

Vertebrate Damage Management:
California ground squirrel
control in Rangeland and Pasture

**Fresno County Department of
Agriculture**

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California Ground Squirrel

Biology, damage, control and legal
status

Economic Impact

- A 1997 * study of **19 crops** in California valued at \$8 billion suffered a mean estimated loss due to non-predator vertebrates of **\$95.9 million**. (range was **\$43.2 to \$155.7 million**)
- It was estimated that **400 jobs annually are lost** as a result of vertebrate damage.
- The results represent the lower end of total impacts because of the selected crops studied. Also, many agricultural related problems such as irrigation canals were not considered.
- (*Hueth,Cohen,Sangruejee,and Zilberman, UC Berkley)

2009 Economic Impact Study

- In 2009, for California, rodent and bird damage to 22 crops in 10 counties caused revenue losses ranging from \$168 to \$504 million (Schwiff *et al.* 2009).
 - Job losses ranged from 2,100 to 6,300.
 - These figures do not include damage to structures (irrigation canals), ecological damage (bird nests) and rodent transmission of diseases (bubonic plague, hanta virus and leptospirosis).
- In Fresno County the revenue loss ranged from **\$18.1 to \$54.1 million**.
 - Job losses ranged from 278 to 832.

The King of Destruction



- ▶ California ground squirrel (*Spermophilus beecheyi*) is found almost anywhere in Fresno County.
- ▶ It inhabits natural rangeland, pastures, orchards, ditchbanks, foothill slopes with scattered trees, open lands, rock outcroppings.



Ground Squirrel Biology

- ▶ Ground squirrels are **diurnal** and love to warm themselves in the fair weather sun.
- ▶ Approximately, 80% **hibernate** during the winter, and 40-60% **estivate** during the summer.
- ▶ **Breeding** occurs during February and March.
- ▶ Young **emerge** late-April into May.
- ▶ Westside squirrels are 2 to 3 weeks ahead of eastside squirrels.



Photo: Terry Salmon - UC Davis

Embryo counts can be a good indicator of potential population levels and damage.



Photo: Fred Rinder - Fresno County Dept of Ag

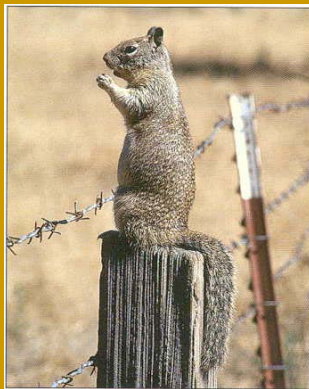
- Ground squirrels produce one litter a year with normally 7-8 young. Highs of **16** have been recorded.

Embryo can be at various stages of development in the same area.



Photo: Fred Rinder-Fresno County Dept of Ag

How Much Damage?



- Studies have indicated that ground squirrels cause a significant loss of green foliage to grazing cattle and sheep.
- **200** ground squirrels eat daily as much as one **steer**.
- **20** squirrels can consume daily as much as one **sheep**.

Ground squirrel tip off's... piles, trails and holes

- Brush and trash piles provide protection.
- Well worn trails lead to active burrows.
- Established colonies can take over a bank.



Ground squirrels can travel up to $\frac{1}{2}$ mile to a food source. The colony on the side of the hill was $\frac{1}{4}$ mile from an olive orchard.

Photo: Fred Rinder - Fresno County Dept of Ag



Damage to drip emitters



Photo: Terry Salmon - UC Davis

Ground squirrel damage to drip



Photo: Wildlife Pest Control Uni. of Calif.
Agriculture and Natural Resources Publication # Z1385

Built to chew!



Photo: Fred Rinder - Fresno County Department of Agriculture

Bark damage by ground squirrel gnawing



Photo: Wildlife Pest Control Uni. of Calif.
Agriculture and Natural Resources Publication # 21385

Ground squirrel tracks...



