Using IPM to Manage Ground Squirrels and Pocket Gophers

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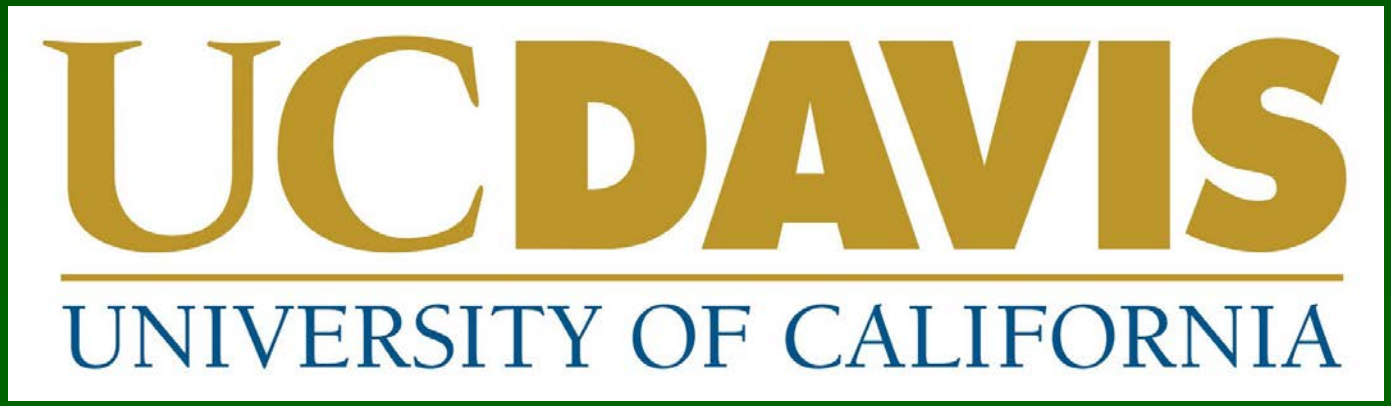


Species Identification (Ground Squirrel)

- 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 Squirrel)

- 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.

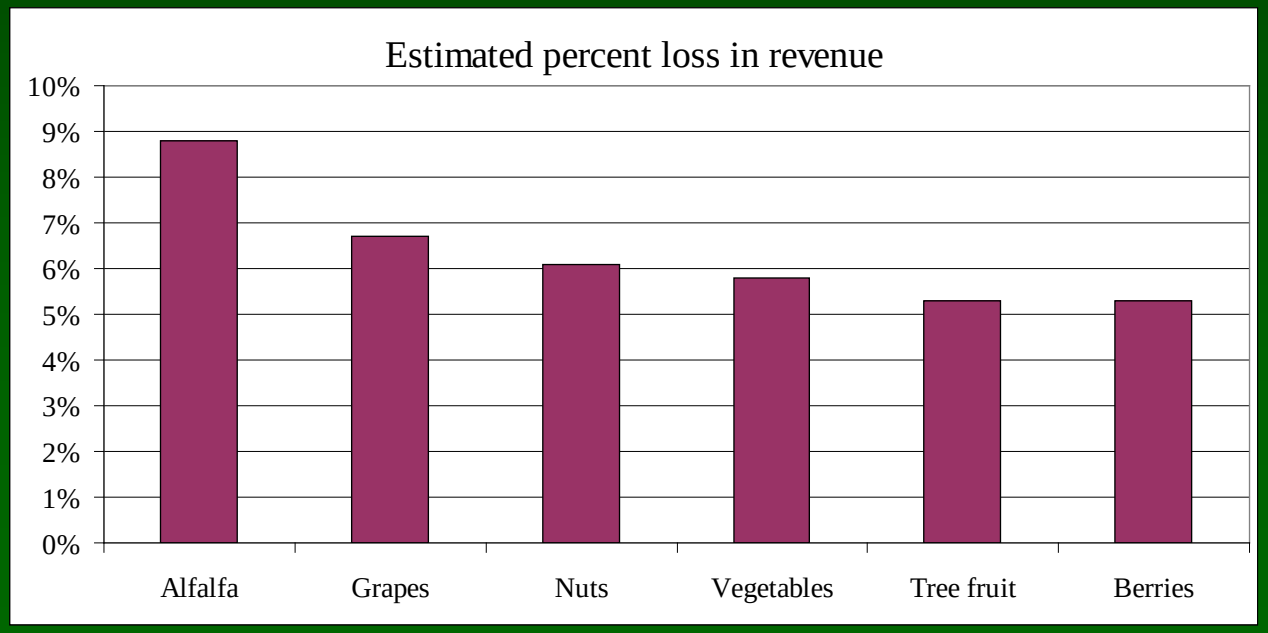
Species Identification (Pocket Gopher)

- Burrowing rodent about 6-8 in long; rarely seen above ground.

- Gopher mounds are plugged and often fan-shaped.

Species Identification (Pocket Gopher)

- One of two most damaging wildlife species in CA ag.
- Damage estimates range from 5.3-8.8% loss for various crops when present.

