



GROUND SQUIRREL CONTROL

History and Integrated Pest Management

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UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

PesT AND PRoTected

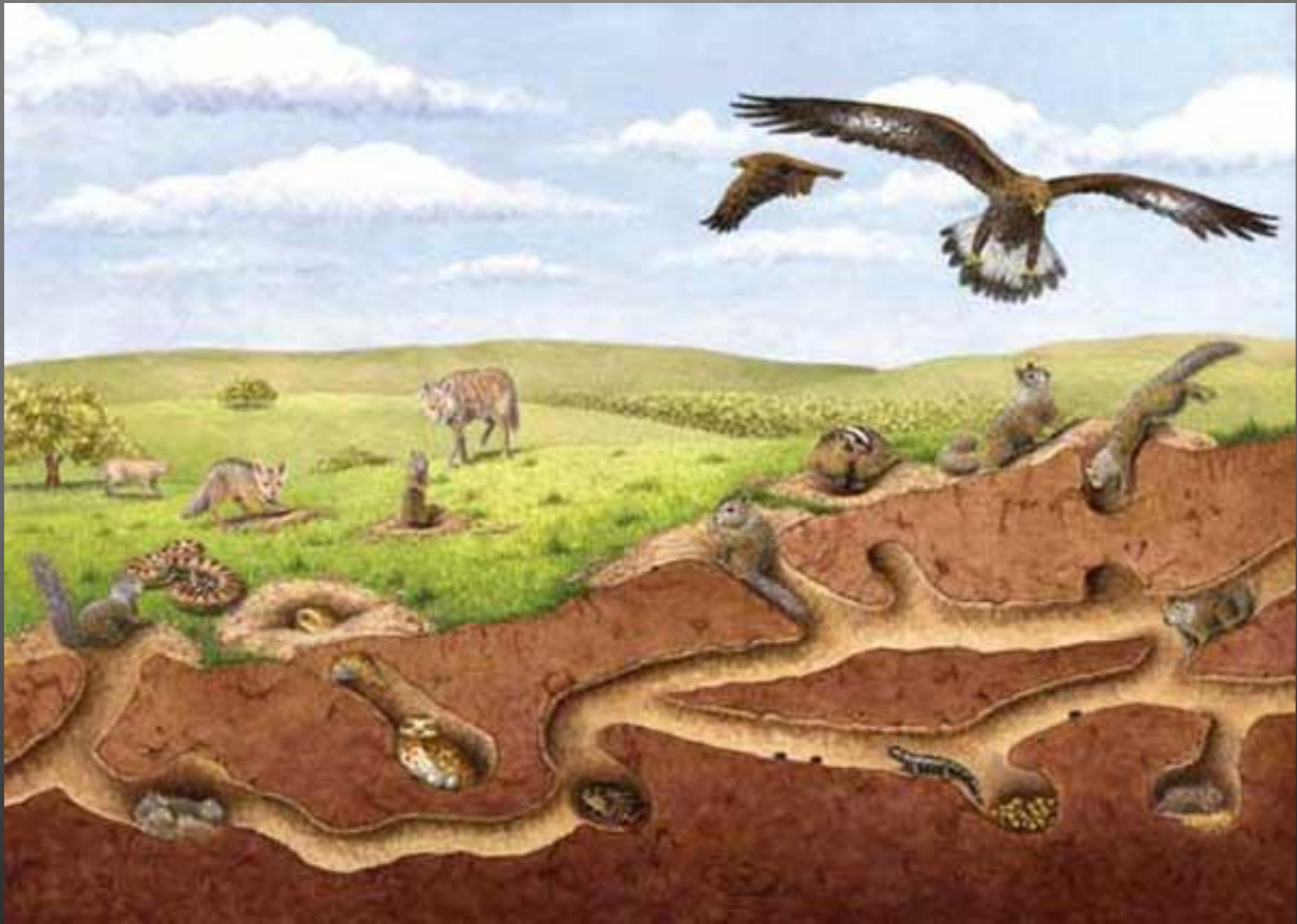


WHY WE CONTROL THEM?

- Protect infrastructure
- Reduce crop loss
- Protect trees especially seedlings
- Minimize burrows, open holes
- Protect people from pathogens i.e. bubonic plague

The image features a dark gray background with decorative circuit-like patterns in the corners. These patterns consist of thin yellow and white lines forming various shapes, including circles and straight paths, resembling a stylized electronic board. The patterns are located in the top-left, top-right, bottom-left, and bottom-right corners.

200 SQUIRRELS = 1 STEER





WHY WE PROTECT THEM?

