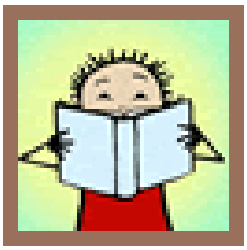
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

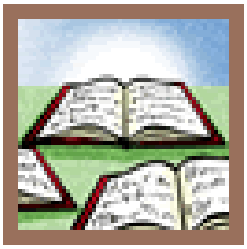
Opossums

(Didelphis virginiana)



Introduction: The opossum is the only native North American marsupial (animals that carry their young in an abdominal pouch). It is not, however, native to California; it was introduced many years ago and has now become well established throughout much of the state.

Identification: Opossums are about the size of a house cat and have coarse grayish fur, a pointed face, and hairless rounded ears. They are about 2 to 3 feet long, including the hairless tail, and weigh up to 15 pounds. Males are usually larger than females. Their feet resemble small hands with widely spread fingers. Opossums are well adapted for climbing. Their long, hairless, prehensile tail and opposable toe on the hind foot assist in holding onto small branches or similar structures. Opossums can also carry nesting materials and other items with their tails.



Legal Status: The California Fish and Game Code classifies opossums as nongame mammals. If you find opossums threatening growing crops or other property of which you are the owner or tenant, you may control them using any legal means. Department of Fish and Game (DFG) regulations prohibit the relocation of wildlife without written permission from the DFG. Always check to make sure that there are no local restrictions pertaining to the removal of opossums prior to taking any action.

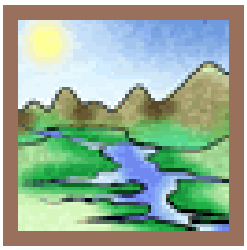
Damage: In its nocturnal foraging the opossum is a true omnivore, feeding on fruits, nuts, green plants, insects, snakes, frogs, birds and their eggs, and small mammals such as meadow voles. It eats fresh meat and carrion and may often be seen feeding on road kills. Opossums that live near people may visit vegetable gardens, compost piles, garbage cans, or food dishes intended for dogs or cats. Having lost much of their natural fear of people they will enter a home through a pet door in a search for food. Fortunately, they are not aggressive unless cornered.

Opossums are considered a nuisance in gardens and near homes where they feed on berries, grapes, and tree fruits and nuts, and defecate on garden paths and patios. They will fight with cats and dogs and can inflict serious injury with their sharp, pointed teeth.

Opossums carry diseases such as leptospirosis, tuberculosis, relapsing fever, tularemia, spotted fever, toxoplasmosis, coccidiosis, trichomoniasis, and Chagas' disease. They may also be infested with fleas, ticks, mites, and lice. Opossums are hosts for cat and dog fleas especially in urban environments.

Range: Range Map.

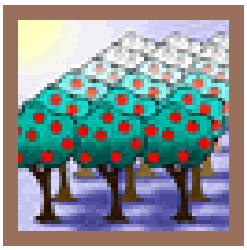
Virginia Opossum



Habitat: The preferred habitats are diverse, ranging from arid to moist and wooded to open fields. They prefer environments near streams and wetlands. Opossum may take shelter in abandoned burrows of other animals, tree cavities, brush piles, and beneath dense cover. In urban and suburban settings they may den under steps, porches, decks, garden sheds, and if accessible, in attics, garages, and beneath houses, where they make untidy nests. The old belief that opossums are nomadic without well developed home ranges has been disproved. They have complex but flexible social relationships with overlapping home ranges that allow high populations to develop where food is plentiful.

Biology: The opossums mating season extends from January to July; two litters are produced averaging about 7 young each. After a short 13 day gestation period, the ½ inch long young are born. Like other marsupials, the blind helpless young find their way into the mother's pouch, where each attaches to one of the 13 teats. They remain for about 8 weeks, during which they continue development and growth. At approximately 11 weeks of age they can leave the pouch for short periods. When the young become too

large for all to fit inside the pouch, some will ride along by hanging onto the mothers back. The young are weaned at about 14 weeks. Females mate again after the first litter of the season becomes independent. The second litter will be sufficiently grown to leave the mother by fall. Mortality in the young is high; most perish before they are a year old. Young that survive until the next spring will breed. Few opossums live beyond 3 years.



Damage Prevention and Control Methods: Opossums generally do not become too numerous. However, they are highly adaptable and are great survivors. Once they have invaded a neighborhood they will probably remain as long as food, water, and shelter are available.

Exclusion: Most problems with opossums occur when they nest beneath stairs, porches, decks or buildings.

Screening or blocking them out is effective. Before doing so make sure the animal has left before undertaking any blocking activities. An easy way to determine if the animals have left is to sprinkle a smooth layer of flour about 1/8 inch thick in front of the entrance. Examine this patch soon after dark; the presence of footprints indicates the animal has left and the opening can be closed off. Close off all potential openings with ¼ inch mesh hardware cloth. This small mesh also excludes rats and mice. Note, opossums usually live alone unless they are with young.

Opossums can also be excluded from gardens by means of a poultry wire fence. The fence should be 4 feet high with the top 12 to 18 inches of the fence bent outward, away from the garden and not attached to any support. Since the top of the fence is not rigid the fence bends under the animal's weight, preventing climbing. As an alternative any standard wire fence can be made opossum proof by stretching electric charged wire in front of the top of the fence, 3 inches out from the mesh. Use a cattle-type electric fence charger to activate the wire, and follow installation instructions carefully.

Habitat Modification: The aim of habitat control is to make your premises less appealing to the opossum. Cut back overgrown shrubbery and trim trees that overhang rooftops at least 5 feet from the roof edge. Pick up and dispose of fallen fruit. Stack firewood or similar tightly to avoid leaving attractive gaps suitable for a den. Alternatively, store lumber 18 inches off of the ground. Garbage cans should have tight lids. Remove food left for pets outdoors by nightfall.

