

Agricultural Non-predator Vertebrate Pests

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Agricultural Pest List



- California Ground Squirrel
- Pocket Gopher
- Deer Mouse
- Meadow Vole
- Jackrabbit

Economic Impact

- A 2009 * study of 22 crops in 10 California counties suffered an mean estimated loss due to non-predator vertebrates of **\$336 million**. (range was **\$168 to \$504 million**)
 - It was estimated that between **2,100 and 6,300 jobs annually are lost** as a result of vertebrate damage.
 - In Monterey County alone, it was estimated that between **\$44 and \$128 million dollars** in revenues were lost and approximately 1,000 jobs were lost.
 - The results represent the lower end of total impacts because of the selected crops studied. Also, many agricultural related problems such as infrastructure damage were not considered.
- (*Schwiff, Gebhardt, and Kirkpatrick USDA/APHIS/WS)

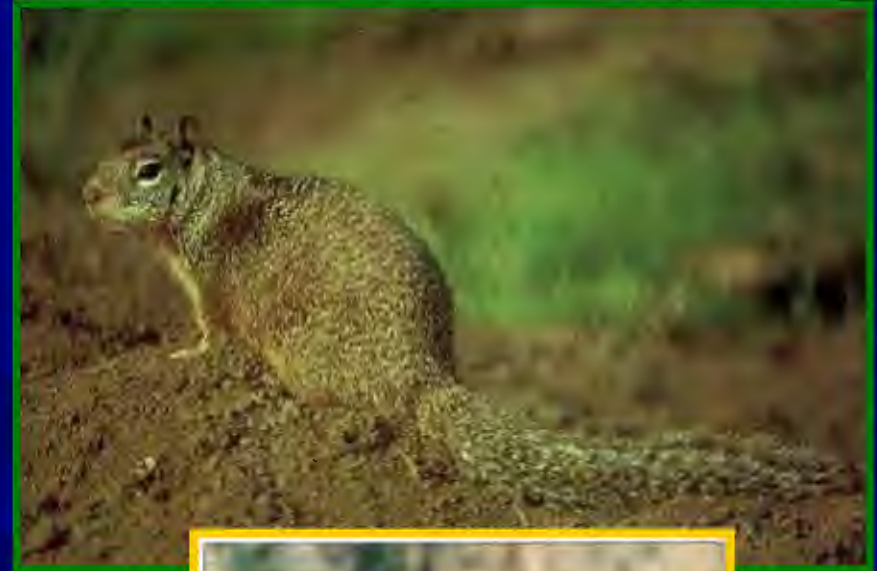
California Ground Squirrel



- California ground squirrel (*Spermophilus beecheyi*) is found throughout California, except desert habitats.
- It inhabits natural rangeland, pastures, orchards, ditch banks, 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 December through June.
- One litter per year with 6 to 8 young each litter.
- Young emerge late-April into June.



Crop damage



Ground squirrel colonies left uncontrolled can lead to...



...Erosion



Levee Breaks



Legal Status and Control

- Ground Squirrels are classified as a non-game mammal by the CDFG 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 and chlorophacinone .01% and .005%, **zinc phosphide 2.0%**
 - fumigation
 - gas cartridges or aluminum phosphide (phostoxin/fumatoxin)
 - trapping
 - shooting

To maximize success of any ground squirrel control program, bait treatment should be done when ground squirrels are active and the natural food supply (green vegetation) is not available which takes place in late spring or early summer depending on location.