Photo: Fred Rinder - Fresno Co Depart of Ag

Ground squirrel damage to grain

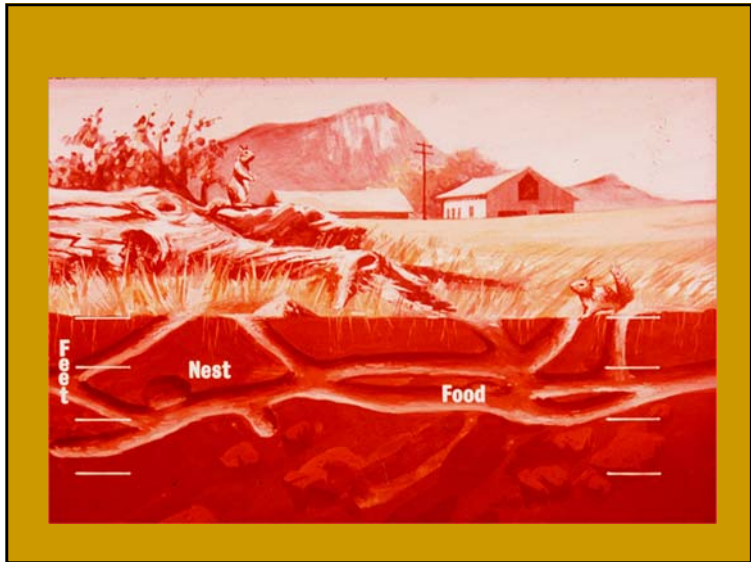


Photo: J.P. Clark - CDFA

Built to dig!



Photo: Fred Rinder - Fresno County Dept of Ag



Giant burrow in almond orchard

Photo: Terry Salmon - UC Davis

Ground squirrel colonies left uncontrolled can lead to...

Photo: Fred Rinder - Fresno County Dept of Ag, - Salt Creek

...Erosion

Photo: Fred Rinder - Fresno County Dept of Ag
Salt Creek, western Fresno County

Levee Breaks



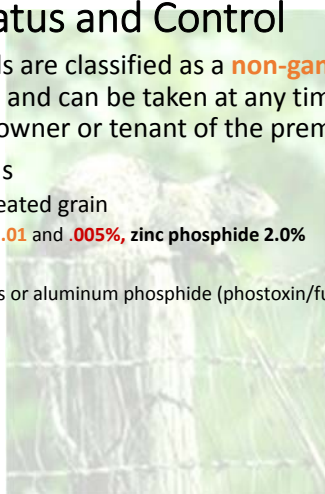
Ditchbank colony



Photo: Terry Salmon - UC Davis

Legal Status and Control

- Ground Squirrels are classified as a **non-game** mammal by the CDFW Code and can be taken at any time or in any legal manner by the owner or tenant of the premises.
- Control methods
 - baiting with treated grain
 - **diphacinone .01** and **.005%**, **zinc phosphide 2.0%**
 - fumigation
 - gas cartridges or aluminum phosphide (phostoxin/fumatoin)
 - trapping
 - shooting



Burn or shred brush piles quickly...reduce shelter and protection



Photo: Fresno County Dept of Ag

Eliminate trash piles



Photo: Fred Rinder - Fresno Co Dept of Ag

You could not build a better ground squirrel condo

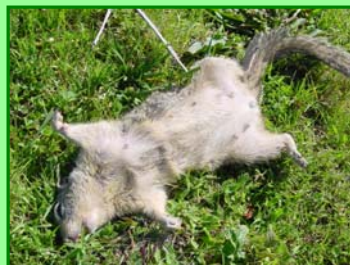


Photo: Fred Rinder - Fresno County Dept of Ag

To maximize success for any ground squirrel control program, bait treatment should be done when most of the squirrels are above ground. This usually occurs during the breeding period in March. Ideally, baiting should begin when there is a **50:50 ratio** of males to females.



► Male



► Female

Photo: Fred Rinder - Fresno Co Dept of Ag

The grain labels at the County require pre-baiting. Stomach contents can help determine when to start



Photo: Fred Rinder - Fresno Co Dept of Ag Spreckels Sugar Co Mendota

In the middle of the switch



Photo: Fred Rinder - Fresno County Dept of Ag

Brown stomach contents indicates squirrels are feeding on seeds, time to bait!



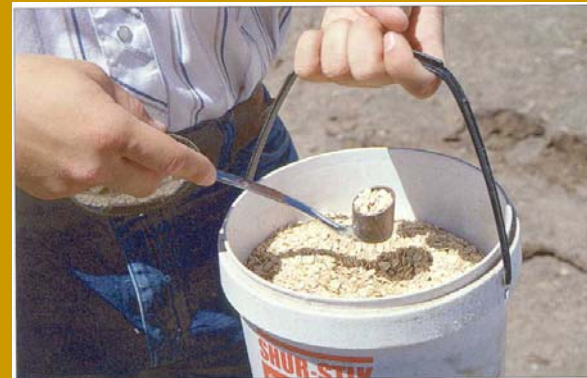
Photo: Fred Rinder - Fresno County Dept of Ag