- Keystone Species?
- 

Western Burrowing Owl

- Species of Special Concern





San Joaquin kit Fox

- ENDANGERED



Photo Credit: Greg Schechter

California Ground Squirrel



Location found: Woodland, CA
Diagnosis: habituated to humans
Length of care: 4 weeks
Approximate cost of care: \$1220



A family found this squirrel when she was a baby and decided to keep her. They soon realized that wild squirrels make terrible pets and they brought her to our hospital. Unfortunately, the squirrel had become used to humans and could no longer survive in the wild. Luckily, Lindsay Wildlife Museum was able to house the ground squirrel

DANGER/PELIGRO

This Property Area Under Fumigation
DO NOT ENTER/NO ENTRE



PHOSPHINE GAS



This Property Area Is Being Fumigated With

- EPA#
- | | | | |
|---|---|---|--|
| <input type="checkbox"/> 72959-1 FUMTOXIN® TABLETS | <input type="checkbox"/> 72959-2 5467 FUMTOXIN® PELLETS | <input type="checkbox"/> 72959-6 CELS/STRIPS | <input type="checkbox"/> 72959-9 PHOSTOXIN® TABLET PREFABS |
| <input type="checkbox"/> 72959-1-0657 FUMTOXIN® TABLETS | <input type="checkbox"/> 72959-4 PHOSTOXIN® TABLETS | <input type="checkbox"/> 72959-7 SPOUT FUMIGANT | <input type="checkbox"/> 72959-10 DELTA FUMEX |
| <input type="checkbox"/> 72959-2 FUMTOXIN® PELLETS | <input type="checkbox"/> 72959-5 PHOSTOXIN® PELLETS | <input type="checkbox"/> 72959-8 PHOSTOXIN® TABLET ROPE | |

THIS SIGN MAY ONLY BE REMOVED BY A CERTIFIED APPLICATOR OR A PERSON WITH DOCUMENTED TRAINING AFTER THE STRUCTURE AND/OR COMMODITY IS COMPLETELY AERATED (CONTAINS 0.3 PPM OR LESS OF PHOSPHINE GAS) IF INCOMPLETELY AERATED COMMODITY IS TRANSFERRED TO A NEW STRUCTURE, THE NEW STRUCTURE MUST ALSO BE PLACARDED IF IT CONTAINS MORE THAN 0.3 PPM PHOSPHINE. WORKERS EXPOSURE DURING THIS TRANSFER MUST NOT EXCEED ALLOWABLE LIMITS.

FUMIGATION PERFORMED BY:

Name HP-PRC PEST CONTROL
Address 75-A CRESTVIEW LANE
CAMPBELL, CA 95008



DATE OF FUMIGATION:

START 2-18-12 FINISH 2-19-12

EMERGENCY TELEPHONE

Day 907-554-0953

Night

FOR HUMAN OR ANIMAL EMERGENCIES CALL 1-800-308-1856

ALL OTHER CHEMICAL EMERGENCIES CALL CHEMTREC 1-800-424-9300


FORM NO. PEST-1 (REVISED 12/07) (P/07)

TAPE HERE

Care or Kill?



HISTORICAL PERSPECTIVE CONTROLLING SQUIRRELS FOR OVER 200 YEARS

- Superabundant population of squirrels
 - Benefit from “human invasion”
- 
- 

HISTORY OF SQUIRREL CONTROL

WRITTEN IN 1918 BY CA STATE COMMISSION OF HORTICULTURE

- California has had enough!
- A 236 page pamphlet detailing squirrel habitats, behaviors, and control methods
- Details on Squirrel Week

California Ground Squirrel

A Bulletin Dealing With Life Histories
Habits and Control of the Ground
Squirrels in California

The California Ground Squirrel is probably known by sight to more people than any other one of our four hundred kinds of native mammals. It inhabits open ground in well-settled territory and it forages abroad during the daylight hours when its movements are most likely to attract attention. Numbers are to be seen from the windows of passing trains, and the traveller by automobile is often thrilled by the narrow escapes of those heedless individuals which dash across the road immediately in advance of him, not infrequently to their own undoing. Then, too, this squirrel has, perhaps, been more widely advertised than any of our other mammals. A few years ago it came into prominence as a proven disseminator of the dreaded bubonic plague, and it has become notorious for its exceeding destructiveness to cultivated crops.

The term "Digger Squirrel" is often applied to this species, more especially in the foothill and mountain regions, in recognition of its burrowing habits, to distinguish it from the tree-inhabiting gray and red squirrels. The book name, *Beechey Ground Squirrel*, much used in the literature relating to it, is derived from the accepted scientific name *Citellus beecheyi*. This name, *beecheyi*, was bestowed upon the animal by its original describer (Richardson, 1829, p. 170) "in honour of the able and scientific Commander of the Blossom," Captain F. W. Beechey. The British ship "Blossom" cruised the Pacific Ocean northward even to Bering Strait during the years 1825 to 1828. Collections of specimens were brought back from many localities visited, including San Francisco and Monterey; among these specimens was one or more of the squirrels in question. These were evidently preserved for the most part by Mr. Collie, surgeon of the ship, who is quoted by Richardson as stating that "this kind of Spermophile 'burrows in great numbers in the sandy declivities and dry plains in the neighbourhood of San Francisco and Monterey, in California, close to the houses. They frequently stand up on their hind legs when looking round about them. In running, they carry the tail generally straight out, but when passing over any little inequality, it is raised, as if to prevent it being soiled. In rainy weather, and when the fields are wet and dirty, they come out but little above ground.'" And further information is given, according, for the most part, with what anyone can see for himself today in the same general region. This attests to the acuteness of observation of Mr. Collie, and also shows how the squirrels had already, some ninety years ago, begun to impress people with their numbers and boldness.