 **Male**



 **Female**

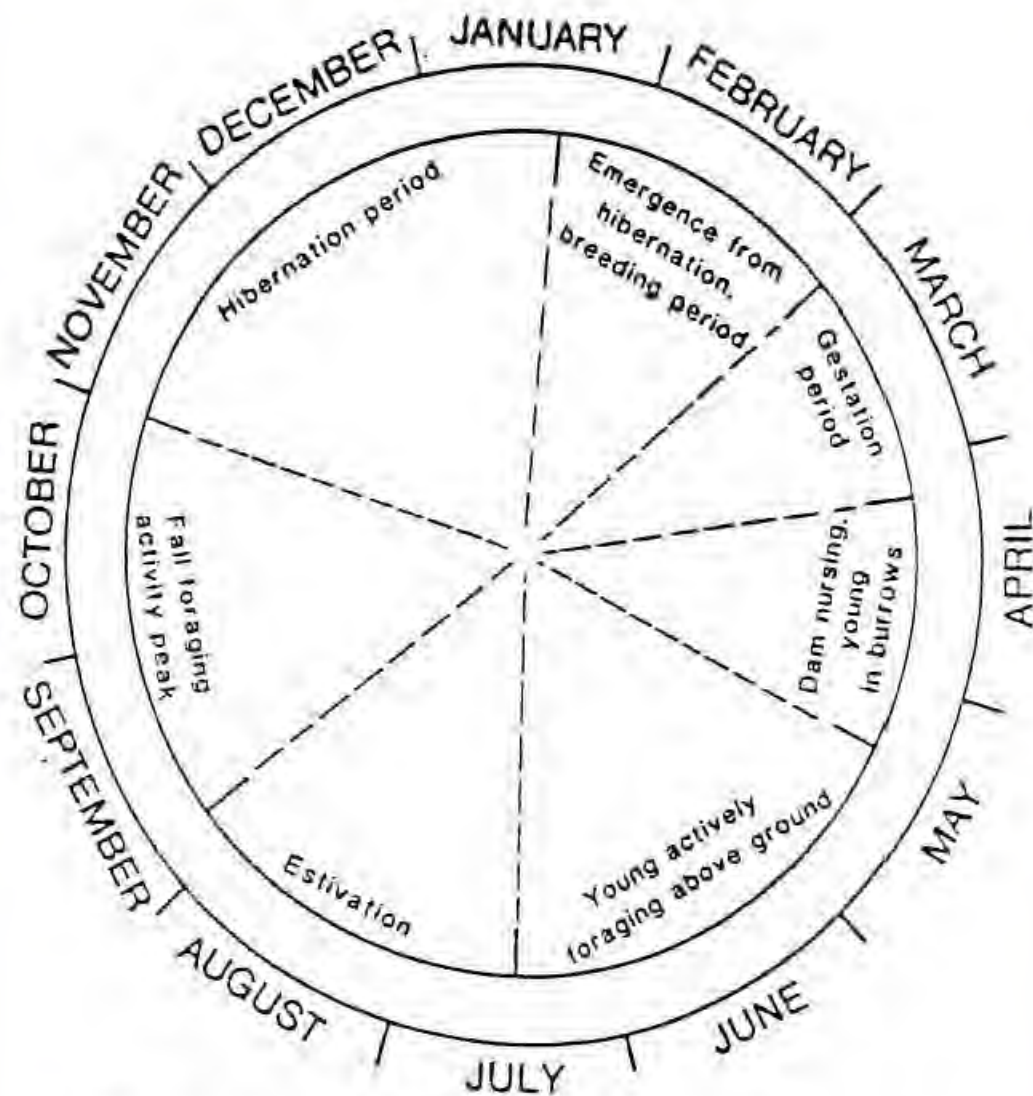


Fig. 1. Major biological events in the annual life cycle of the California ground squirrel in central California.

Bait Stations



Keep bait stations in good repair



Anticoagulant spot treatment



Ground squirrels are excellent foragers, they will find it.

Do not clump or pile!!!



Prebaiting enhances acceptance



Prebaiting at the burrow.



Treat only active burrows



Conibear #110 trap



Gas Cartridges



Aluminum phosphide



Know your squirrel



Pocket Gophers



- Pocket gophers (*Thomomys* spp.) inhabit much of California, absent from deserts, rocky soils and very high mountain meadows.
- The pocket gopher is named for its external fur-lined cheek pouches found on both sides of their mouths.
- The pouches are used to carry food.

Gopher Biology

- Gophers are most abundant in good soils with ample moisture and plant growth.
- Very territorial and anti-social, except during breeding season.
- In irrigated lands with continued vegetation forage, gophers breed most of the year. Up to 3 litters with 5-6 young each.
- Gestation is 28 days.
- They do not hibernate.

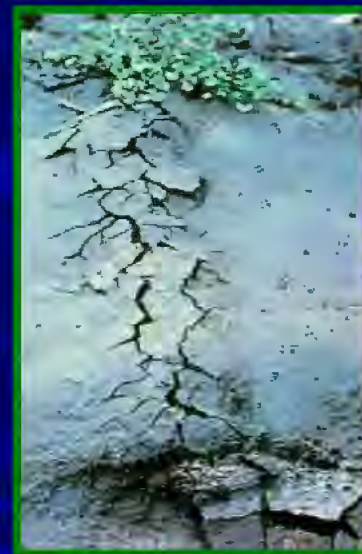


Gopher Damage

- Gophers attack alfalfa, golf course turf, lawns, vegetable roots, root and bulb crops.
- They also damage the crowns and roots of trees, vines and shrubs.
- Gophers often attack the roots of vines. Unfortunately, their activity is not apparent until the vines begin to die off.



Gopher or Mole?



Legal Status



- Pocket gophers are classified as nongame mammals by the CDFG Code.
- No permit required.
- If injuring crops or property, may be taken any time in any legal manner by owner or tenant of premises.