Clean Rolled Out Groats



Photo: Fred Rinder - Fresno County Department of Agriculture

Prebaiting enhances acceptance



Prebaiting at the burrow



Photo: Fred Rinder - Fresno County Department of Agriculture

Prebait should be scattered



Photo: Fred Rinder - Fresno County Department of Agriculture

Treat only active burrows... ground squirrels constantly houseclean, in this case no one is home



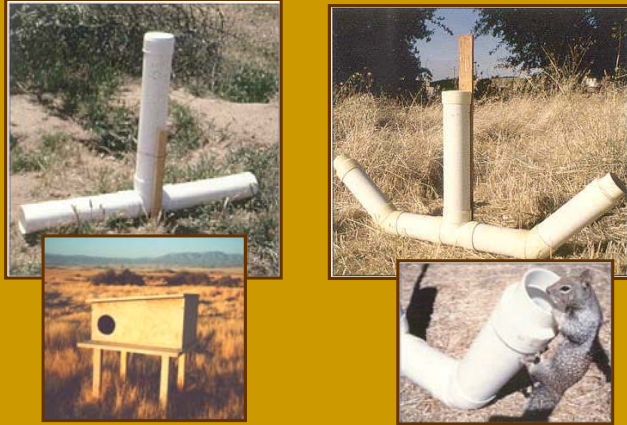
Photo: Fred Rinder - Fresno County Dept of Agriculture

Too much prebait... no reason to go inside.



Photo: Fred Rinder - Fresno Co Dept of Ag

Bait Stations - Diphacinone .005%



Diphacinone .005% Anticoagulant Bait



Photo: Fred Rinder - Fresno County Department of Agriculture

Let's talk about anticoagulants

- ▶ **Diphacinone/Chlorophacinone** are first generation anticoagulants and belong to the chemical group of indandiones.
- ▶ **Chronic** in action, requiring multiple feedings over several days to a week.
- ▶ Reduces the **clotting ability** of the blood and causes damage to the capillaries. Blood clotting is gradually reduced and blood is lost until death occurs. **Vitamin K** is the antidote.
- ▶ Symptoms are extreme lack of color to the skin, muscles, liver and heart. **Bleeding** from the nose can be common. Internal hemorrhage may be found in the abdominal and thoracic cavities.
- ▶ Dogs are especially sensitive. A 44 lb dog would need to eat 6 ounces. Smaller dogs and puppies are more susceptible.
- ▶ However, the larger body size of the predator/scavenger compared to the rodent prey and the dilution factor associated with the **normal diet** reduces the odds of a lethal threshold being achieved.
- ▶ **Do NOT get complacent!!!**

Keep bait stations in good repair



Photo: Fresno Co Dept of Ag

Do not allow grain to get moldy



Photo: Terry Salmon - UC Davis

Keep bait stations secured, not like this!...



**or like this...
wrong bait and poor application...**

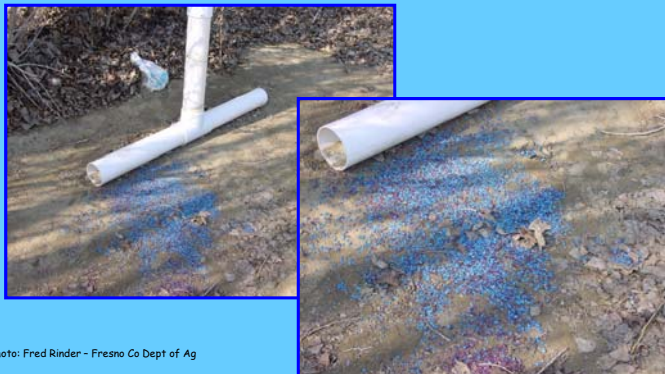


Photo: Fred Rinder - Fresno Co Dept of Ag

...and NEVER like this!!!



Photo: Fred Rinder - Fresno County Dept of Ag

Good bait station placement and security



Photo: Fresno County Dept of Ag

Ground squirrel entering a 3" opening

Photo by J.P.Clark-CDFA



Diphacinone .005% Spot Baiting

Using a bait spoon scatter **1/3 cup** (0.1 lb) over **40 to 50 sq ft**
Second application **4 days** after first application
Do **not apply** more than 10 lbs/acre/treatment
Do **not graze livestock** in spot-treated areas while bait is present
Do not PILE!



Diphacinone .005% spot application



Ground squirrels are scavengers..they will find it.



Do not clump or pile!!!



Photo: Fred Rinder - Fresno Co Dept of Ag

Do not pile!!!!