Frightening: Not Recommended. However, a motion activated sprinkler device sometimes induces a short term fright response in opossums. If the animal has established the habit of visiting the yard or garden, this frightening method rarely lasts for more than a few days.

Fumigants: Not recommended.

Repellents:

An array of chemical repellent products are marketed for repelling various wildlife including opossums. Unfortunately, none offer significant results. The odor of mothballs or naphthalene crystals, used as a home remedy repellent, has occasionally been reported to be successful in driving opossums from confined areas although this is not recommended.

Toxic Bait: No toxicants are registered for opossum control. Poison baits sold for rodents should NOT be used to control opossums. The legal penalty for such pesticide misuse can be substantial, and the practice usually comes to light through the accidental poisoning of someone's pet.

Trapping: Opossums are not wary of traps and can easily be caught with a box or cage type live catch trap. Traps should be at least 10 by 12 by 32 inches in size. Set traps along trails or known routes of travel. Fish flavored canned cat food works well as trap bait, but it often attracts cats as well. To avoid this possibility try using raw chicken eggs, jam or peanut butter spread on bread. Other baits can include overripe fruit such as grapes, bananas, or melon.

Live trapping presents the problem of dealing with the animal once captured. It is illegal to relocate an opossum without a permit. Remember, when trapping always check the trap daily. Live captured opossums should be euthanized by CO_2 gas. Trapping opossums requires a trapping license issued by the Department of Fish and Game. Local restrictions may also apply to removal of opossums.

Other Considerations:

Shooting: In rural areas where legal and safe to do so; always check with your local Fish and Game Warden to ensure compliance with local laws and ordinances. Because of their nocturnal habits, shooting is not very effective.

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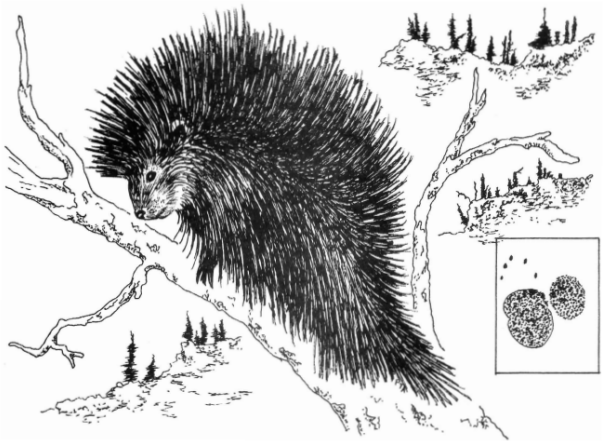
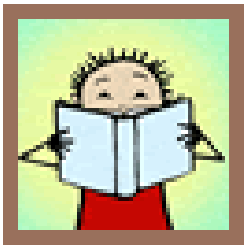
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Porcupine

Erethizon dorsatum

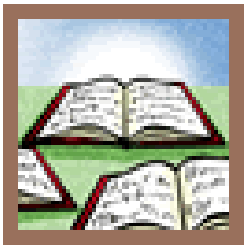
Family: Erethizontidae





Introduction: The porcupine is found in coastal western areas of California, north of San Bernardino, north of the San Francisco, and inland mountain regions. It is found in a wide range of habitats, including coniferous forests, cottonwood stand alone prairie river bottoms, deserts, and alpine tundra. The name "porcupine" comes from the Latin porcus, meaning swine, and the French epine, derived from the Latin spina, meaning thorn. Translated this literally means the "irritable back." The porcupine is a beautiful creature of nature. It is an interesting animal with an important place in the environment. It is edible and has been used as an emergency food by humans. The quills are used for decoration (esp. Native American) and their hair for fly fishing lures. Porcupines are not wary creatures.

Identification: Porcupines are large bodied, short legged, slow and awkward rodents. They walk with a clumsy waddle. Adults are usually 25 – 30 inches long and weigh 10 to 30 pounds. They use the sharp, barbed quills which cover their body for defense.

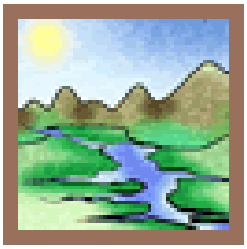


Legal Status: Porcupines are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.

Damage: Porcupines partially or completely girdle large pine and juniper trees, often near the top of the tree, resulting in a weakened, dead, or spike-top tree that is useless for commercial purposes. The inner bark and needles of mature trees are eaten, and small seedlings may be completely consumed. Porcupines often make nuisances of themselves around camps by gnawing leather boots, saddles, and ax handles, presumably because of the salty perspiration residue. They can destroy siding on cabins when seeking plywood resins. They are fond of apples and other fruits and they occasionally damage young fruit trees, alfalfa, sweet corn, and truck crops. Porcupines can pose a threat to dogs and similar pets from their quills. Domestic stock may occasionally nuzzle a porcupine and be injured by the quills. This can be serious if not removed promptly.

Range: Porcupines are common in coniferous forests in western and northern North America. They wander widely from cottonwood, prairie, and river bottoms to alpine tundra. In California they are found chiefly in areas of coniferous trees, north from Marin County in the coast range, and north from the San Bernardino and Tehachapi Mountains inland.

Porcupine



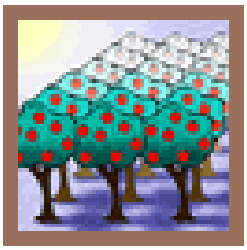
Habitat: Usually forested areas, but occasionally away from trees if brush is available. Porcupines eat herbaceous plants, inner tree bark, twigs, and leaves. Trees with thin smooth bark are preferred with a preference for ponderosa pine, aspen, willow, and cottonwood.