The California Ground Squirrel may be distinguished from other members of the squirrel family by the combination in it of the following characters: essentially ground-dwelling habits, relatively large size, long bushy tail, tall pointed ears, and generally grayish coloration with a three-cornered silvery white patch on each shoulder. Close inspection discloses a finely dappled pattern of coloration (see Fig. 2) such as is not shown in any tree squirrel or in any of our other ground squirrels except its near relatives, the Douglas, Fisher, Rock and Catalina Island squirrels. The detailed descriptions, measurements, etc., as given in the accompanying small-type paragraphs, should be studied for further particulars in this connection.




FIG. 2. A typical example of the California Ground Squirrel, the rodent of chief economic importance in the state. Note the bushy tail, tall pointed ears, the grayish-white shoulder patch, the marked back and rump, and the bushy tail. Photographed from life by J. Dixon.

AI NUMBER ISSUED BY
T CONTROL DIVISION
Superintendent - - - Editor
ON, Asst. Superintendent, Associate Editor


California State Printing Office

Original from
UNIVERSITY OF CALIFORNIA



1808-1st recorded control campaign
resulted in thousands killed in 9 days
in Santa Barbara. Methods unknown.

Control need was associated with the
Missions, farming and loss of crops.



REGULATIONS AND BOUNTIES

1889

San Benito County ordinances allowing squirrel control on neighboring property- not upheld by supreme court

1892

One party from Bradley, Ca (Monterey County) turned into the Monterey Board of Supervisors 21,755 squirrel tails to claim \$1,085 (\$32,977 2021 \$)

In San Benito County claims were paid 105,200 squirrel tails at 5 cents (\$1.52 per squirrel 2021)



Squirrel Fricassee

KILL SQUIRRELS



STATE LAW DEMANDS IT

DO YOUR PART TO

SAVE FOOD

DO IT RIGHT DO IT

NOW

Ask Your County Horticultural Commissioner for
Methods of Control

Issued by Rodent Control Division
W. C. JACOBSEN, Insp.

G. H. HECKE
State Commissioner of Horticulture

SACRAMENTO, CALIFORNIA

RODENT CONTROL DIVISION

In 1918 POTUS called upon All Californians to destroy the Ground Squirrel.

This Action followed the Governor proclaiming Squirrel Week

SQUIRRELS MENACE YOUR CROPS



KILL THEM

Ask your County
Horticultural Commissioner
for Control Methods.

issued by
Rodent Control Division
State Commission of
Horticulture,
G.H. Hecke,
Commissioner