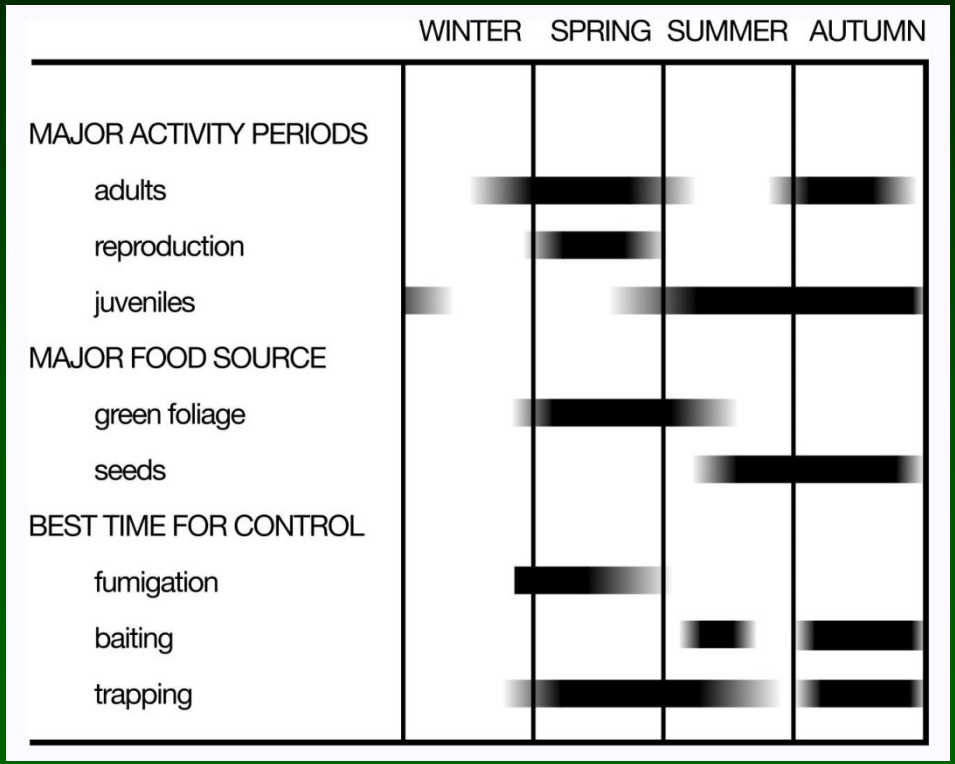


Current Control Strategies

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

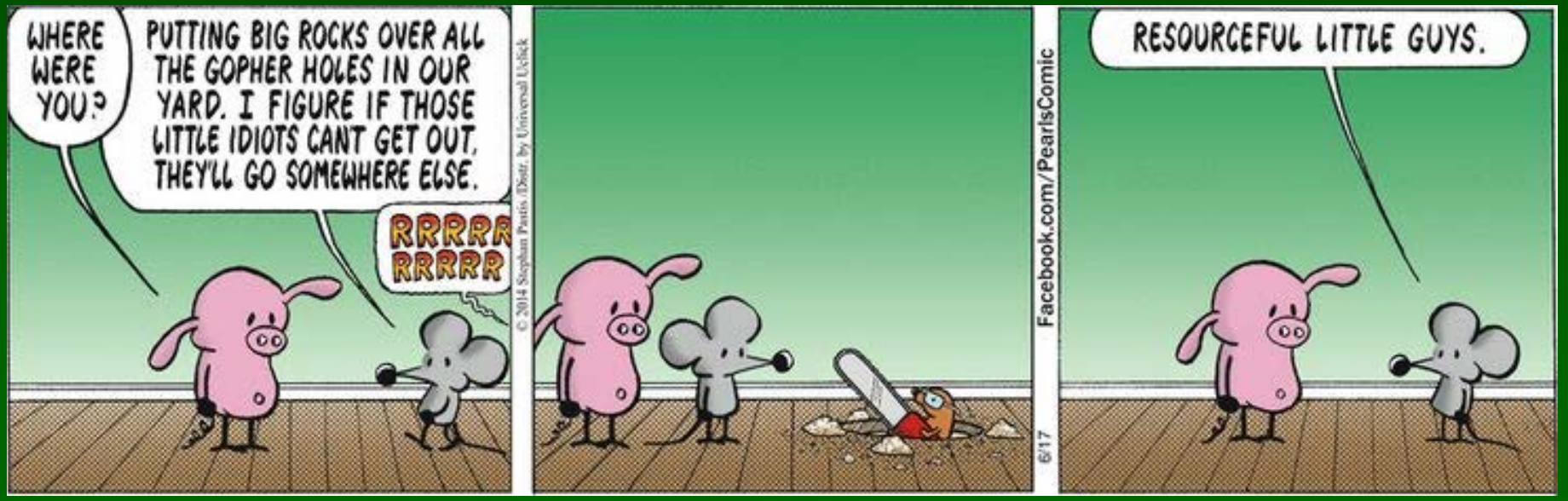
Importance of Biology/Ecology

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



What Control Options are Available?

	Habitat modification	Baiting	Burrow fumigation	Trapping	Exclusion	Repellent	Frightening	Shooting
Ground squirrel	X	X	X	X				X
Pocket gopher	X	X	X	X	?			



Control Options—Biocontrol

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- Gopher snakes kill a few gophers but are unlikely to control populations.

Control Options—Habitat Modification

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

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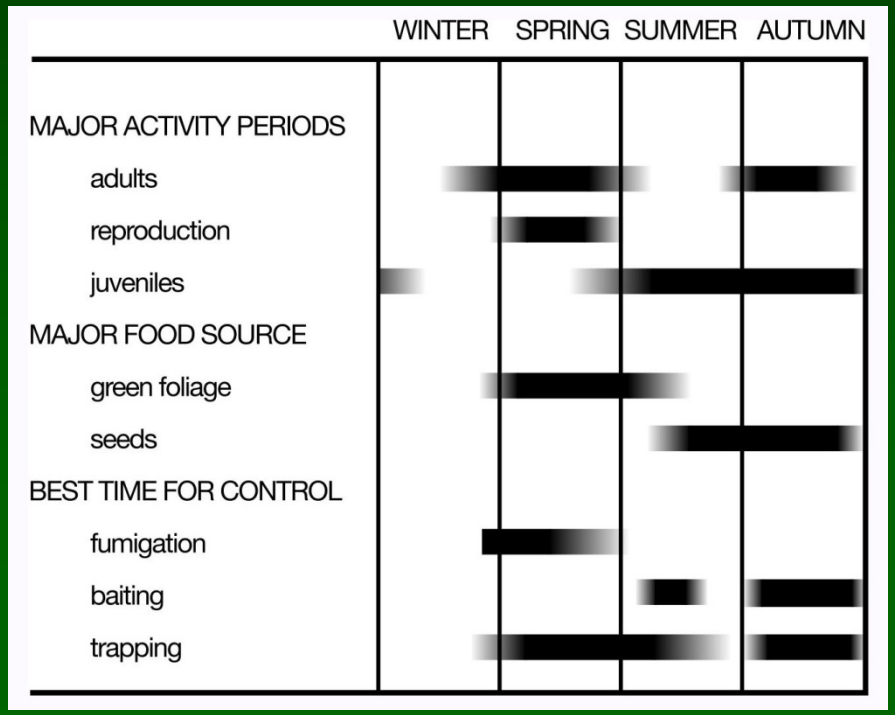
  - destroy old burrows
  - control weeds to reduce food sources for gophers

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.