Biology: The barbed quills are their main means of defense. They are constantly replenished, and although the violent tail-switching during an attack may throw quills several feet, the quills are too light to penetrate skin. Generally one slap with the spiny tail is sufficient to discourage further aggression. An adult porcupine may weigh 13 to 30 pounds or more; the female being considerably smaller.

Porcupines are slow-moving and clumsy, but they are excellent if somewhat awkward climbers. Porcupines are most active at night but they may be seen during the day, especially in the top of a tree. They have been known to swim to get food. Porcupines eat many succulent plants and the buds, leaves, inner bark, and cambium of numerous kinds of trees. During spring and summer they usually feed on herbs and shrubs. In fall and winter and in periods of drought, their diet consists largely of bark and leaves of conifers, especially ponderosa pine and several species of juniper. Mistletoe is a favorite food during the colder months.

Porcupines rest in the dense foliage of a particular tree or in a cave near the feeding grounds. Often, you can find hundreds of their oval-shaped brownish pellets, about 5/8 inch wide at these sites. Porcupines do not hibernate in winter, but there may migrate in fall from higher elevations to sheltered areas of the forest, or to dens which serve as a refuge in harsh weather. Dens may be in rock crevices or in hollow trees or logs; sometimes in winter they will stay in a large pine tree for weeks at a time rather than trudge through snow. As weather warms in the spring, porcupines resume ground feeding and move toward areas offering greener food during summer.

Mating takes place sometime between September and December. After a gestation period of about seven months, the young are born in April, May, or June. Only one young is born, rarely two, and their quills become hard and sharp as soon as the baby is dry. Within two days, it can climb and soon follows its mother on feeding trips. It is able to eat solid food a few hours after birth and is completely weaned after ten days. The baby stays with its mother for five or six months and then takes off on its own to live a rather solitary existence. Except during the mating season and when denning in winter, porcupines are seldom seen together. Porcupines reach sexual maturity at three years and may live for many more years. Bobcats, mountain lions, fishers, and wolverines seem to be successful predators of porcupines; the coyote and domestic dog corner and kill numerous porcupines, but they often sustain serious quill injury in return.



Damage Prevention and Control Methods

Exclusion: Fencing small tree plantings, orchards and gardens is effective in reducing porcupine damage. Electric fences are effective when the smooth electric wire is placed 1-1/2 inches above 18 inch high poultry

wire. Porcupines will climb fences, but an overhanging wire strip around the top of the fence at a 65° angle to the upright wire will discourage climbing.

A wire basket completely enclosing small trees may be very effective. A band of aluminum flashing at least 30 inches wide, placed so as to encircle the trunk will protect fruit and ornamental trees.

Habitat Modification/Cultural Methods: Thinned forest stands are vulnerable to porcupine damage because more forest floor vegetation can thrive. Porcupine populations are usually reduced in numbers in closed canopy stands where understory vegetation is scant.

Frightening: Not recommended

Fumigants: Not recommended

Repellents:

Not recommended

Toxic Bait: No toxicants are registered to control porcupines.

Trapping: Steel leg hold traps are illegal in California for trapping porcupines. Trapping porcupines requires a trapping license issued by the Department of Fish and Game. Porcupines are rather easy to live-trap with large commercial cage traps (32 x 10 x 12) inches or homemade box traps. Place the live trap in the vicinity of damage and bait with a salt-soaked cloth, sponge or piece of wood. Live traps also can be set at den entrances. Remember that relocation and release of mammals is illegal in California. Live trapping will either involve contacting your local wildlife control center or conducting appropriate euthanasia which is not recommended without experience.

Other Considerations: Porcupines are mobile and will continually reinvade control areas. Complete control is not desirable as it would require eradication of porcupine. However, economic losses can be considerable from porcupines feeding on forest plantings, ornamentals and orchards. Try to limit lethal control to the few animals causing damage. In areas of high porcupine populations, plant alternative ornamentals that are not preferred food.

Shooting: Persistent hunting and shooting of porcupines in areas which require protection can be effective in reducing the population. Night hunting, where legal, is effective. During winter months porcupines are active and can be tracked in the snow and shot with a .22 caliber gun. Porcupines often will congregate around good denning sites and extensive girdling of trees may occur in the area. In such places large numbers may be taken by shooting.

Always check with your local Fish and Game warden for compliance with local gun control regulations.

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BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

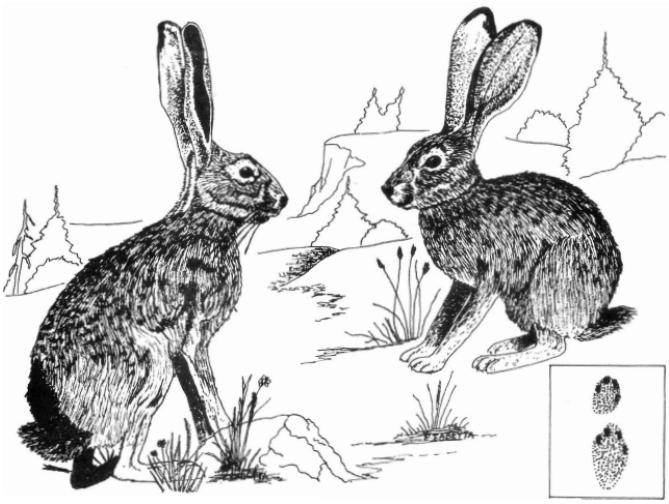
Rabbits - Black-tailed jackrabbit, Cottontail, Brush rabbits

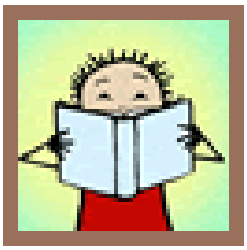
Black-tailed jackrabbit *Lepus californicus*

Cottontail rabbit *Sylvilagus audubonii*

Brush rabbit *Sylvilagus bachmani*

Family: Leporidae



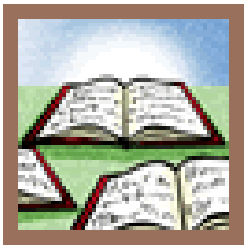


Introduction: Three rabbits are common to California: the black-tailed jackrabbit, the cottontail, and the brush rabbit. Of these, the jackrabbit is the most destructive because of its greater size and occurrence in agricultural areas. Cottontails are common pests in landscaped areas. Hereinafter 'rabbits' shall refer to all three species unless distinguished.