Sacramento

california

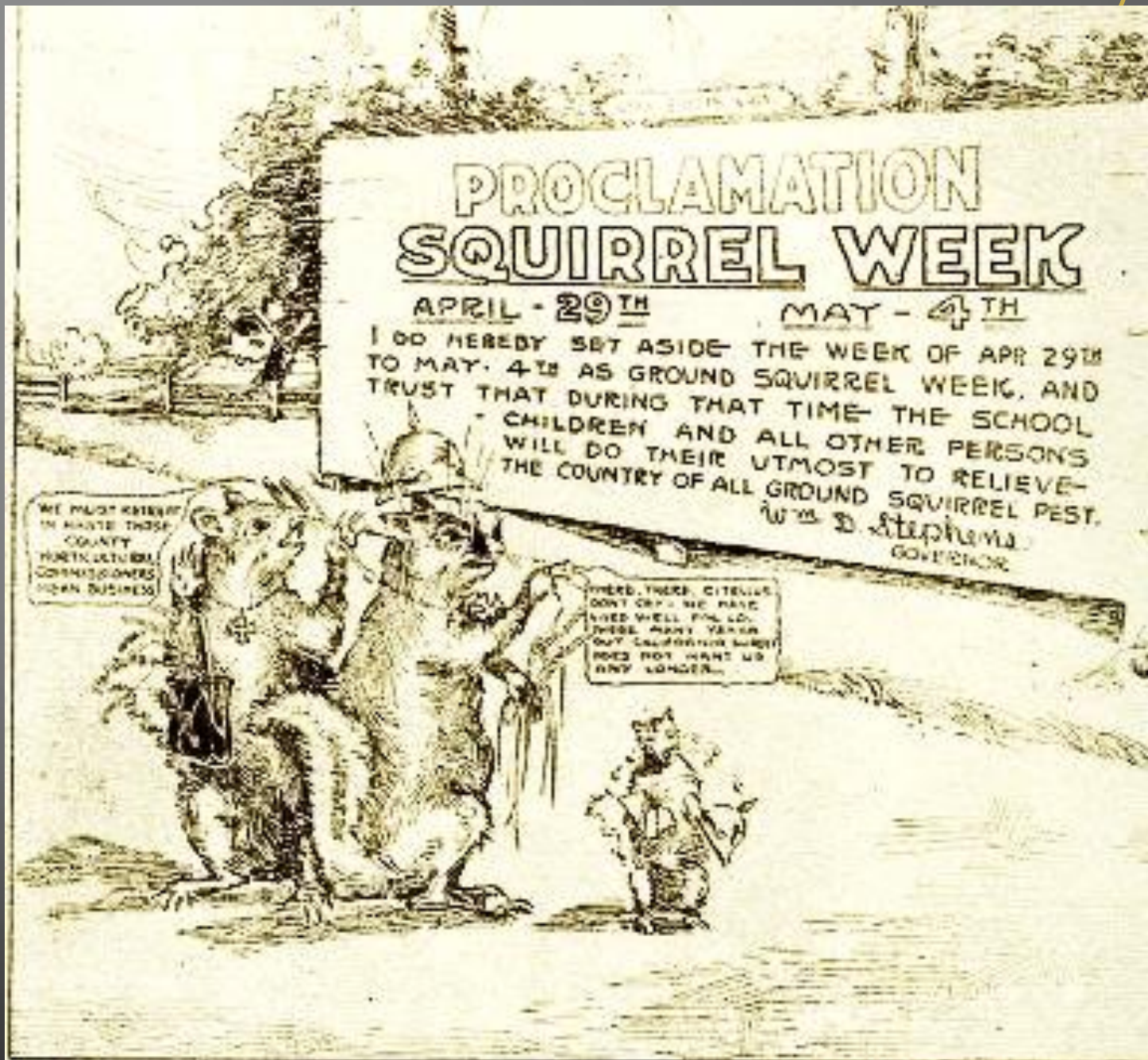


Fig. 61. Poster used in shop and store windows throughout the state.

GIFT

NOV 21 1917

KILL THE SQUIRRELS

CHILDREN, WE MUST KILL THE SQUIRRELS TO SAVE FOOD. BUT USE POISONS CAREFULLY.

