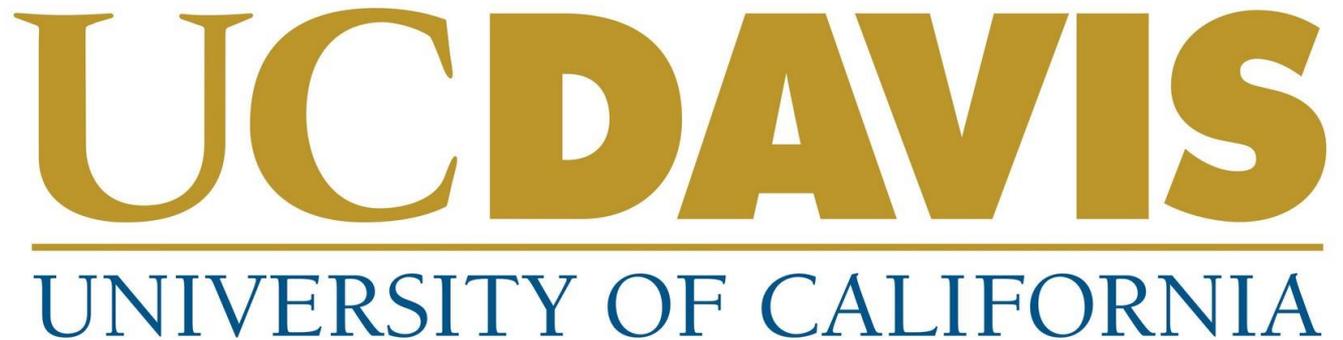


# Managing ground squirrel populations

Roger A. Baldwin

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# Species Identification (Ground Squirrels)

- Gray-brown fur with semi-bushy tail.
- Are social.
- Damage includes girdling of trees, consumption of forbs and grasses, 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.



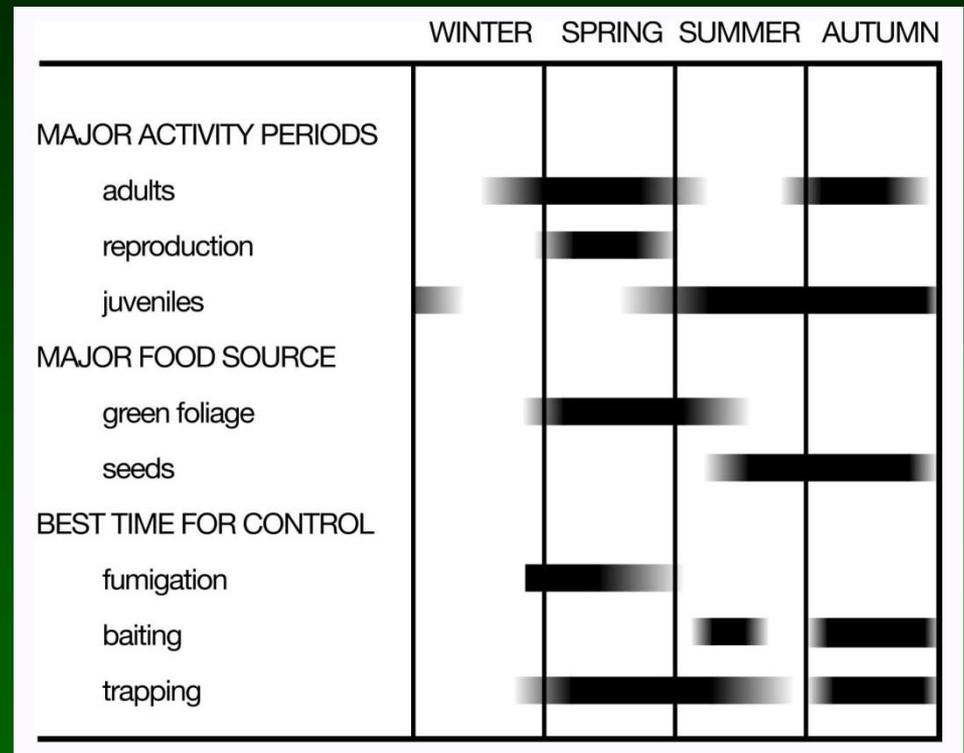
# Current Control Strategies

- 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	X	X	X	X				X

# Control Options—Biocontrol

- Natural predators have been used to control vertebrate pest populations.
- Raptor perches are inconclusive at best.