Rabbits can be destructive and eat a wide variety of plants, grasses, grains, alfalfa, vegetable, fruit trees, vines, and many ornamentals. They also cause damage to plastic irrigation through their gnawing activities.

Identification: The jackrabbit is about the size of a house cat 17 to 22 inches long. It has long ears, short front legs, and long hind legs. They populate open or semi open lands in valleys and foothills.

Cottontail and Brush rabbits are smaller and have shorter ears. They inhabit bushy areas where cover is dense and landscaped areas provide excellent habitat. They can also be found beneath junipers and other large, low-growing evergreen shrubs.



Legal Status: Black-tailed jackrabbits, cottontails, and brush rabbits, are classed as game mammals by the California Fish and Game Code.. There is an important distinction between the three species as to when control is permitted. Jackrabbits may be taken (i.e., killed or trapped) anytime or in any legal manner by the owner or tenant of the premises, or employees thereof, if they are damaging growing crops or other property, which includes ornamental plants and irrigation lines.

Cottontails or brush rabbits may be killed or trapped by the owner or tenant of the land, or by any person authorized in writing by such owner or tenant, when the rabbits are damaging crops or forage. If any person other than the owner or tenant transports cottontails or brush rabbits from the property where they were taken, they must carry written authority from the owner or tenant. All three rabbit species cannot be sold i.e. for fur or meat. Recent legislation clarification from the California Attorney General (Opinion 06-109, 2007) makes it lawful to kill cottontail rabbits that are materially harming landscaping, ornamental plants, or gardens. In fact the Attorney General also clarified that the taking could be done by an individual or employee using air powered pellet projectiles (air rifle), at anytime, within 150 yards of an occupied residence, if the rabbits are materially harming landscaping, ornamental plants, or gardens, and such use is in conformity with applicable local ordinances.

Damage: Alfalfa and other forage, hay, grain, various truck and field crops, and the bark and tender shoots of small orchard trees and young grapevines.

Rabbits can be very destructive in nurseries, gardens and landscaped places. This is particularly true where wild or uncultivated lands border residential zones, parks, greenbelts, or other landscaped places. Open lands such as uncultivated, wild areas provide resting and hiding cover during the day within easy travel distances to prime, irrigated food sources.

The cosmopolitan tastes of rabbits are well illustrated by the following partial list of crops and plants they damage: vegetables (beans, beet, broccoli, carrot, lettuce, peas); tree and berry crops (almond, apple, blackberry, cherry, citrus, pistachio, plum, raspberry, strawberry); herbs (cilantro, parsley); and ornamental plantings (various flowers, shrubs, trees, and turf). Rabbits also gnaw and cut plastic irrigation lines.

Most rabbit damage is close to the ground, except where snow allows rabbits to reach higher portions of plants. Rabbits use their incisors to make a characteristic diagonal, 45° cut when clipping off woody twigs, buds from saplings, or flower heads. Twig clipping by rabbits is

sometimes confused with deer browsing. Deer damage can be identified easily if it occurs above a height that rabbits can reach (about 2 feet) and by careful examination of the damaged twigs. Deer have no upper front teeth and must twist and pull when browsing, leaving a ragged break on the branch. Rabbits clip twigs off cleanly, as if with a knife.

Rabbits tend to gnaw the smooth, thin bark from young trees. The rough bark of older trees discourages gnawing, although old damage and gnaw marks are often present on old bark along with fresh patches of gnawing in areas of younger growth. Gnawing can completely girdle a tree, and clipping can remove the terminal shoot and lateral branches from plants. Damage by cottontails and brush rabbits is often concentrated in areas near escape cover. Jackrabbits, however, will feed far into open areas and can eat 1/2 to 1 pound of green vegetation each day. Cottontails have been especially damaging to nursery stock and irrigation systems.

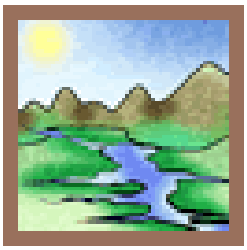
Tularemia, or rabbit fever, may be carried by rabbits. This disease is relatively rare in humans but can be contracted by handling an infected rabbit with bare hands or by eating insufficiently cooked rabbit meat.

Range: The Black-tailed jackrabbit is found throughout California from below sea level to above 12,000 feet. Elsewhere it ranges throughout the southwestern United States, southern Great Plains, and no further north than central South Dakota. Cottontails and Brush rabbits range throughout most of California except the northern most parts of the State.

Black-tailed Jackrabbit

Cottontail

Brush rabbits



Habitat: Jackrabbits typically occupy open grasslands and sparsely vegetated deserts in the California valleys and foothills. They do not build nests but make a depression in the soil beneath a bush or other vegetation. They are relatively sparse in the humid coast region and in the higher mountains.

Cottontails and brush rabbits inhabit brushy areas where vegetative cover is dense. Landscaped areas are an excellent example of this. They also find cover under piles of rock, brush or debris.