POISON BARLEY

HOTEL CALIFORNIA BOARD BILL FOR SQUIRRELS IN 1917 THIRTY MILLION DOLLARS

OUR STAR BOARDERS

AND YOU MAY SERVE ME SOME NICE, YOUNG BARLEY SPROUTS

WAITER, TODAY ILL HAVE MY FAVORITE DISH - WHOLE WHEAT CAKES

MR. SQUIRREL

MRS. SQUIRREL

MENU
WHEAT
OATS
BARLEY
ROASTERS
SQUASHES
NUTS

OUR STAR BOARDERS

AND YOU MAY SERVE ME SOME NICE, YOUNG BARLEY SPROUTS

STATE COMMISSION OF HORTICULTURE

G. H. HECKE, Commissioner

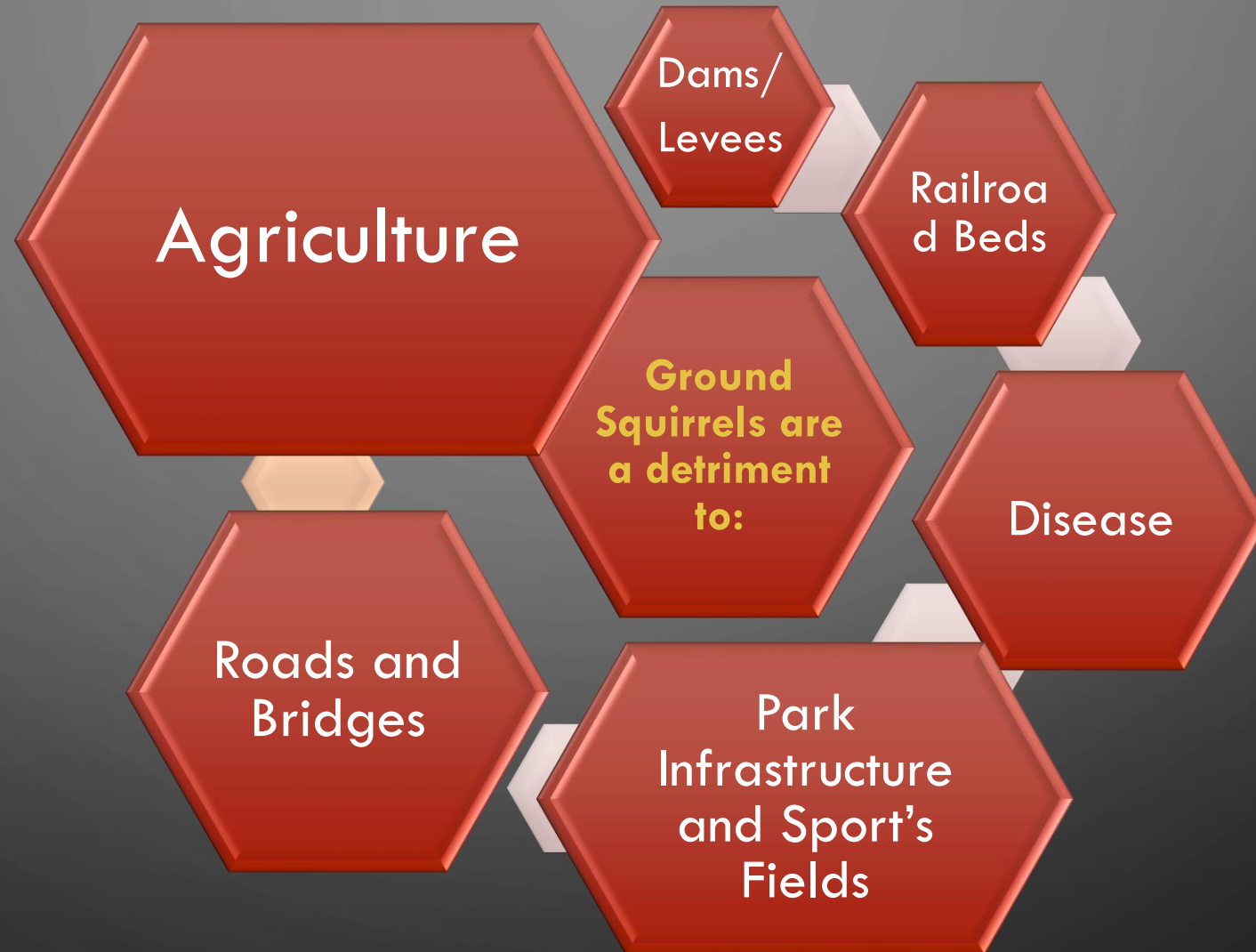
RODENT CONTROL DIVISION

W. C. JACOBSEN, Superintendent

Sacramento, California



WHY DO WE CONTROL SQUIRRELS? THEY ARE A PEST AND CAUSE SERIOUS DAMAGE



Santa Clara County





Closed Park



SQUIRREL - BURROWS

- 5- 30 ft - long
- 2-4 feet deep
- Feed within 150 ft of openings

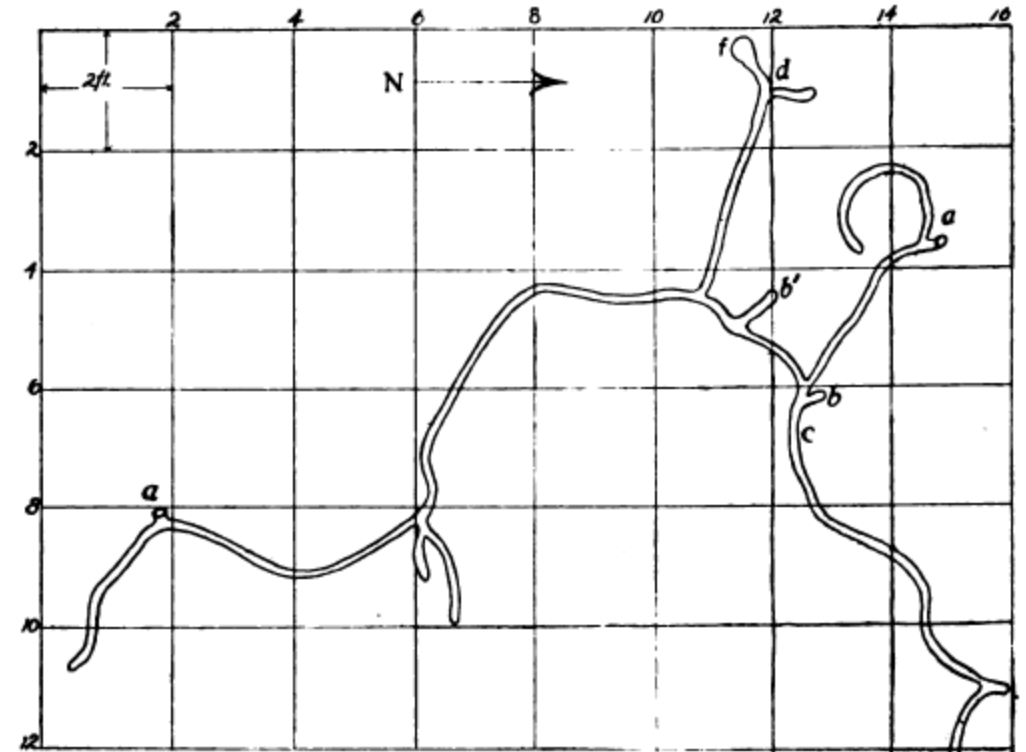


FIG. 21. Plot of a used burrow belonging to a female Belding Ground Squirrel, as excavated by J. Grinnell and T. I. Storer in a meadow near the Tioga Road, on Snow Flat, 8,700 feet altitude, Yosemite National Park, June 28, 1915.

