

An integrated approach to managing burrowing rodents

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Species Identification (Ground Squirrels)

- Gray-brown fur with semi-bushy tail.

Are social.

- Damage includes girdling of vines, chewing of irrigation lines, and abundant burrow openings.



Species Identification (Ground Squirrels)

- Squirrels are active throughout the day and are frequently visible.
- They prefer to burrow next to buildings, on field edges, and alongside fencerows and roadsides.



Species Identification (Pocket Gophers)

- Burrowing rodent about 6-8 in long; rarely seen above ground.
- Gopher mounds are plugged and often fan-shaped.



Species Identification (Pocket Gophers)

- They feed on taproots weakening and/or killing plants.
- Then can girdle vines below ground.
- Mounds can also kill plants, can create weed seed-beds, and can increase erosion.



Species Identification (Meadow Voles)

- Have dark grayish brown fur and are 4-6 inches in length.
- Populations tend to cycle, exhibiting irruptive growth patterns.



Species Identification (Meadow Voles)

- Dig shallow burrows and leave well-worn trails. Fecal pellets are often present.
- Primary damage caused by girdling of stems, consumption of vegetation, and gnawing of cables, pipes, etc.



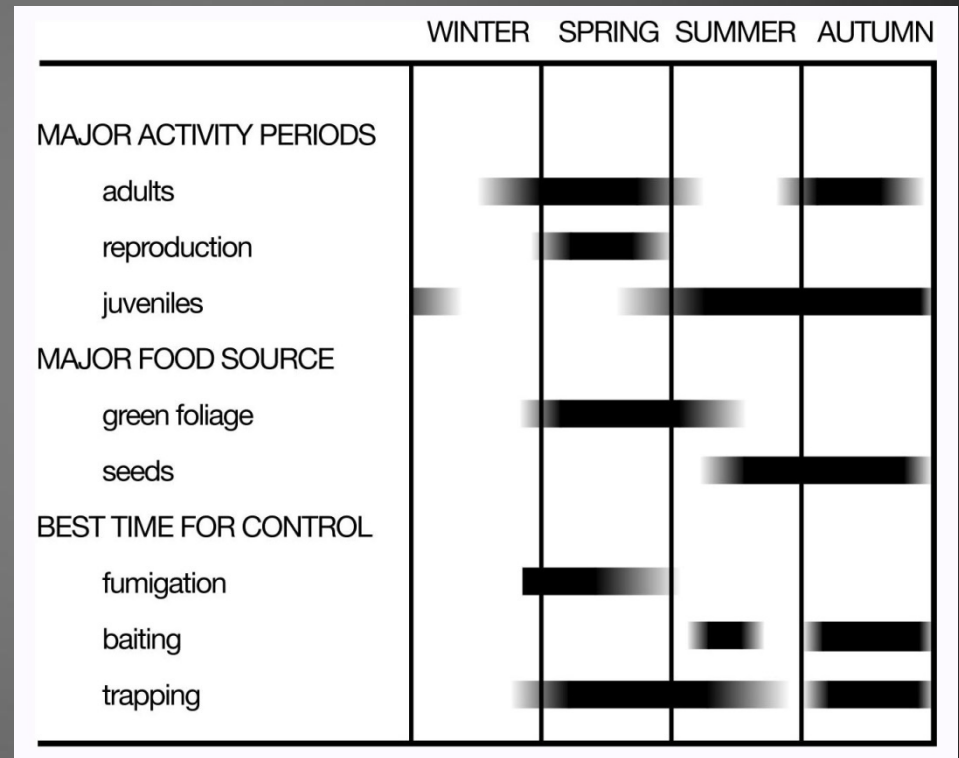
Current Control Strategies

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



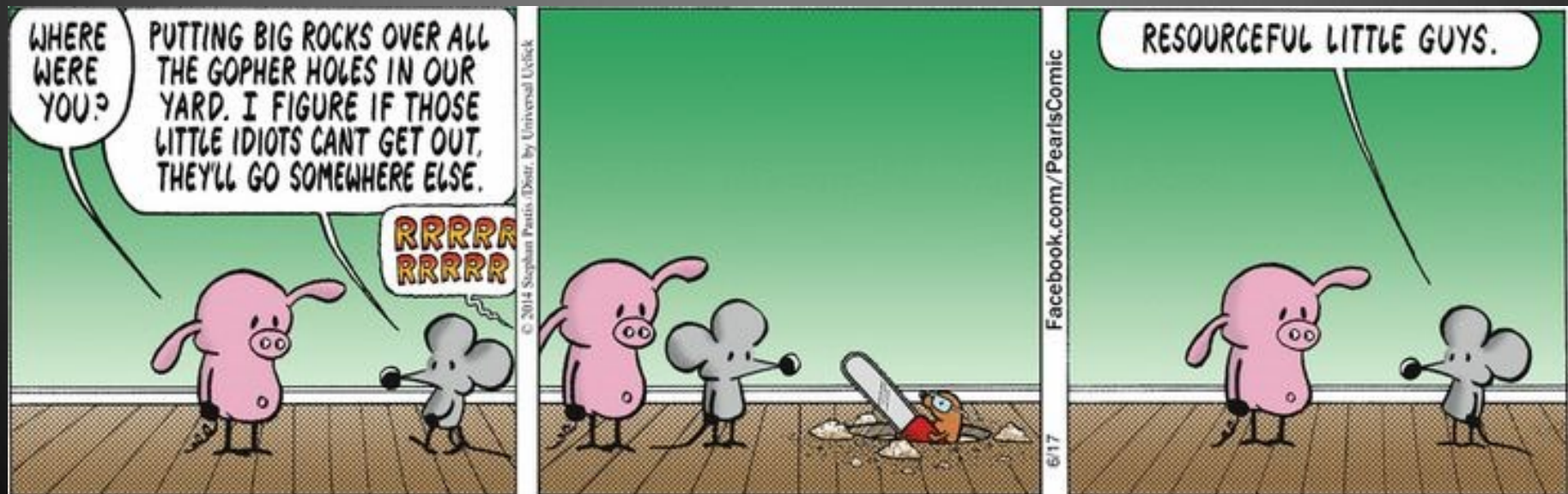
Importance of Biology/Ecology

- Understanding the biology and ecology of vertebrate pests will guide management decisions.
- **Example:**
 - ground squirrels



What Control Options are Available?

	Habitat modification	Baiting	Burrow fumigation	Trapping	Exclusion	Repellent	Frightening	Shooting
Ground squirrel	yes	yes	yes	yes				yes
Pocket gopher	yes	yes	yes	yes			unknown	
Vole	yes	yes		unknown	yes			



Control Options—Biocontrol

- Natural predators have been used to control vertebrate pests.