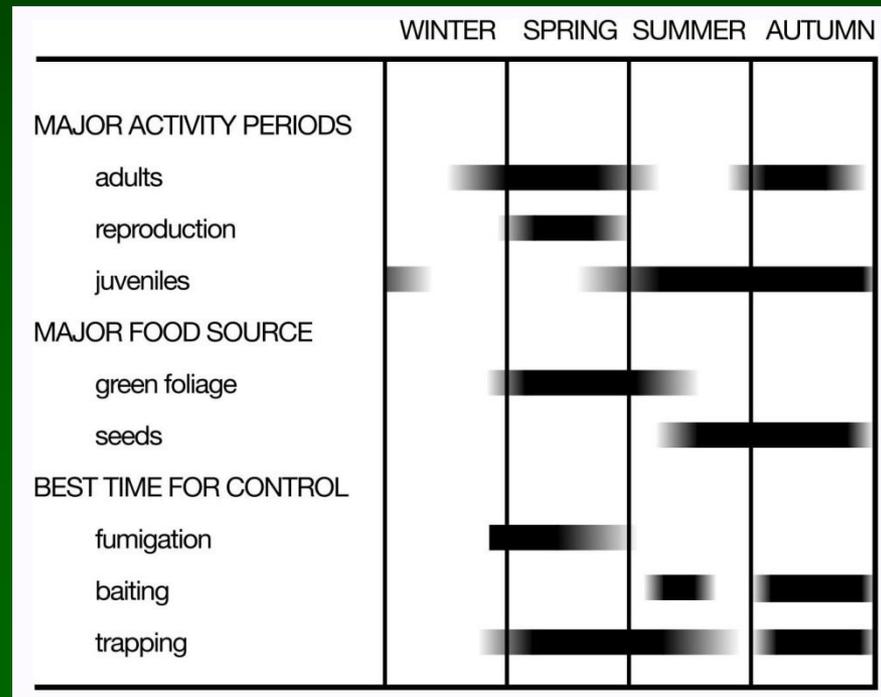
# Control Options—Habitat Modification

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



# Control Options—Trapping

- Control of small populations of ground squirrels is possible with traps.
- Trapping for ground squirrels is effective year round except during middle of summer and can be a good follow up to alternative control methods.



# 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.



# Control Options—Trapping

- Conibear traps can be placed at burrow entrances.
- Conibear traps can also be placed inside boxes to bait ground squirrels in while excluding larger animals.



# Control Options—Trapping

- Gopher box traps can be used in tandem when set along runways.
- Tube traps can be set along runways, as well.
- Live traps are also effective. However, they require euthanizing captured animals.



# Control Options—Baiting

- Involves use of poison baits to control vertebrate pests.
- Two main kinds:
  - anticoagulants
  - acute toxicant



# Control Options—Baiting

- Two kinds of anticoagulants:
  - first generation
  - second generation
- First generation options
  - chlorophacinone
  - diphacinone
- Are now restricted-use



# Control Options—Baiting

## Anticoagulants

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



# Control Options—Baiting

## Bait station design

- Commercial
- Upside down T



# Control Options—Baiting

## Bait station design

- Commercial
- Upside down T
- Modifications to upside down T
- Use in K-rat territory



# Control Options—Baiting

## Zinc phosphide

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



# Weighing the Positive and Negative Attributes of Rodenticides

## 1<sup>st</sup> generation anticoagulants

### Positive attributes:

- lower primary nontarget risk
- antidote available
- good bait acceptance
- readily available

### Negative attributes:

- requires larger amount of bait
- some potential for secondary risk
- slower time to death than other toxicants
- is restricted-use material



# Weighing the Positive and Negative Attributes of Rodenticides

## Zinc phosphide

### Positive attributes:

- short time from consumption to death provides quick control
- less expensive than anticoagulants
- essentially no secondary risk

### Negative attributes:

- acutely toxic; primary risks can be high for aboveground applications
- bait acceptance can be poor
- precipitation can influence efficacy
- no antidote
- is restricted use material



# Control Options—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).
- Fumigants should not be used around buildings.

	WINTER	SPRING	SUMMER	AUTUMN
<b>MAJOR ACTIVITY PERIODS</b>				
adults		██████████		██████████
reproduction		██████████		
juveniles	██████████		██████████	
<b>MAJOR FOOD SOURCE</b>				
green foliage		██████████		
seeds			██████████	██████████
<b>BEST TIME FOR CONTROL</b>				
fumigation		██████████		
baiting			██████████	██████████
trapping		██████████	██████████	██████████



# Control Options—Fumigation

## Aluminum phosphide

- Tablets can be used for ground squirrels.
- Is a restricted use pesticide.
- Recent study exhibited 97–100% control.



# Control Options—Fumigation

## Recent changes

- Buffer zones extended from 15 to 100 feet.
- Application sites now are to be posted.
- Fumigation Management Plan is still required.
- Contact local Ag Comm. office for details.



# Control Options—Fumigation

## Gas cartridges

- Recent study exhibited 62–86% control.
- Caution must be used with gas cartridges to prevent fires.