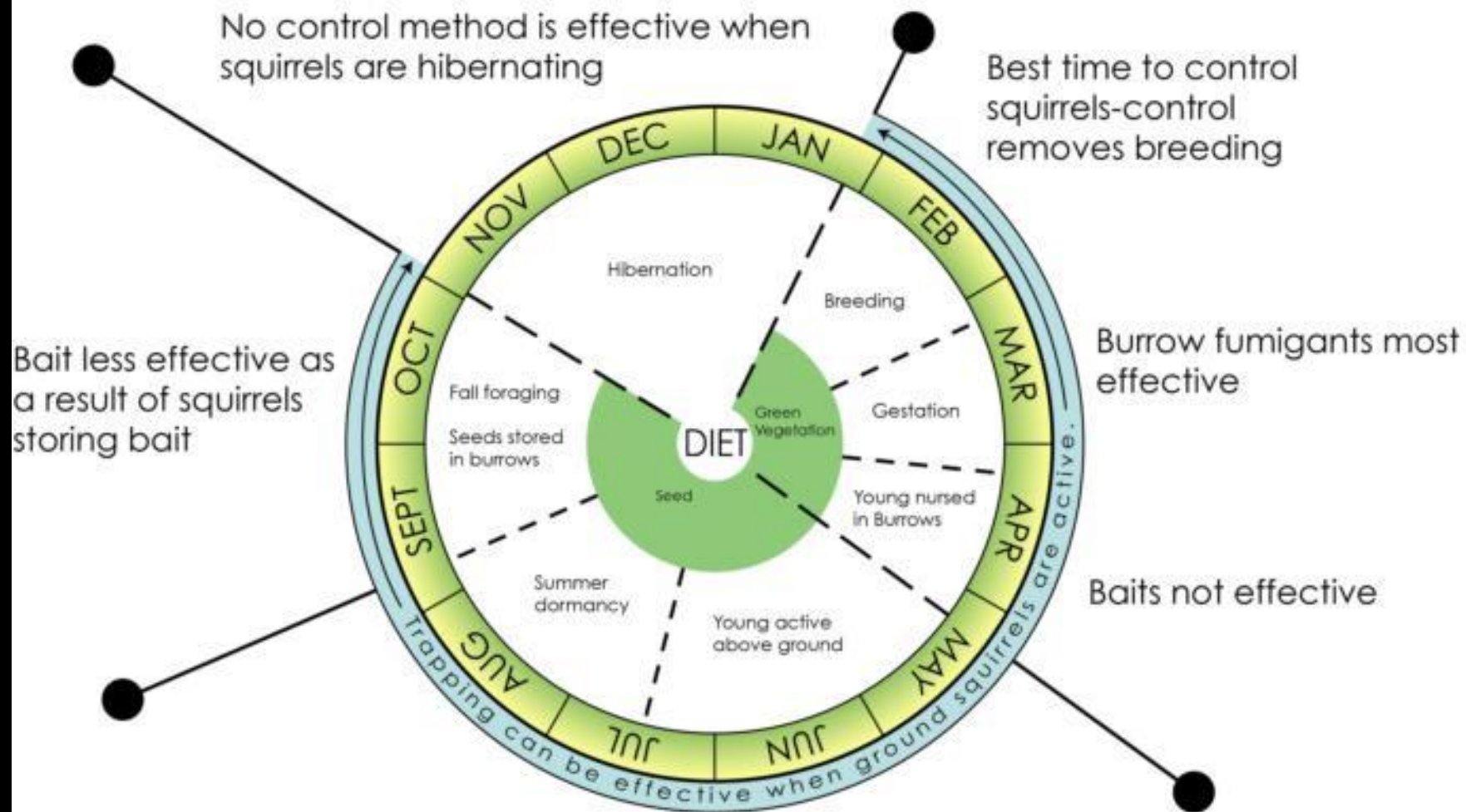
Main opening of burrow at *a* (down this the squirrel went when shot, and was subsequently found at *c*); two other openings at *a'* and *a''*; at *b* and *b'* blind branches directed downward (the squirrel may have essayed to dig deeper at these points but was discouraged by water); food materials, including lily tubers, in chamber at *f*; in the enlargement at the point marked *nest* was an accumulation of dry grass, the remains of an old nest or the beginning of a new one (the young would not have been born for about two weeks); boulder at *g* bulged out over the portion of the burrow adjacent to it, affording protection to the supposed nest-chamber.

Diameter of burrow, 45 to 65 millimeters; average of several measurements, 52. Average depth beneath surface of ground, about 135 mm. Greatest depth, at *b* and *b'*, 330 and 270, respectively. Total length of system, about 54 feet.

INTEGRATED PEST MANAGEMENT

The careful consideration of **all available pest control techniques** and subsequent **integration** of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are **economically justified** and **reduce or minimize risks** to human health and the environment. Emphasize least disruption to ecosystem and encourage natural pest control methods.