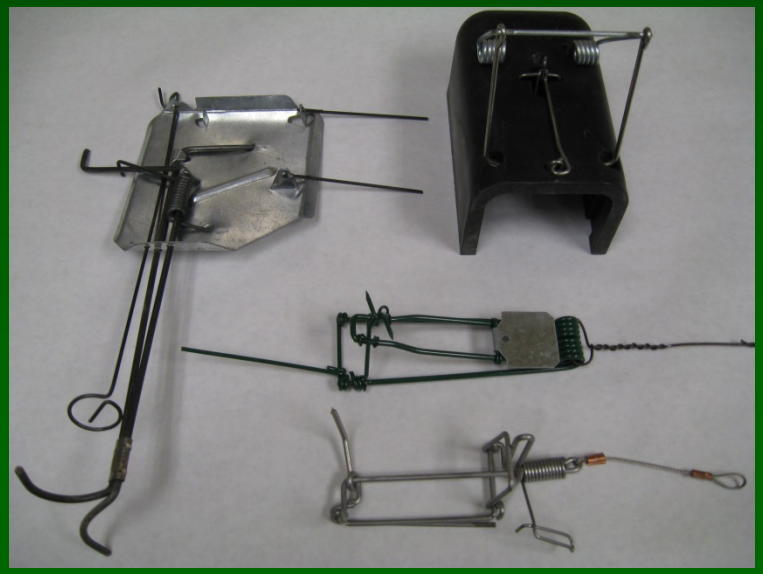
Control Options—Trapping

- 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—Trapping

Pocket gophers

- Has many positive attributes including:
  - knowledge that you've removed the target animal.
  - no use of toxic chemicals.
  - available for use in organic setting.
  - can be efficient and economical once user becomes proficient at trapping.
- Two main kinds of traps: pincers and squeeze-type box traps.

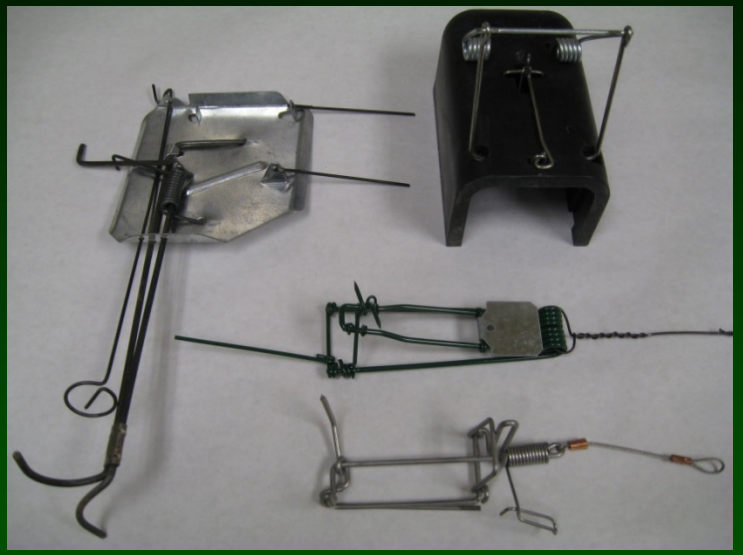


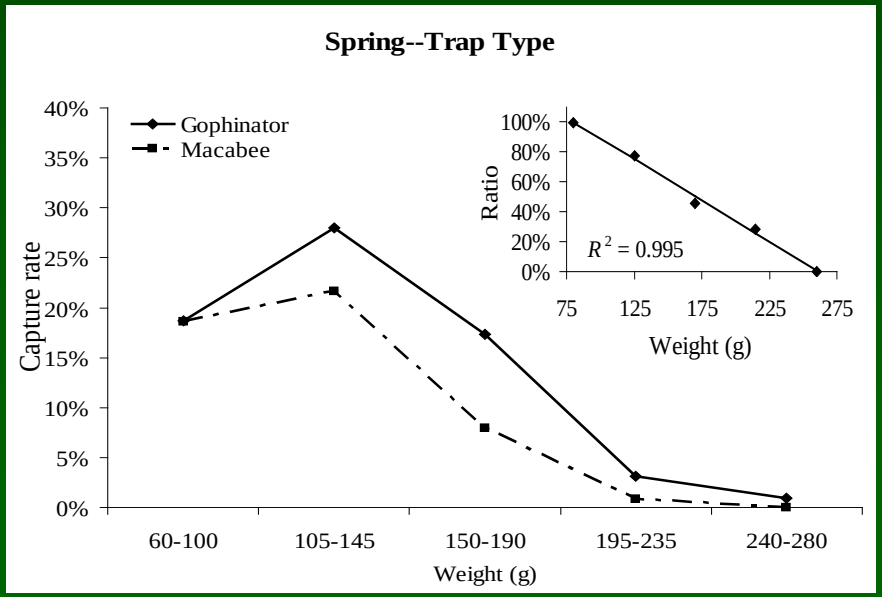
Trapping—Options

Pocket gophers

- Gophinator trap was more effective than Macabee trap.

- Captured heavier gophers at a greater rate.