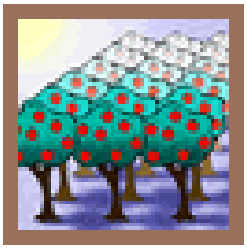
Biology: The jackrabbit is a hare rather than a rabbit, because the young are born full furred and with their eyes open and they can hop about when born. Hares differ from rabbits in anatomy and in the lack of burrowing or nesting; although individual hares often have a more or less regular retreat or "form" at the base of a bush or clump of grass. Jackrabbits rely upon speed

and dodging to escape enemies. They live chiefly in open places, seldom inhabiting dense brush or woods. Grazed lands tend to have larger jackrabbit populations than areas with higher grass cover.

Hares are most active from early evening to early morning. Succulent grasses and a wide variety of green vegetation are the principal foods eaten. Arnold (1942) estimated that 12 hares eat as much as one sheep, and about 62 rabbits consume the same equivalent as a 1,000 lb. range cow. Vorhies and Taylor (1933) estimated the equivalents were 30 hares for one sheep and 148 hares for one 750 lb. cow after correcting for the 60% mesquite and cactus browse (Hares eat their own "soft" feces during the daytime when resting, apparently to satisfy vitamin needs. "Hard" pellets are not eaten.

In general, the breeding season runs from early spring to late summer, although breeding may continue all year where winters are mild. Females may produce more than one brood a year, especially on irrigated land. After a gestation period of about six weeks, a litter of 1 to 8 young, usually 3 or 4, is born; the greatest number of young are produced in spring months. A year old female may produce 14 or more young each year. Some young are apparently born in a "form" which may be a fur-lined depression or a simpler shelter; the young are more nocturnal than adults and are rarely seen until half grown. It is presumed that the mother returns to her young to suckle them at night, but the age of weaning has not been established.

Coyotes, bobcats, and eagles are among the principal natural enemies of hares. Jackrabbit populations build up to cyclic high levels about every seven years followed by a drastic reduction in numbers by disease. The period of the cycle may vary from five to ten years. Crop damage is more severe in years when they are abundant.



Damage Prevention and Control Methods

A number of methods can be used to reduce rabbit damage but physical exclusion, trapping, and, to a lesser degree, repellents are recommended for protecting garden and home areas. In cases where these methods are not practical, contact your local farm advisor or agricultural commissioner for further information.

Exclusion: Rabbits cause extensive economic losses to agricultural, horticultural and forestry interests. Landowners and occupiers therefore require cost-effective and humane means of controlling rabbit numbers. One of the most common forms of managing the problems rabbits pose is to deny them access to vulnerable areas. Fencing is currently recommended as a humane and environmentally acceptable means of excluding rabbits and thereby reducing damage to agricultural, horticultural or forestry interests.

Exclusion is most often accomplished by the construction of fences and gates around the area to be protected. Woven wire or poultry netting should exclude all jackrabbits from the area to be protected. To be effective, the fence must be of mesh not greater than 1-1/2 inches, 30 to 36 inches high, with the bottom 6 inches turned outward and buried at least 6 inches below ground

level. Rabbits can and will jump, and dig. However, the aforementioned provisions should negate this. Turf should be placed at intervals on the lapped portion of the netting to hold it firmly in place, vegetation will grow. Frequent fence maintenance checks are recommended. While fence netting can be erected stand alone. If more substantial fencing is required use fence posts. Fence posts should be 5` 6 inches high, 2` 3inches diameter and spaced every 16yds. Two steel wires should be strung between posts and the netting attached using metal rings. End posts should be placed at corners or bends. Include tight fitting gates with sills for access and to prevent the rabbits from digging below the bottom rails. Trials conducted by the UK Forestry Commission show a 10 year lifespan for steel fencing constructed in the manner discussed.

Electric netting and electric strained wire fences have been used with success. Ideally, fences should be erected to surround fully the area to be protected. If this is not practical a strip fence, which extends at least 150yds beyond either end of the problem area, may be used. Tree Guards and Plant Protectors 2ft high mesh guards or shelters, in a range of diameters, are sufficient for protecting newly planted trees and shrubs from browsing and bark-stripping. Split plastic tubes can be fitted over the stems of whips and standards, and plastic spiral guards used on feathered trees. Spiral guards must be wound between branches and it is important to ensure that no gaps are left between the spirals - rabbits are capable of gnawing bark through a space as little as 5mm wide.

Habitat Modification: Remove hiding cover to discourage cottontails and brush rabbits, especially in suburban habitats where alternate habitats may be limited. Remove brambles, piles of brush, stones, or other debris where rabbits might hide. Control vegetation along fence rows, ditch banks, or brushy areas. Keep in mind vegetation management may affect other wildlife, notably songbirds. Removing cover will probably have little effect on jackrabbits because they can use cover that is often great distances from the feeding sites. Conversely, to guard against jackrabbit damage, you should encourage taller and denser vegetation. It is not recommended to supply alternate food sources for rabbits as a method to reduce damage to specific plants. One exception may be for short-term control until other direct methods of control can be used. However, the availability of alternate foods may attract more rabbits and lead to further damage. Although rabbits eat most plants when food is in short supply, some plants are preferred. A list of plants most often preferred is:

Most Often Eaten:

- Annuals and Perennials
- Asters
- Hostas
- Hybrid lilies-Asiatic, Oriental
- Impatiens-young flowers on young plants
- Pansies
- Tulips
- Shrubs and Young Trees
- *Amelanchier* spp. (serviceberry, juneberry)
- *Aronia* spp. (black chokeberry, red chokeberry)
- Baldcypress
- Eastern white pine
- *Euonymus* spp.(burning bush, wahoo)
- Honeylocust
- Hydrangea quercifolia (oakleaf hydrangea)
- *Malus* spp., (apples, flowering crabapples) Prunus spp. (plum, cherry, almond, peach)

Frightening: devices, such as noisemakers and flashing lights, are generally not effective. Ultrasonic units, which rely on sound waves to repel rabbits, are not effective. A dog loose within the area to

be protected can be somewhat effective, depending on the dog, in keeping rabbits away.