California Ground Squirrel - Calendar of Management



Poison baits are most effective during this period

From: University of California Ground Squirrel BMP website: <http://groups.ucarr.org/GSBMP/index.cfm>

TREATMENT CONSIDERATIONS

- AVAILABLE FOOD SOURCES (TIME OF YEAR, LAND USE)
- WEATHER
- LAND TYPE (CROP LAND, PASTURE, HABITAT, ORCHARD)
- LAND USE (PUBLIC ACCESS)
- LOCATION ON LANDSCAPE (BUILDINGS, ACCESS)
- NEIGHBORING EFFORTS
- TOLERANCE (ERADICATION, REDUCE POPULATION)



TREATMENT OPTIONS



CONTROL – HABITAT MODIFICATION - SQUIRRELS

- Remove brush and debris piles
- Fencing 2-3 feet deep in soil
- Good climbers – electric wire along fence
- Irrigate
- Eliminate food sources



**PLEASE
DO
NOT
FEED
THE SQUIRRELS!**



Feeding the squirrels at the Marina is causing overpopulation.

When this happens, the squirrels become sick and die.

You will be helping the squirrels by NOT feeding them.

Thank you!



City of Berkeley Parks, Recreation & Waterfront Dept.

For more information call (510) 981-6720.

DANGER



**DO NOT FEED
SQUIRRELS**
Even if they look furry
and cute

CONTROL - PREDATORS – RAPTORS FOR SQUIRRELS

Red tailed, hawks, eagles, rattlesnakes & coyotes

Raptor perches

Environmentally friendly

Not enough food & they move on

Wide hunting range means your squirrels may be ignored

Kestrels are territorial chasing off larger raptors that eat squirrels

Squirrels alert each other to danger



CONTROL/HABITAT DESTRUCTION - BURROW RIPPING

- 20 inches deep recommended
- 12 inch shanks had no effect
- Unsuitable for rocky areas



CONTROL/HABITAT DESTRUCTION – EXPLOSIVE DEVICE

- Propane & oxygen mixture ignited
- Destroys burrows (preventing reinfestation)
- Potential turf destruction
- Bystander risk
- Loud
- Studies are not favorable
30% success rate



CONTROL/HABITAT DESTRUCTION - BURROW FILLER

- Filling in burrows with water and sand
- Relatively new product unknown success rate
- Prevents burrow reuse



CONTROL - REPELLENTS

- Castor Oil Repellent: limited effectiveness, in addition poisonous to humans and pets
- Vibrations, grain with plaster of paris, Juicy Fruit gum,; no evidence this works



CONTROL – TRAPS

- Squirrels
- Box & tunnel traps, Conibear, Live traps
 - Effective, but requires lots of labor
 - Trap shyness, alter camo and bait
 - Time Consuming- checking traps, euthanizing



CONTROL -LIVE TRAPS

- Most effective Feb-Oct
- Keep traps out of the sun
- Check traps daily
- Dispatch humanely and dispose of properly



CONTROL - LIVE TRAPS EUTHANASIA

- California Fish and Game Code, once a live animal is trapped, it must either be released where it was trapped or it must be euthanized.
- Gun if it is legal to discharge a firearm in that area
- Not legal to drown
- Not legal to use Carbon Monoxide (car exhaust)
- Euthanasia chamber – commercial or constructed
- CO2 is recommended method

CONTROL – SHOOTING

- Lead bullets 2019 no longer allowed
- Limited in urban areas
- Labor intensive



CONTROL – FUMIGANTS – INCENDIARY DEVICES

- Recent study 62-86% control
- Risk of fire in dry conditions
- Risk to other species using burrows
- Tunnels can be quickly sealed
 - Requires persistence



CONTROL – FUMIGANTS – CARBON MONOXIDE

- Study of 3 devices at 5 sites:
 - 7 to 100% control
- Tunnels can be quickly sealed
- Road flares & car exhaust are not legal in California must use registered device