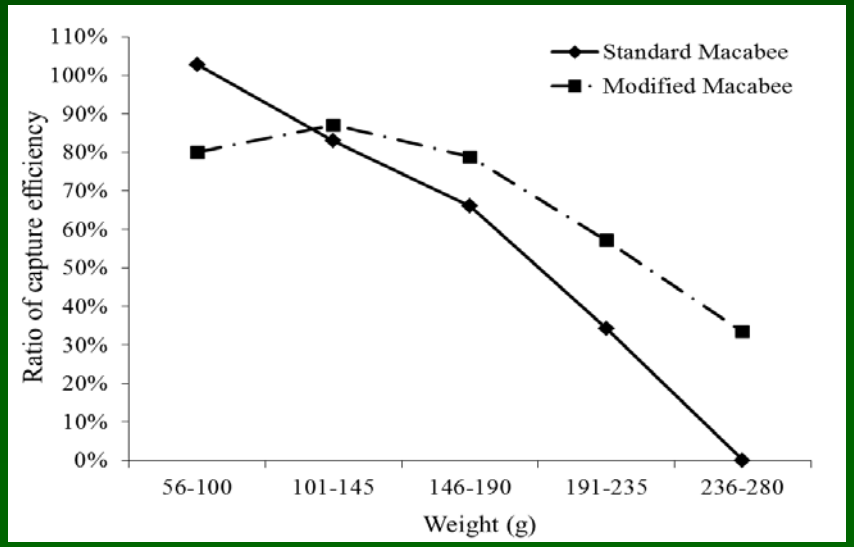


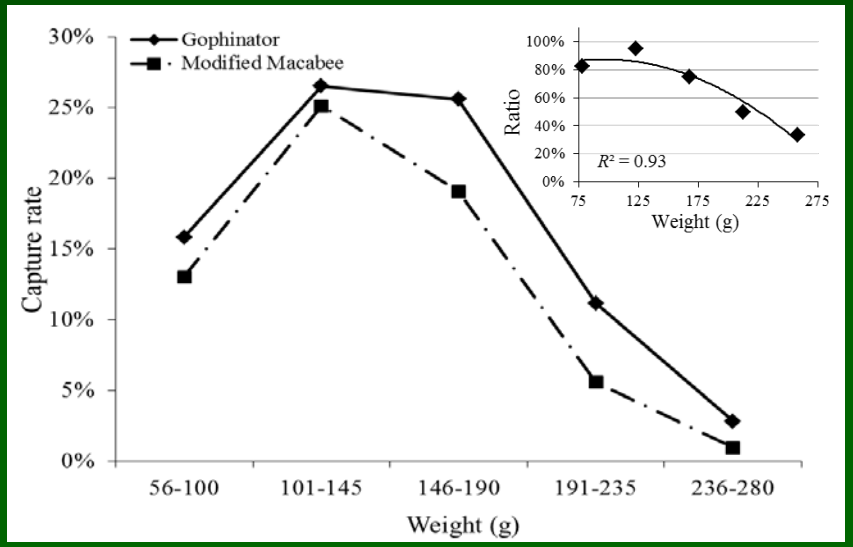


Trapping—Options

Pocket gophers

- Modified Macabee increased capture success when compared to standard Macabee, but still underperformed when compared to the Gophinator.





Trapping—Options

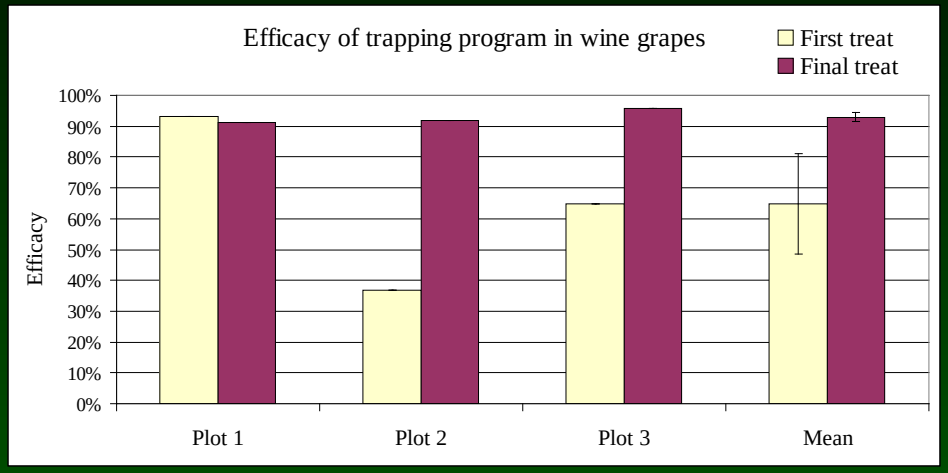
Pocket gophers

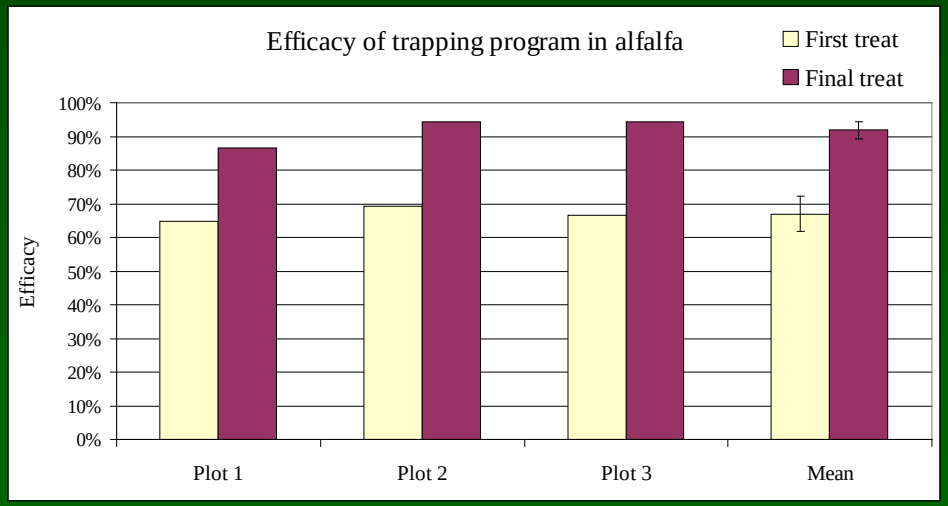
- Covered sets yielded slightly higher capture rates in spring-summer, but not autumn.
- Efficacy was offset by setting time.
- We did not observe a difference in the number of captures across attractants.
- Human scent had no effect.

