ground squirrels?

- Trapping license is required if trapping for profit.
- No trapping license required if you're the homeowner or a county employee

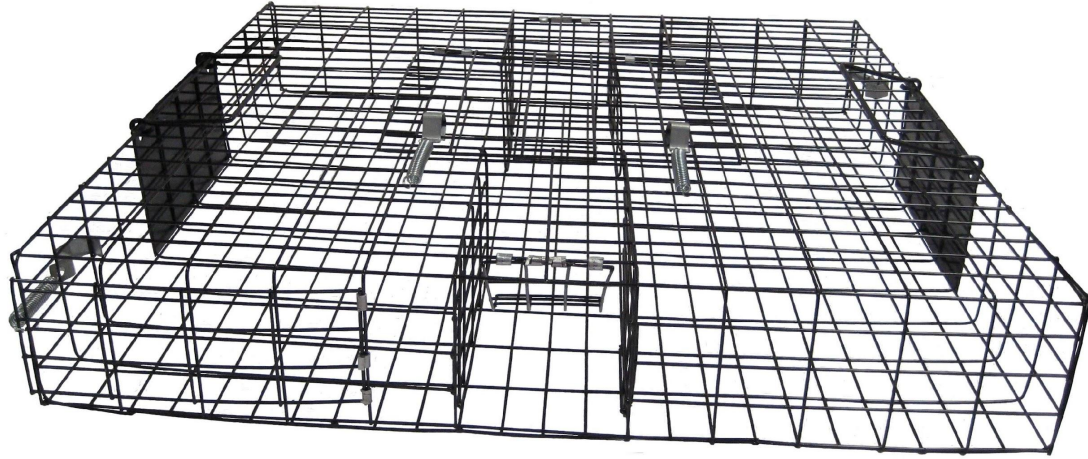


# Control Options—Trapping

- Body-gripping traps, tube traps, and box-type squeeze traps are common kill traps.
- Wire cage traps are common live traps.
- Live traps require euthanization of vertebrate pests. No drowning!
- Wear gloves



# Trapping



# Control Options—Trapping

- Conibear traps can be placed at burrow entrances.
- Conibear traps can also be placed inside boxes to bait ground squirrels while excluding larger animals.
- Wear gloves when handling all traps!



# Control Options—Habitat Modification

- Involves altering habitat to reduce the desirability for pests.
- Example:
  - remove brush piles to control ground squirrels
  - destroy old burrows





# 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.



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



# Control Options—Biocontrol

- Natural predators have been used to control vertebrate pests.
- Owl boxes are not appropriate for ground squirrels.
- Raptor perches appear ineffective as of now, but research continues



**Thank you!**

Questions?

[cawhitesell@ucanr.edu](mailto:cawhitesell@ucanr.edu)