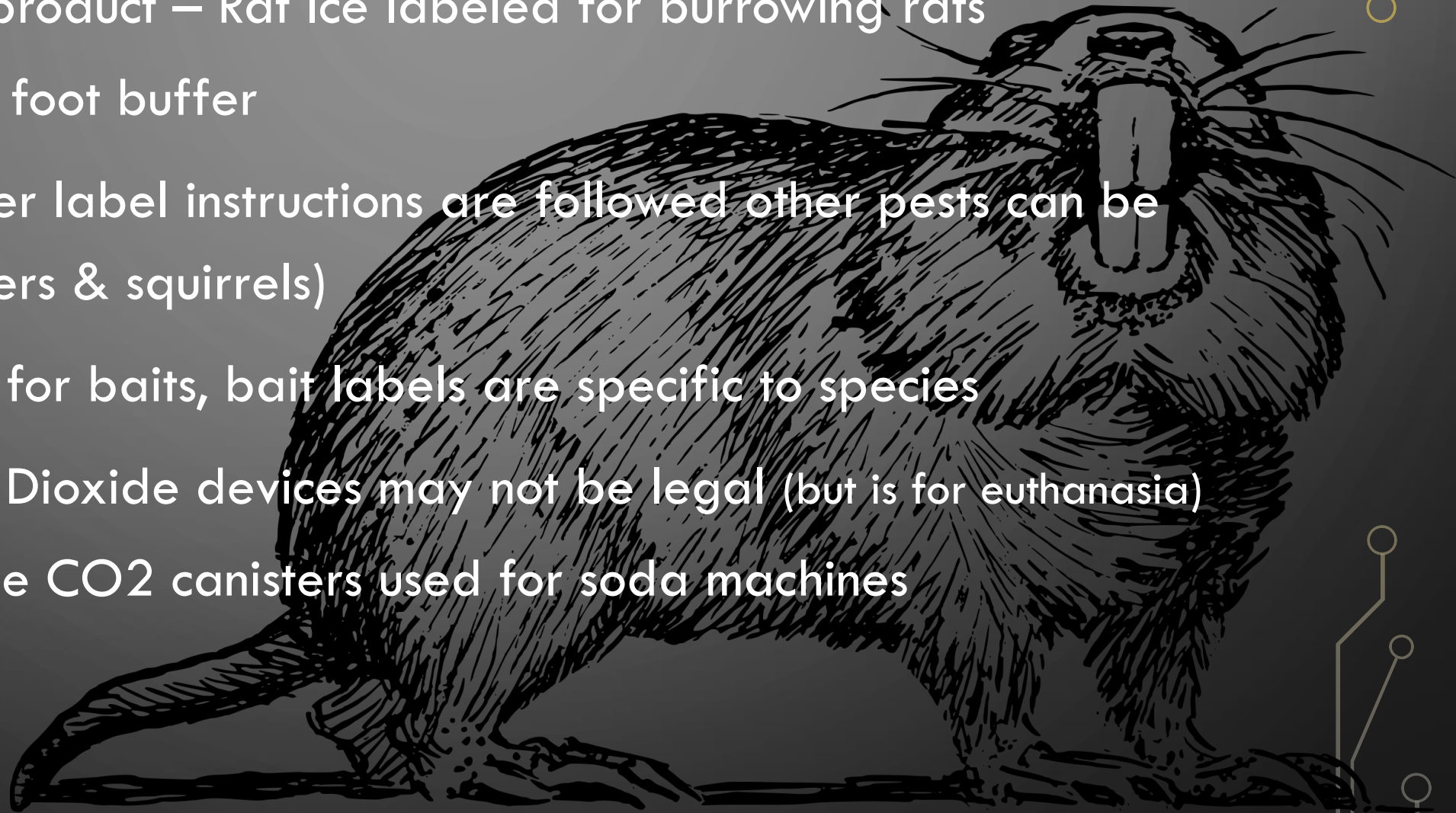
– FUMIGANTS – ALUMINUM PHOSPHIDE

- Risk of fire in dry conditions
- Labeling requirements
 - Signs
 - Buffer zones
 - SCBA or monitor device
- Restricted Material requirements
- Recent study 97-100% control



CONTROL – TUNNEL FUMIGANTS- CARBON DIOXIDE

- Current legal product – Rat Ice labeled for burrowing rats
 - Dry Ice, 10 foot buffer
- As long as other label instructions are followed other pests can be treated (gophers & squirrels)
- This is not true for baits, bait labels are specific to species
- Other Carbon Dioxide devices may not be legal (but is for euthanasia)
 - For example CO2 canisters used for soda machines



ENDANGERED ANIMALS THAT USE SQUIRREL BURROWS

Burrowing Owl

CA Tiger Salamander

San Joaquin Kit Fox – we have
the habitat, no known
inhabitants



CONTROL - BAITS

Pesticide permit



- Issued through the County Ag office
- Paperwork
- Employee Training
- Storage concerns

BAIT STATIONS – SQUIRRELS ONLY

- Commercial or homemade
- Must be affixed



TOXIC BAIT (EARLY SUMMER)

- Anticoagulant treated grain
- Must be eaten in several feedings
- Use bait station or box
- Kills over 2 to 4 weeks



BROADCAST BAIT

- Broadcast grains or stations



CONTROL - BAITS

Acute toxicants – one time feeding

Zinc Phosphide, turns to phosphide gas with the presence of water & acid, prevents cells from producing energy



AUTOMOBILE LOAD OF 515 POISONED SQUIRRELS FROM 200 ACRES
(POISONED IN MORNING, LOADED AT NOON)



TREATMENT PLAN

Ground Squirrels

- Monitor
 - Large population
 - No endangered species
- Integrated Pest Management Plan
 - Remove Debris
 - Don't feed wildlife
 - Zinc phosphide in autumn
 - Aluminum phosphide in spring
 - Trapping in summer