Trapping—Efficacy

Pocket gophers

- Exhibited high efficacy in wine grapes after two treatments.
- Exhibited high efficacy in alfalfa after two treatments.





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

1st 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

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

Control Options—Baiting

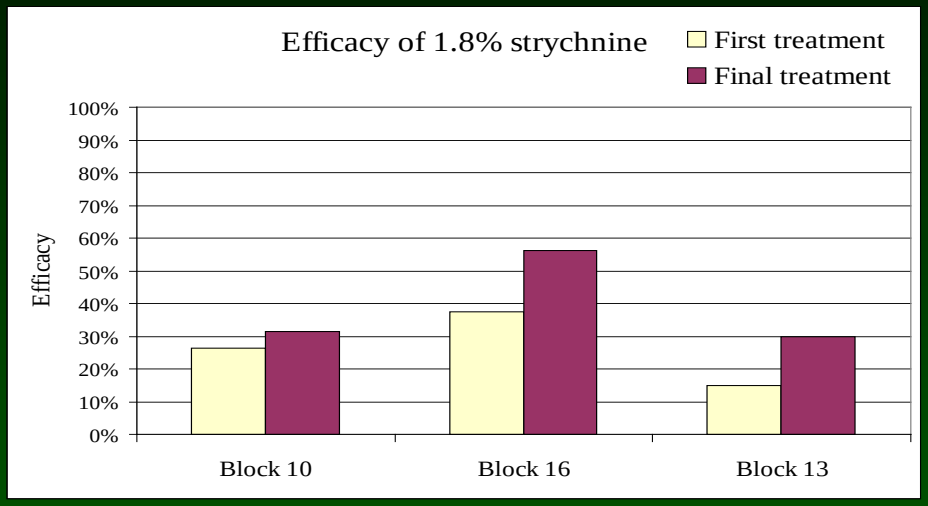
Pocket gophers

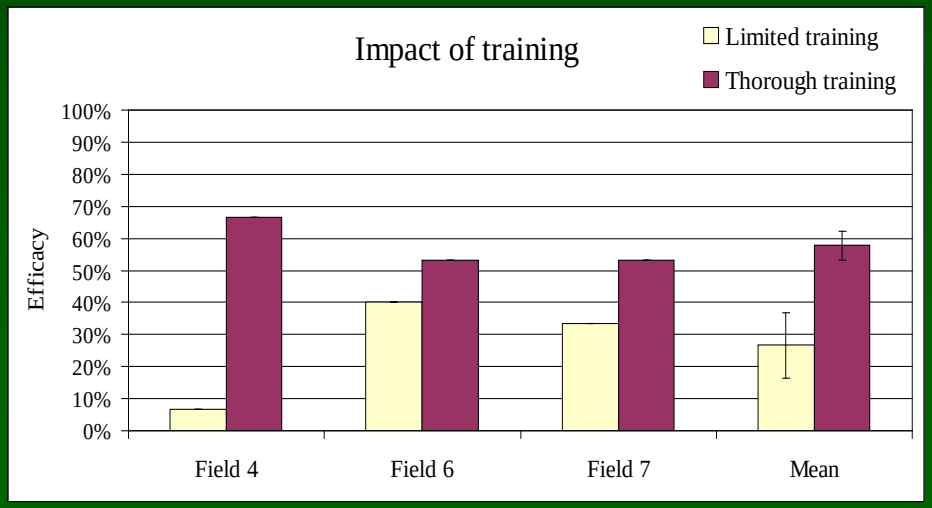
- Strychnine works best.
- Use probe to find tunnel.
- Dispense bait in tunnel.

Control Options—Baiting

Pocket gopher

- efficacy for pocket gopher baits varies across studies.
- study with 1.8% strychnine indicated low efficacy.
- potential reasons could include poor applicator training.