Fumigants: Not recommended. The rabbit species do not create burrows sufficient to make fumigants effective.

Repellents:

Various chemical repellents are registered to prevent rabbit damage. They may be useful when applied to trees, vines, or ornamentals. Repellents can be classified as area (odor), taste, or contact (sticky) repellents. Research has shown that repellents with putrescent whole-egg solids can reduce browsing by rabbits.

Apply repellents before damage occurs and reapply them frequently, especially after a rain, heavy dew, or sprinkler irrigation, or when new growth occurs. In all cases, follow the label directions for the repellent you are using.

The usefulness of repellents is limited. They work best to protect woody plants during the early years before they bear fruit or during winter. Most cannot be used on plants or plant parts to be eaten by humans. Repellents usually fail when used in a vegetable garden, which contains highly preferred rabbit foods, even if the repellents are registered for use on edible crops.

Toxic baits:

CDFA labels	Jackrabbits	0.005% Chlorophacinone grain bait
		0.005% Diphacinone grain bait
	Cottontail rabbit	0.005% diphacinone grain bait (Orange County only).

These are registered for use in certain agricultural situations to resolve crop damage problems where jackrabbits are numerous, but their use in urban and suburban situations is not practical. Rabbits killed by toxic baits should be collected and disposed of in a sanitary landfill or by deep burying to comply with label instructions. Because the rabbits are likely to die outside the baited property, carcass recovery is almost impossible.

Predators:

Rabbits serve as food for a number of predators, including hawks and coyotes, but in urban and suburban situations, the greatest threat is from cats and dogs. Although relatively vulnerable to predation, rabbits generally cope well and maintain their populations in spite of this threat.

Trapping:

Cottontail and brush rabbits are relatively easy to trap alive. However, jackrabbits are very difficult to capture in this manner as they are often reluctant to enter confining spaces. Live trapping of cottontails and brush rabbits is not recommended because it creates the dilemma of what to do with the trapped animal. Rabbits can carry certain diseases such as tularemia and are considered agricultural pests. The California Fish and Game Code, makes it illegal to relocate and release without a written permit. Handling a live rabbit also creates the possible hazard of disease transmission to the trapper. They can be dispatched by quickly breaking their necks, although experience is necessary. Euthanesia with carbon dioxide (CO_2) gas is considered humane.

A number of kill traps are effective for cottontails and brush rabbits. They can be trapped with a Conibear trap (No. 110), which kills the animal outright. The Conibear trap can be placed inside a covered box constructed out of 3/4-inch (1.9cm) exterior plywood with a 4-inch (10.2cm) wide entrance. To further reduce hazards to children, pets, and poultry, position the trap back from the entrance. Slots at the back end of the box help in positioning the trap, as does the hinged lid. The hole cut in the top of the hinged portion and covered with 1/4-inch (0.64cm) mesh hardware cloth serves as a means to check the trap or bait. Other kill-type traps, such as a tunnel trap, are also available.

Place traps near cover where the rabbits feed or rest. For bait, use whatever the rabbits are feeding on; carrots, cabbage, fresh green vegetables, or apples. Place the bait at the back of the trap; some placed just outside the trap is helpful too. Be aware that rarely is one trap enough. In a garden type setting three to six traps are recommended. Check traps daily to replenish bait or remove the catch. Trapping rabbits requires a trapping license issued by the Department of Fish and Game.

Other Methods:

Shooting can be an effective means of eliminating small numbers of rabbits where it is safe to do so in rural locations, but it is prohibited in urban and suburban locations. Best results are achieved in early morning or around dusk when rabbits are more active. Check both local and game regulations for license requirements and any restrictions on shooting in your area.

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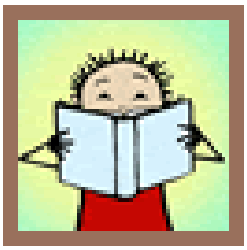
Rattlesnakes

Crotalus atrox **Western Diamondback**
C. viridis **Western**
C. cerastes **Sidewinder**
C. scutulatus **Mojave**
C. mitchellii **Speckled**
C. ruber **Red Diamond**

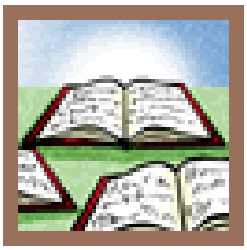
Family ViperidaeViperidae



Introduction: The rattlesnake is a member of the pit viper family. It is the only venomous snake native to California. Six species are found in various areas of the state encompassing nearly the whole state, from below sea level to about 11000 feet. Rattlesnakes are an important part of the ecosystem, preying on rodents, birds, and other small animals, in turn they are preyed on by certain birds.

Identification: Adult rattlesnakes can approach 6 feet in length and 31/2 inches in diameter. Rattlesnakes have a distinctive triangular shaped head. This is important in identification as other non poisonous Californian snakes do not have this distinguishing feature. A less reliable means of identification is the rattle. The rattle, on the end of the tail, is composed of interlocking horny segments. Young rattlesnakes are born with this rattle. A new segment is formed each time the snake sheds its skin. Since segments can break off, the rattle is not a good indicator of age. Similarly, just because a snake does not have a rattle does not mean it is not a rattlesnake as the rattle may have completely broken off. The diamond shaped head is the most reliable characteristic.

Rattlesnake detection is difficult because they are not easy to see or to locate in their hiding places. Be alert to their potential presence during the time of year when rattlesnakes are present in your region.