Management of gophers

■ Traps

- Macabee, blackhole, Victor mole trap

■ Exclusion

- wire mesh around root ball

■ Fumigation

- aluminum phosphide
- Gas cartridges

■ Baits

- strychnine, anticoagulants, zinc phosphide

■ Burrow Exploder

■ Bio-control

- Owls, snakes, weasels, foxes, badgers and coyotes



Deer Mouse



- Deer Mice (*Peromyscus maniculatus*) are found abundantly throughout California.
- They are highly adaptable and mobile, with high fertility.
- Primarily nocturnal and do not hibernate.
- Home range 1/3 of an acre.

Deer Mouse Biology

- Deer mice nest in logs, trees, burrows, buildings and among rocks.
- 2 to 4 litters with 3 to 5 young per year.
- Gestation 22 to 25 days.
- Females are sexually mature at 6 to 7 weeks.



Damage



- High populations of deer mice can cause damage to almond, avocados, citrus, pomegranate, seed alfalfa and sugar beets.
- Deer mice will dig up and eat melon and alfalfa seeds.

Legal Status

- Deer mice are classified as a nongame mammal by CDFG Code.
- If injuring crops or other property, may be taken at any time and in any legal manner by the owner or tenant of the premises.



Control Measures

■ Trapping

- Only to monitor population size.

■ Baits

- Spot baiting is rarely done.
- Aerial or mechanical broadcast baiting of anticoagulant treated grain bait.
 - Spread bait evenly 2 to 6 pounds per acre
 - Sufficient bait to last 4 days
 - Deer mice are very aggressive foragers and their keen sense of smell will enable them to locate food very easy.

Meadow Vole



- Meadow vole (*Microtus californicus*) are found anywhere there is good vegetative cover.
- Active all year round.
- Will forage any time but are chiefly diurnal.
- Mouse-like, but with shorter tails.

Meadow Vole Biology

- Voles may produce 2 to 5 litters per year.
- Within 15 hours after young are born breeding may occur again.
- Females can breed at 21 days old. Usually at 4 to 6 weeks.
- Litter size of 1 to 9.
- Gestation is 21 days.



Burrows and Runways

- Will use 1 to 2 inch wide runways through matted grass.
- Small piles of brownish feces and short pieces of grass stems usually litter runways.
- Home range is less than a 60-foot radius.



Meadow Mouse Damage



- Permanent pasture, hay, alfalfa and grains.
- Artichokes, carrot, Brussels sprouts, cauliflower, potatoes, sugar beets and tomatoes.
- Nursery stock.
- Bark of apple, citrus, cherry and olive trees.

Legal Status

- Meadow mice are classified as nongame mammals by the CDFG Code.
- If injuring growing crops or other property, they may be taken at any time or in any legal manner by the owner or tenant of premises.



Jackrabbit

- Black-tailed jackrabbit (*Lepus californicus*) are very common in California particularly on the central valley floor.
- They prefer open grassland and sparsely vegetated areas.
- Jackrabbits rely on speed and agility to evade predators.



Jackrabbit Biology

- Jackrabbits are most active from early morning to early evening.
- Early spring to to late summer is normal breeding season.
- Litters have 1-8 young born in a “form”. Highs of 14 are recorded.
- May have more than one brood a year.



Damage

- Jackrabbits can damage alfalfa, cotton, beans, hay, grain, many truck and field crops, and the bark of and tender shoots of young grapevines and small orchard trees.
- It is estimated that 12 jackrabbits consume as much as one sheep and 62 jacks eat the equivalent as a 1,000 pound range cow. (Arnold, 1942).
- They can be infected with tularemia.

Legal Status



- **Black-tailed jackrabbits are classified as game mammals by the CDFG Code.**
- **When damaging growing crops or other property, may be taken at any time or in any legal manner by owner or tenant of premises.**

Control Measures

- Fencing and trunk guards.
- Herding into roundup clover fence traps.
- Shooting.
- Anticoagulant .005% treated grain bait in a covered self-dispensing bait station.



WEB SITES

<http://groups.ucanr.org/vpctraining>

<http://www.ipm.ucdavis.edu/PMG/menu.v>

www.vpcrac.org

Picture Acknowledgements

- **Outdoor California, March-April 1992, Vol. 53, No.2; September-October 1991, Vol. 52, No. 5. California Department of Fish and Game (CDFG).**
- **California's Wild Heritage, Threatened and Endangered Animals in the Golden State, CDFG. 1990**
- **National Geographic Book of Mammals, National Geographic Society, Washington, D.C. 1981**
- **California Department of Pesticide Regulations, Endangered Species Project, Slide presentation 1997 and 1999.**
- **The Audubon Society Pocket Guide, Familiar Mammals of North America, Chanticleer Press Edition, 4th printing January 1992.**
- **The Audubon Society Pocket Guide, Familiar Animal Tracks of North America, Chanticleer Press Edition, January 1993.**
- **Smithsonian Magazine, August 2001, Smithsonian Institution, Washington D.C.**