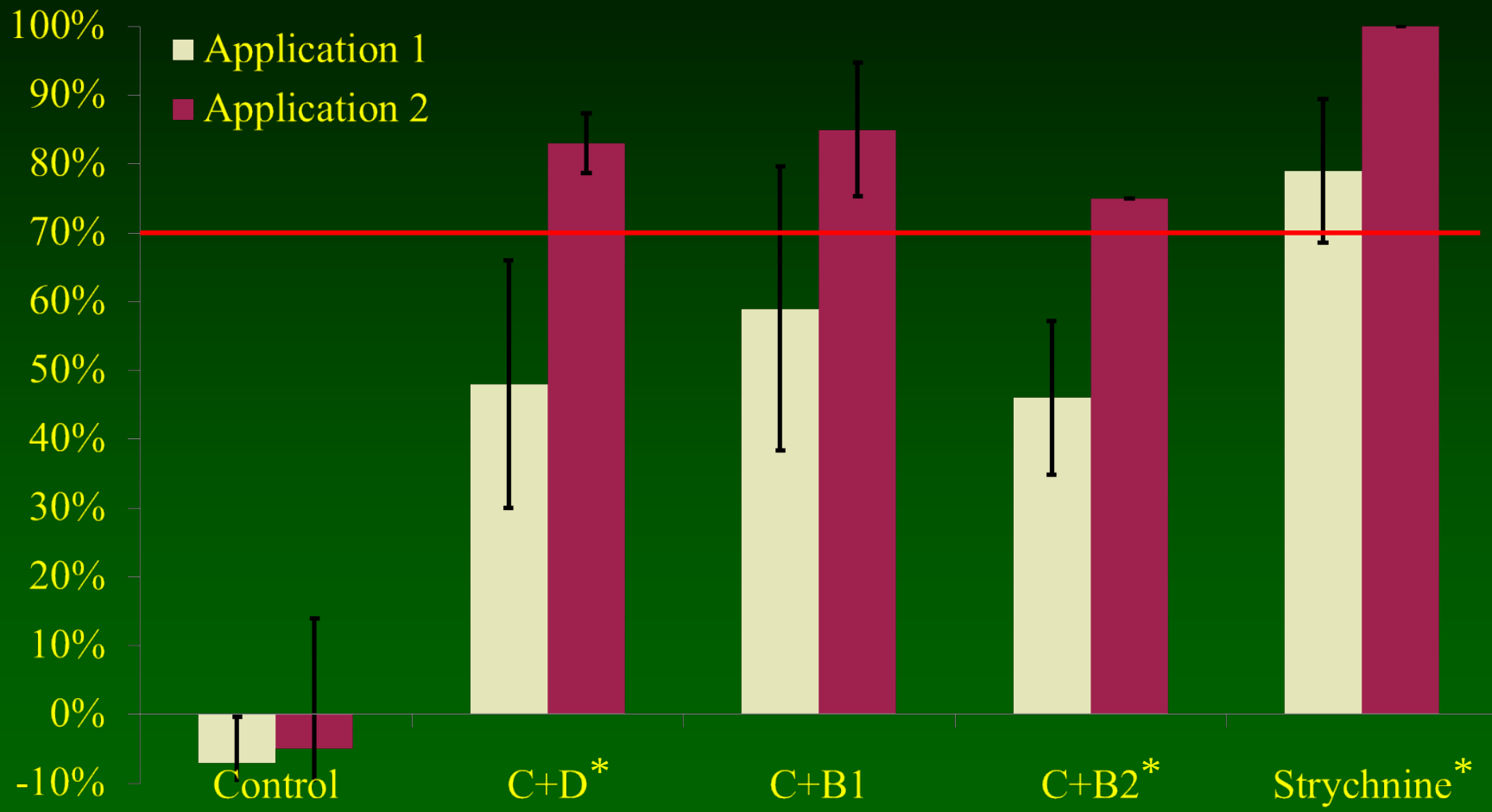




Pocket Gopher Rodenticides

Product	AI	Carrier	S. Rosa	Pala	Total
Control	Maintenance diet	Rat chow	1/10	0/10	5%
CDFA	Chlorophacinone (0.01%)	Oat grain	3/5	2/5	50%
Rozol	Chlorophacinone (0.005%)	Wheat grain	3/5	2/5	50%
Wilco D	Diphacinone (0.005%)	Milo grain	------	0/5	0%
RCO Patrol	Diphacinone (0.005%)	Pellet	1/5	2/5	30%
Wilco ZP	Zinc Phosphide (2.0%)	Wheat grain	2/5	3/5	50%
Bell ZP	Zinc Phosphide (2.0%)	Pellet	4/5	0/5	40%
Omega	Strychnine (0.5%)	Oat grain	5/5	0/5	50%
Avalon	Strychnine (0.5%)	Mixed grain	5/5	1/5	60%
Bromethalin	Bromethalin (0.01%)	Milo grain	------	0/10	0%
Terad$_3$	Cholecalciferol (0.075%)	Pellet	------	2/5	40%
C+D	Chole (0.03%) + Diph (0.005%)	Pellet	5/5	3/5	80%
C+B 1	Chole (0.03%) + Brod (0.0025%)	Pellet	------	5/5	100%
C+B 2	Chole (0.015%) + Brod (0.0025%)	Pellet	5/5	5/5	100%
C+B 3	Chole (0.015%) + Brod (0.00125%)	Pellet	------	6/10	60%

Pocket Gopher Rodenticides

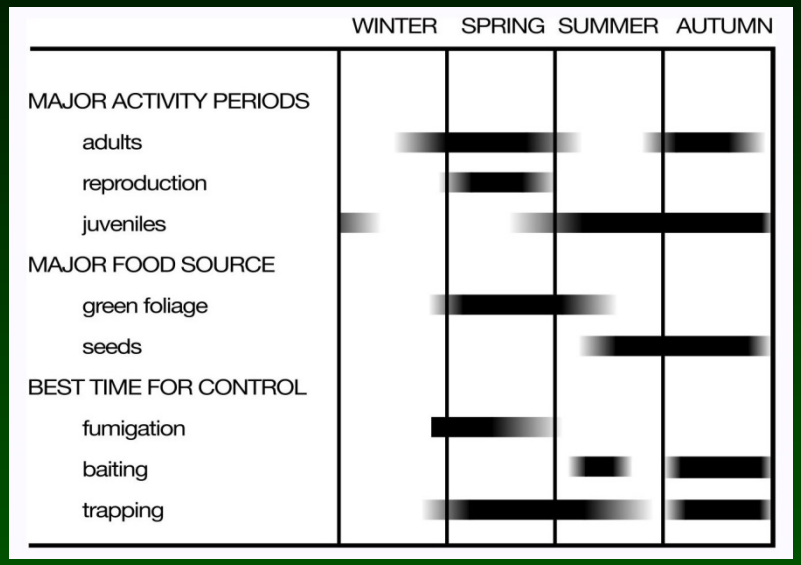


* Significantly > 70%; $P < 0.10$.

- C+B1 may still be worth pursuing.

Control Options—Fumigation

- Involves use of poison gas in burrows to control burrowing mammals.
- Works best when soil moisture is high (after ground squirrels emerge in spring).
- Fumigants should not be used around buildings.



Control Options—Fumigation

Aluminum phosphide

- Tablets can be used for ground squirrels and gophers.
- Is a restricted use pesticide.
- Studies show 97–100% control for CA GS and 90-100% for gophers.

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

- Studies show 62–86% control for CA GS; do not work well for gophers.
- Caution must be used with gas cartridges to prevent fires.