Legal Status: California Department of Fish and Game Regulations classifies rattlesnakes as native reptiles. California residents can take rattlesnakes on private lands in any legal manner without a license or permit.

Damage: Rattlesnakes can pose a danger to people, pets, and domestic animals. About 800 rattlesnake bites are reported annually in the United States. While seldom fatal they can be extremely painful and can lead to severe medical trauma.

Range: Range maps for the six species

Western Diamondback

Western Rattlesnake

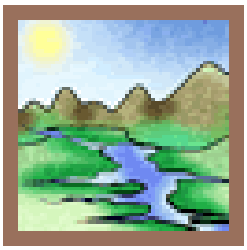
Red Diamond

Mojave

Speckled

Sidewinder

The range maps provide a general indication of where rattlesnakes can occur in California. However, rattlesnakes may be very sparse or nonexistent in some parts of their range, alternatively they can sometimes be found outside their normal range, transported there by humans or natural mechanisms such as flowing water.



Habitat: Rattlesnakes can be found hidden in rock crevices, under logs, in heavy brush, or in other areas where they are protected, including tall grass. They can also be found on roads, paths, and other areas where cover is limited. Be careful when moving brush, wood, logs, or other debris.

In known rattlesnake range areas, be alert when kneeling down to work in

the garden and watch where you step. Rattlesnakes are often well camouflaged and wait quietly for their prey. In the wild rattlesnakes should be left alone. Rattlesnakes around the home or garden are not acceptable to most people.

Biology: Western Diamondback – this is the largest and most common rattlesnake in California (*Crotalus atrox*). It is found primarily in Imperial, Riverside, and San Bernardino Counties from sea level to 7000 feet (2130m). It is probably the most dangerous rattlesnake in California because of its size and aggressive disposition.

Western Rattlesnake (*C. viridis*) - is common throughout much of California. It is not found in true desert regions or in areas of the Central Valley where irrigated agriculture has eliminated its habitat. It is generally recognized as comprising three subspecies, Northern Pacific, Southern Pacific, and Great Basin.

Sidewinder (*C. cerastes*) – is the smallest rattlesnake in the state. It is named because of its peculiar method of sideways locomotion. It is sometimes called the horned rattler because of the hornlike scales above its eyes. Sidewinders are most commonly found in sandy desert areas from below sea level to 6000 feet (1820m).

Mojave Rattlesnake (*C. scutulatus*) – ranges in the desert and foothills of southeastern California from sea level to high elevations.

Speckled rattlesnake (*C. mitchellii*) are found throughout Baja California up to Los Angeles.

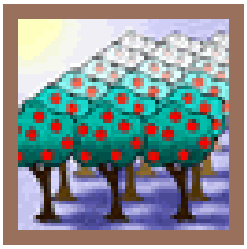
Red Diamond rattlesnake (*C. ruber*) is found in the southwest corner of California from the Morongo Valley west to the coast and south along the peninsula ranges to mid Baja California.

Most rattlesnakes forage for prey in or near brush, areas of tall grass, rock outcrops, rodent burrows, around and under surface objects and sometimes in the open. Adults eat live prey, primarily rodents; the young take mostly lizards and young rodents.

To catch their prey, rattlesnakes, wait until the animal is near. The snake strikes with two large fangs that inject toxic venom to subdue the prey. The snake then swallows the paralyzed animal whole. Rattlesnakes will feed on carrion when no other food is available.

When inactive, rattlesnakes tend to seek cover in the crevices of rocks, under surface objects or beneath dense vegetation, in rodent burrows. In some areas rattlesnakes hibernate for several months in crevices in rock accumulations. Unlike most reptiles, rattlesnakes give birth to live young. Young rattlesnakes require protection and are likely to be born in abandoned rodent burrows, rock crevices or other secluded places.

Rattlesnakes are included in the pit viper family because they have small pits on each side of the head between the eye and nostril. These pits are in fact temperature sensitive organs which allow the rattlesnake to detect prey, even in total darkness. The nostrils and tongue also detect the odors of prey. Rattlesnakes have the most highly developed venom delivery system of all snakes. The snake can control the amount of venom ejected from either or both fangs. Even after its death, a rattlesnake can still, by reflex action, inject venom for an hour or more. Caution is therefore advised when handling what appears to be a dead snake.



Damage Prevention and Control Methods

Rattlesnakes add to our wildlife diversity and are important members of our ecosystem. They should be left alone whenever possible, especially in wildland areas.

Exclusion: Rattlesnakes may seek refuge beneath open buildings. Wherever there is a gap or opening they will enter and inhabit a building, just as house mice do. Sealing all cracks and other openings greater than ¼ inch can prevent this. Gaps beneath garage doors are often large enough to permit snakes to enter, especially young ones. In the summer rattlesnakes may be attracted to cool or damp places, such as beneath buildings and in basements. Access doors on crawl holes should be inspected carefully for breaks or gaps. Use caution if you must crawl under a house or other buildings. Pump enclosures for hot tubs or swimming pools may provide cover if not well sealed. The dampness associated with ornamental water fountains, pools and fishponds may also make the surrounding area attractive to snakes.

Fences - snakes can be excluded from an area by a snake proof fence. While expensive, this is often necessary in children's" play areas. Ensure gates fit tightly and keep debris and vegetation from collecting around the fence. Snakes can climb accumulated vegetation and gain access to the top of the fence. Check the fence frequently to ensure it has not been damaged in any way.