# Control Options—Fumigation

Carbon monoxide producing machines

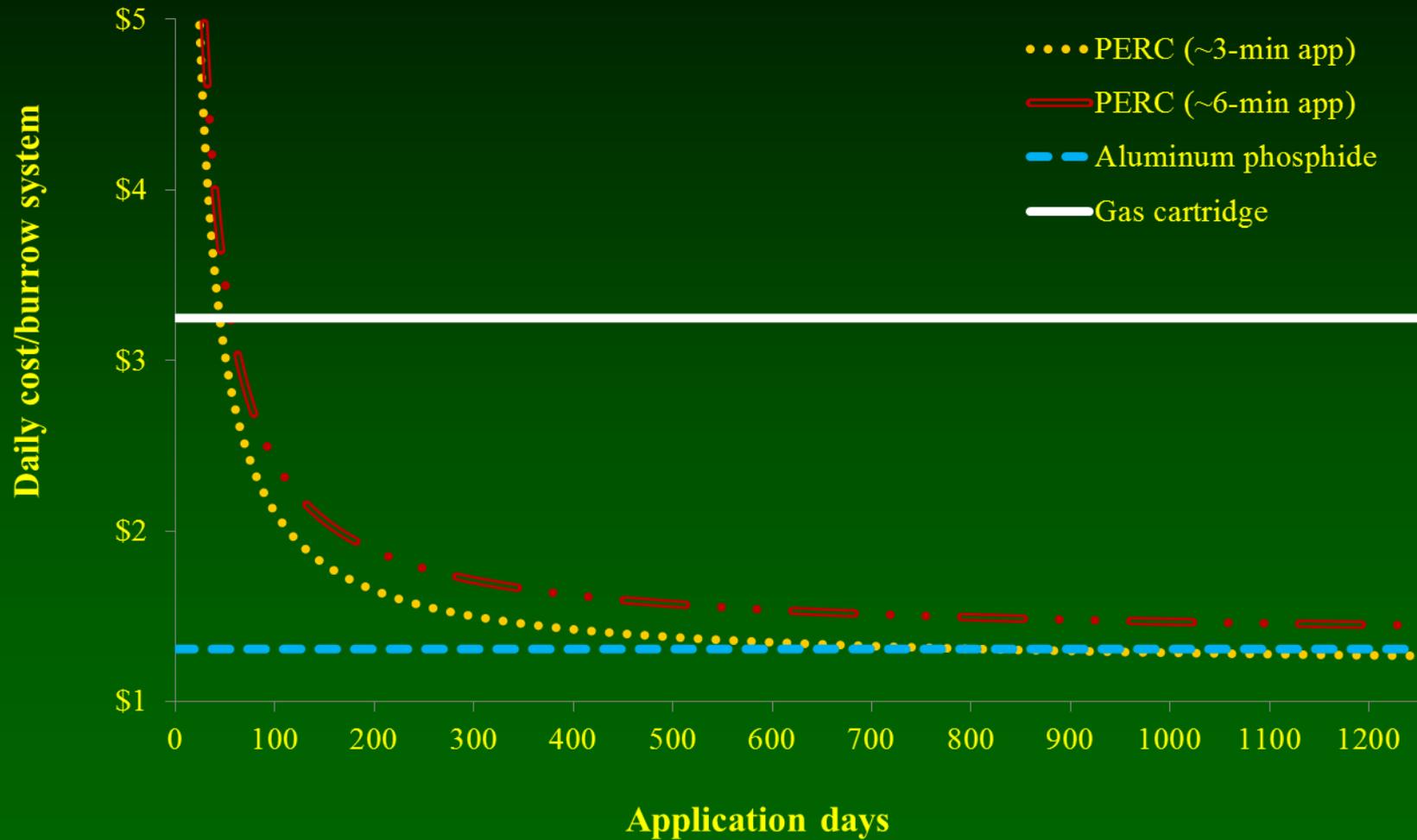


# Control Options—Fumigation

- Steve Orloff and I have already begun to collect efficacy data.
- PERC appears to be effective, while the Cheetah was completely ineffective.

Species	Device	Authors	# of fields	Efficacy
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%

# Control Options—Fumigation



# Control Options—Shooting

- Shooting can be effective for controlling ground squirrels although it is labor intensive.
- Lead bullets are no longer allowed in California Condor range and banned statewide starting 2019.



# Control Options—Other Strategies

Gas explosive device



# Control Options—Other Strategies

## Burrow ripping



# Case Study Example

## California ground squirrel

### Specifics

- very large population in vineyard
- initiating control after harvest
- certified applicator
- no endangered species

### Potential plan

- zinc phosphide in autumn
- aluminum phosphide in spring
- anticoagulant bait stations or trapping in summer



A photograph of a squirrel sitting on the ground next to a white PVC pipe. The squirrel is facing left and has its paws near its mouth. A speech bubble is positioned above the squirrel, containing the word "Questions?". The background shows a rocky landscape with sparse vegetation under a clear sky.

**Questions?**