Carbon Monoxide Machines

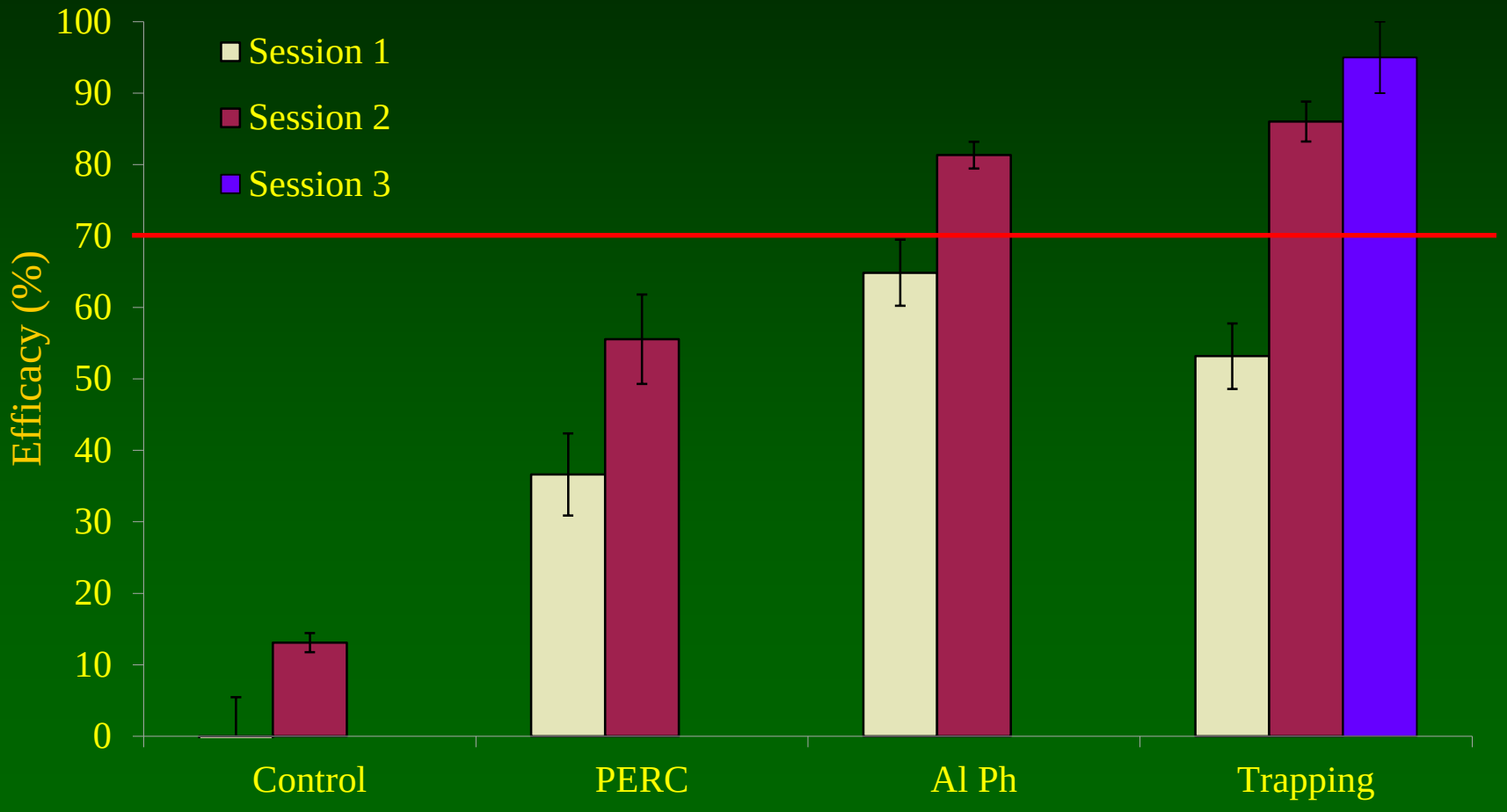
- Legalized in CA since January 1, 2012.
- Potential advantages for CO:
  - Safer for use
  - Multiple applications
- Will now be regulated by CDPR.

Carbon Monoxide Machines

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—Comparisons

- Trapping and aluminum phosphide were most effective for gophers.



Carbon Dioxide

- The Eliminator by IGI, LLC not yet approved for use.

Carbon Dioxide

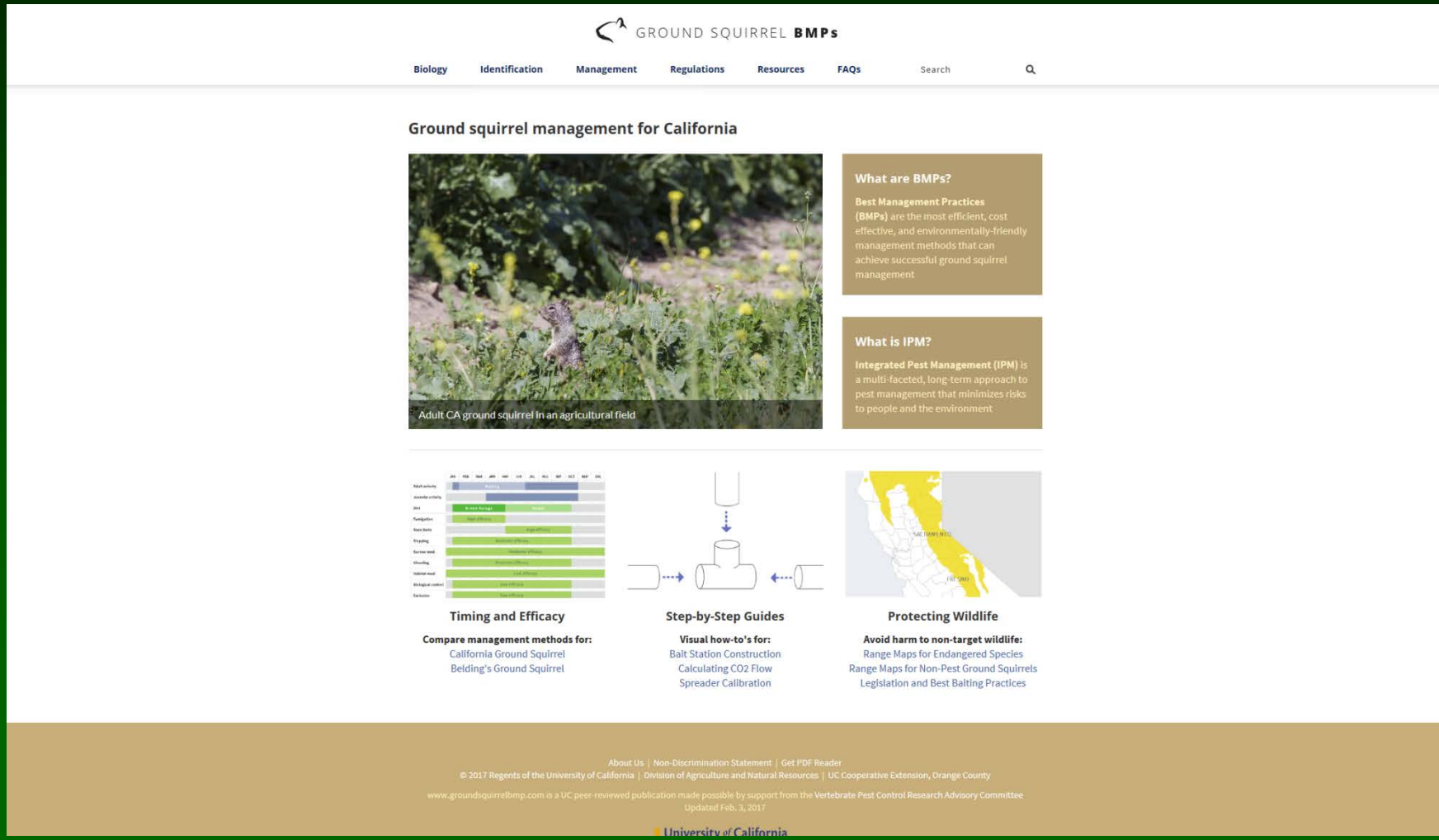
- The Eliminator by IGI, LLC not yet approved for use.
- Dry ice approved for rats, but not ag fields.