- Owl boxes have shown some success for gophers; raptor perches appear ineffective for ground squirrels.



Control Options—Habitat Modification

- Involves altering habitat to reduce the desirability for pests.
- Example:
 - destroy old burrows
 - remove or reduce cover for voles



Control Options—Exclusion

Voles

- Tree protectors can eliminate damage caused by voles



Control Options—Repellents

Protec-T registered for use
against pocket gophers in SDI

- ~41% reduction in gophers
- perhaps effective in reducing damage



Control Options—Trapping

Ground squirrels

- Body-gripping traps, tube traps, and box-type squeeze traps are common kill traps.



Control Options—Trapping

Ground squirrels

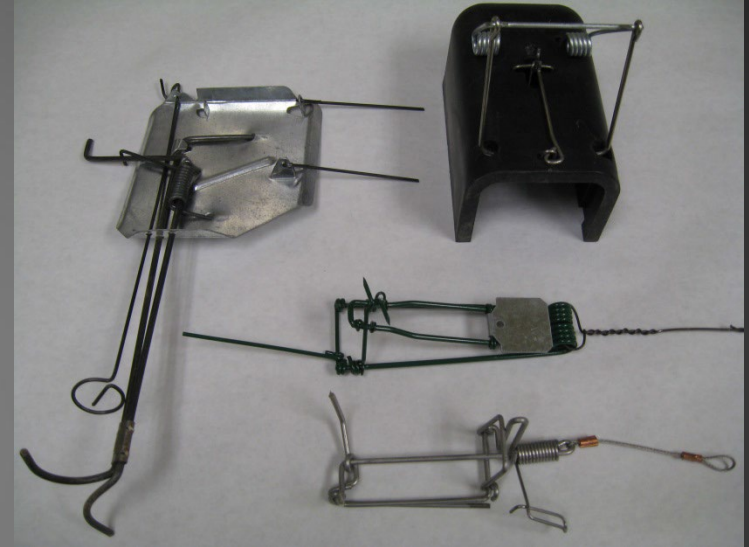
- Wire cage traps are common live traps.
- Live traps require euthanizing target animals.



Control Options—Trapping

Pocket gophers

- Gophinator trap was more effective.
- Covered sets yielded slightly higher capture rates in spring-summer, but not autumn.
- Efficacy was offset by setting time.
- We did not observe a difference in the number of captures across attractants.
- Human scent had no effect.



Control Options—Baiting

- Involves use of poison baits to control vertebrate pests.
- Essentially all restricted-use products except for a few homeowner options for gophers.

	Anticoagulants	Zinc phosphide	Strychnine
Ground squirrels	yes	yes	
Pocket gophers	yes	yes	yes
Voles	yes	yes	

Control Options—Baiting

Anticoagulants

- used for spot treatments, broadcast, or in bait stations
- require multiple feedings



Control Options—Baiting

Zinc phosphide

- is an acute toxin.
- potential bait shyness, therefore not recommended with bait stations.
- can be used for spot treatments and broadcast baiting.
- not to be used in or around buildings.



Control Options—Baiting

Pocket gophers

- Strychnine works best.
- Use probe to find tunnel.
- Dispense bait in tunnel.