Photo: Fred Rinder - Fresno County Dept of Ag

Diphacinone .01%
Anticoagulant Bait



Photo: Fred Rinder - Fresno County Department of Ag

Mechanical broadcast for ground squirrel control
10 lbs/swath acre – Repeat 4 days after first application
Do **not graze livestock** in treated areas while bait is present



Photo: CDFA

Broadcast along fence row



Photo: CDFA

Why isn't **diphacinone .01%** allowed in bait stations or be piled?



■ Ground squirrels will stuff their pouch with grain. As the affects of the anti-coagulant proceed the ground squirrel will attempt to eat more because of its increased weakness due to blood loss. This could increase the risk of secondary poisoning.

Zinc phosphide 2.0% treated grain



Photo: Fred Rinder - Fresno Co Dept of Ag

Let's talk about zinc phosphide

- Zinc phosphide 2.0% is a slower acting **acute** rodenticide. It has a garlic-like odor and is slightly bitter.
- When exposed to **moisture**, it decomposes and releases **phosphine gas**. Moist soils can present a problem.
- Lecithin/Mineral oil is added to zinc phosphide during mixing to **adhere** it to the oat groat grain and provide limited protection against moisture.
- When zinc phosphide is ingested it comes in contact with dilute acids in the stomach, **phosphine gas** is released, and causes death within 12 to 30 hours. Death is usually overnight with terminal convulsions, paralysis, coma and death from asphyxia.
- Symptoms are nausea, vomiting of black stomach contents, phosphine odor and abdominal pain.
- Zinc phosphide is **not stored** in muscle or tissue. Secondary poisoning is minimal. The only risk being if significant amounts of the gut contents of recently dead rodents are eaten.
- Do not apply more than once per year to the same treatment area.
- In rangeland, only apply in areas with < 50% ground cover.

Zinc phosphide 2.0% hand/spot application



Photo: Fred Rinder - Fresno Co Dept of Ag

Bait must be well scattered



Photo: Fred Rinder - Fresno Co Dept of Ag

Yes..they will find it!!!



Photo: Fred Rinder - Fresno Co Dept of Ag

Stomach contents indicate that the ground squirrels are feeding on seeds. Pre-baiting is Strongly Recommended by label when treating with zinc phosphide 2.0%.



Photo: Fred Rinder - Fresno County Dept of Ag

Rodent Gas Cartridge



Photo: Fred Rinder - Fresno County Dept of Ag

Punch holes in the end of the cartridge and push in fuse



Photo: Fred Rinder - Fresno Co Dept of Ag

Light the fuse



Photo: Fred Rinder - Fresno County Dept of Ag

Push cartridge, **fuse first**, into burrow



Photo: Fred Rinder - Fresno Co Dept of Ag

Allow cartridge to ignite



Photo: Fred Rinder - Fresno County Dept of Ag

Plug the opening



Photo: Fred Rinder - Fresno County Dept of Ag

Aluminum phosphide is a restricted material and a permit is required to purchase and use



Drop in tablets/pellets into hole



Stuff paper into hole. Then fill in hole with dirt and tap down



What's Required to buy Fresno County Grain Baits????

- A Pesticide Applicators Certificate is required for purchase of any of the grain baits
- An Operator Identification permit is required for Diphacinone Baits
- A Restricted Materials Permit is required for Zinc Phosphide Bait
- A Notice of Intent must be filed 24 hours prior to the application of Zinc Phosphide
- Use reporting of any of the products are required by the 10th of the month following their use
- Gas Cartridges do not require a PAC but do require a permit and use reporting

Conibear #110 trap



Cage traps



Photo: Fred Rinder - Fresno County Dept of Ag

Tunnel traps



Photo: Fred Rinder - Fresno Co Dept of Ag

Box traps



UC Statewide IPM Project
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Rodentator



Wear appropriate safety equipment



Photo: Terry Salmon - UC Davis

...because the applicator will need it.



Fire in the hole!



Photo: Terry Salmon - UC Davis

There is a fire hazard!



Photo: Terry Salmon - UC Davis

Ripping ground squirrel colony burrows can provide temporary relief. However, recolonization will occur in approximately the same site. Pheromones from the previous tenants attract the new squirrels to burrow at the old site.



Photo: Terry Salmon - UC Davis

Shooting is time consuming, but can bring much personal satisfaction



Photo and Shot: Fred Rinder - Fresno County Dept of Ag

Points to remember - Don't wait until things are out of control. Start early and aim for 90% control



Any questions?