Control Options—Other Strategies

Gas explosive device

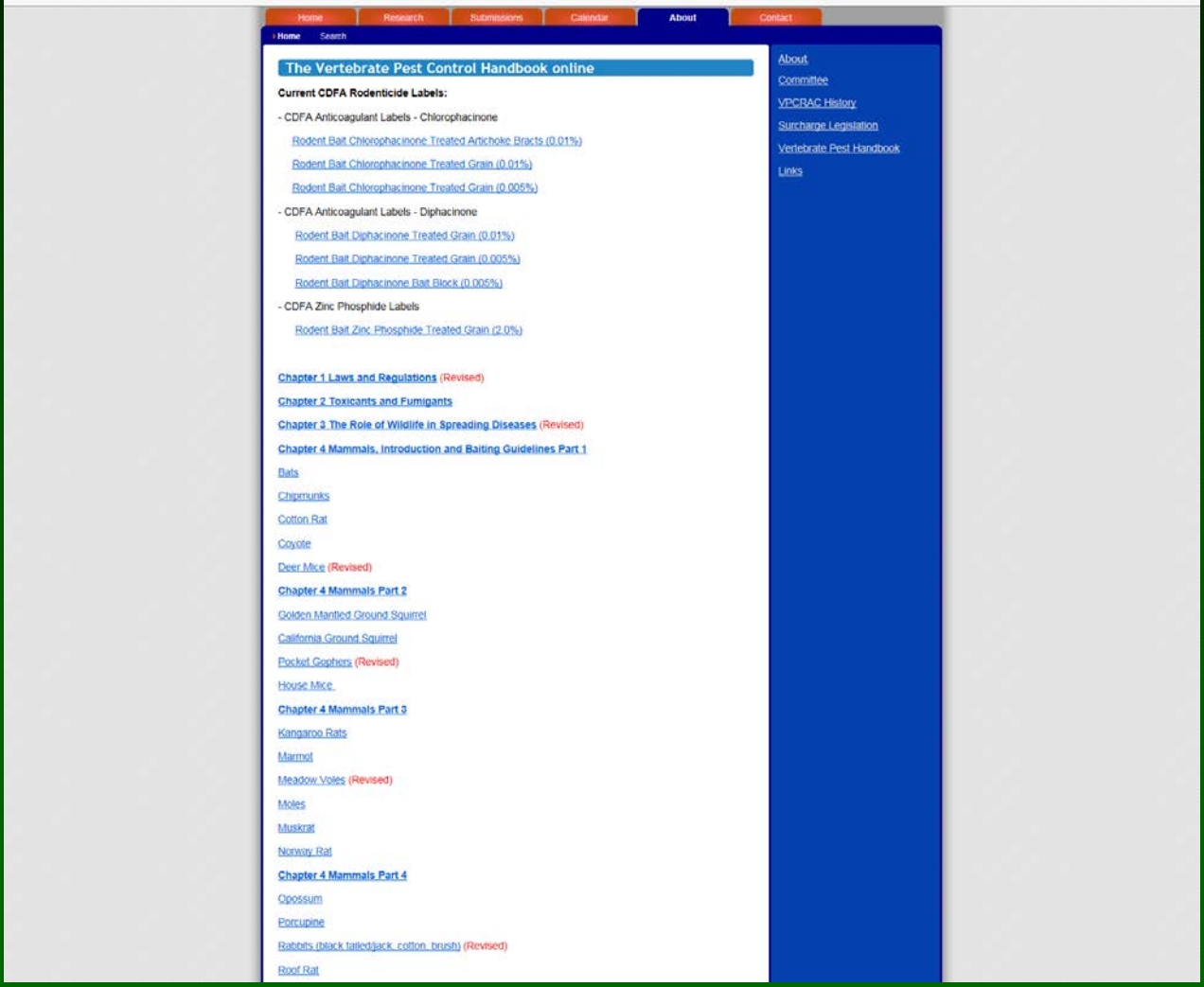
Ground Squirrel BMP website

- http://www.groundsquirrelbmp.com



Vertebrate Pest Control Handbook

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



Questions?
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