Control Options—Fumigation

- Involves use of poison gas in burrows to control vertebrate pests.
- Works best when soil moisture is high (late winter early spring for gophers and after ground squirrels emerge in spring).
- Fumigants should not be used around buildings.



Control Options—Fumigation

Gas cartridges

- Effective for ground squirrels (62–86% control).
- Not effective for gophers.
- Caution must be used to prevent fires.



Aluminum phosphide

- Highly effective for both ground squirrels (97-100%) and gophers (90-100%).
- Is a restricted use pesticide.



Control Options—Fumigation



Control Options—Fumigation

Species	Device	Authors	# of fields	Efficacy
Pocket gopher	PERC	Orloff	3	56%
Pocket gopher	PERC	Baldwin & Orloff	3	62%
Pocket gopher	PERC	Baldwin & Orloff	2	68%
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%

Control Options—Fumigation

Carbon dioxide

- The Eliminator by IGI, LLC recently approved for use.




Control Options—Shooting

- Shooting can be effective for controlling ground squirrels although it is labor intensive.
- Lead bullets are banned statewide.




Ground Squirrel BMP website

<http://www.groundsquirrelbmp.com>

 GROUND SQUIRREL BMPs

Biology Identification Management Regulations Resources FAQs Search Q

Ground squirrel management for California



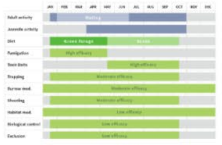
Adult CA ground squirrel in an agricultural field

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

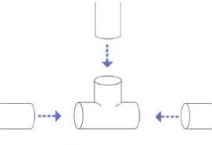
What is IPM?

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




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

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www.groundsquirrelbmp.com is a UC peer-reviewed publication made possible by support from the Vertebrate Pest Control Research Advisory Committee
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 University of California

Vertebrate Pest Control Handbook

<http://vpcrac.org/about/vertebrate-pest-handbook/>

The screenshot displays the website's interface with a blue header and a white main content area. The header contains navigation tabs: Home, Search, Research, Submissions, Calendar, About, and Contact. The main content area is titled "The Vertebrate Pest Control Handbook online" and lists "Current CDFA Rodenticide Labels" with sub-sections for Chlorophacinone, Diphacinone, and Zinc Phosphide, each with links to specific bait types and their percentages. Below this, there are links to various chapters, including "Chapter 1 Laws and Regulations (Revised)", "Chapter 2 Toxicants and Fumigants", "Chapter 3 The Role of Wildlife in Spreading Diseases (Revised)", and "Chapter 4 Mammals, Introduction and Baiting Guidelines Part 1". A list of mammals follows, including Bats, Chipmunks, Cotton Rat, Coyote, Deer Mice (Revised), Golden Mantled Ground Squirrel, California Ground Squirrel, Pocket Gophers (Revised), House Mice, Kangaroo Rats, Marmot, Meadow Voles (Revised), Moles, Muskrat, Norway Rat, and Roof Rat. A right-hand sidebar contains links for "About", "Committee", "VPCRCAC History", "Surcharge Legislation", "Vertebrate Pest Handbook", and "Links".

Home Search Research Submissions Calendar About Contact

The Vertebrate Pest Control Handbook online

Current CDFA Rodenticide Labels:

- CDFA Anticoagulant Labels - Chlorophacinone
 - [Rodent Bait Chlorophacinone Treated Artichoke Bracts \(0.01%\)](#)
 - [Rodent Bait Chlorophacinone Treated Grain \(0.01%\)](#)
 - [Rodent Bait Chlorophacinone Treated Grain \(0.005%\)](#)
- CDFA Anticoagulant Labels - Diphacinone
 - [Rodent Bait Diphacinone Treated Grain \(0.01%\)](#)
 - [Rodent Bait Diphacinone Treated Grain \(0.005%\)](#)
 - [Rodent Bait Diphacinone Bait Block \(0.005%\)](#)
- CDFA Zinc Phosphide Labels
 - [Rodent Bait Zinc Phosphide Treated Grain \(2.0%\)](#)

[Chapter 1 Laws and Regulations \(Revised\)](#)
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[Bats](#)
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[Chapter 4 Mammals Part 2](#)
[Golden Mantled Ground Squirrel](#)
[California Ground Squirrel](#)
[Pocket Gophers \(Revised\)](#)
[House Mice](#)
[Chapter 4 Mammals Part 3](#)
[Kangaroo Rats](#)
[Marmot](#)
[Meadow Voles \(Revised\)](#)
[Moles](#)
[Muskrat](#)
[Norway Rat](#)
[Chapter 4 Mammals Part 4](#)
[Opossum](#)
[Porcupine](#)
[Rabbits \(black tailed/jack cotton brush\) \(Revised\)](#)
[Roof Rat](#)

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A photograph of a squirrel sitting on a bed of dry grass and twigs. To the right of the squirrel is a white PVC pipe. A speech bubble with a grey background and a white border is positioned above the squirrel, containing the word "Questions?" in a yellow, serif font with a black outline. The background shows a rocky, hilly landscape under a clear sky.

Questions?