Habitat Modification: An excellent way to discourage rattlesnakes around gardens and homes is to remove suitable hiding places. Heavy brush, tall grass, rocks, logs, rotten stumps, lumber piles, and other cover should be cleaned

up. Keep weeds mowed close to the ground or remove them. Since snakes often come to an area seeking prey, eliminating ground squirrels, meadow voles, deer mice, rats and house mice is an important step in modifying habitat to make it less attractive for snakes. Rattlesnakes cannot dig burrows but do frequently inhabit those dug by rodents, especially ground squirrels. After rodent control, fill in existing burrows with rocks, soil, sod and pack down firmly.

Frightening: No known methods

Fumigants: None

Repellents: Over the years a number of home remedies have been suggested to repel snakes, such as placing a horsehair rope around your sleeping bag or sprinkling sulfur dust or scattering mothballs around the area to be protected. Unfortunately, none of these work. Additionally, despite what you hear, no plants repel snakes. Currently there is at least one commercially available chemical snake repellent on the market. It has not proved sufficiently effective to warrant its recommendation.

Toxic Bait: None registered.

Trapping: Not recommended. Consult a professional pest or wildlife control operator who specializes in snake removal. Or your local Animal Services department.

Other: Some animals such as peacocks, turkeys, and dogs can be good sentinels for detecting rattlesnakes. If your dog behaves in unusual manner, excessively barking or whining, it would be wise to investigate for the possible presence of a snake.

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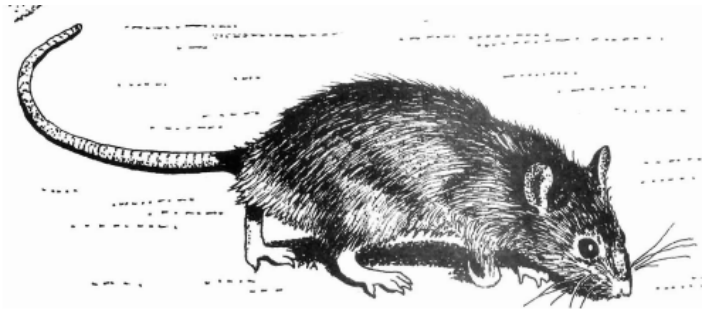
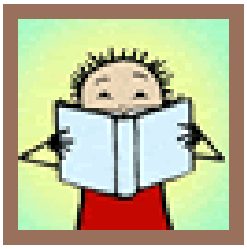
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Roof Rat

Rattus ratus, Black Rat

Family: Muridae



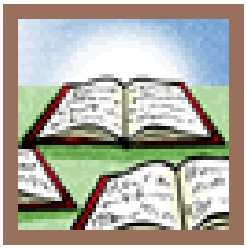


Introduction: The roof rat, like the Norway rat, is an introduced species in the United States. A third rat species, the Polynesian rat (*R. exulans*) is present in the Hawaiian Islands but not on the mainland United States. The Roof rat is commonly known as *Rattus rattus*, the black rat, and ship rat. Roof rats were common on early sailing ships which accounts for their distribution in the USA. Roof rats have a long history as carriers of plague.

Identification: Roof Rats (*Rattus rattus*), sometimes called black rats, are slightly smaller than Norway rats. Unlike Norway rats, their tails are longer than their heads and bodies combined. Roof rats are very agile climbers and usually live and nest above ground in shrubs, trees, and dense vegetation such as ivy. In buildings, they are most often found in enclosed or elevated spaces in attics, walls, false ceilings, and cabinets. The roof rat has a more limited geographical range than the Norway rat, preferring ocean-influenced, warmer climates. In areas where the roof rat occurs, the Norway rat may also be present. If you are unsure of the species, look for rats at night with a strong flashlight or trap a few. There are several key physical differences between the two species of rats. See Table 1.

Table 1. Identifying Characteristics of Adult Rats.

Characteristic	Roof rat	Norway rat
general appearance	sleek, agile	Large, robust
color of belly	gray to white	mostly grayish
body weight	5 to 10 ounces	7 to 18 ounces
tail	extends at least to snout; black, fine scales	shorter than body; dark above; pale below; scales
head	muzzle pointed	muzzle blunt
ears	long enough to reach eyes I folded over	do not reach eyes



Legal Status: Roof rats are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.

Damage: Essentially the same as the Norway rat (see discussion in preceding section) from economic and public health standpoints.

In some agricultural areas, roof rats cause significant damage and loss to tree crops e.g. citrus, avocados, walnuts, almonds, and other nuts. They often eat all the pulp from oranges while the fruit is still hanging from the tree, leaving only the empty rind. With lemons they may eat the rind and leave only the fruit. They may eat the bark and girdle smaller branches. In sugarcane fields they move into fields and eat the stalks. Roof rats may also eat seeds, or seedlings of plants. Vegetable, fruit, melon berry can also suffer minor damage.

Like the Norway rat the roof rat can transmit diseases to humans including murine typhus, leptospirosis, salmonellosis (food poisoning), rat bite fever, and plague. It is also capable of transmitting diseases to domestic animals and is implicated in the transference of ectoparasites as well.

Black Rat

Range: Range: The "roof rat" whose coloration resembles that of the Norway rat, lives along the coast, in the interior valleys and in mountains to 5,000 feet. The "black rat" is a color variant of this species. It is found mainly near salt water. Some sources separate the "roof rat" into two additional subdivisions, the Alexandrine rat and the fruit rat, based on characteristic coloration differences.

Habitat: Buildings, especially upper stories and attics, ships, warehouses, fields, stream banks, dense vines, palms and other trees.

Biology: Roof rats are smaller than Norway rats, and the tail is usually longer than the head and body combined. The roof rat is less aggressive and has been displaced by the Norway rat in some parts of the United States. The roof rat is a more agile climber than his larger cousin and it seems better able to establish in some rural habitats. The roof rat is more likely to choose enclosed spaces in attics, walls, and cabinets for nesting and cover. The roof rat is omnivorous but shows more preference for fruits and vegetables than does the Norway rat; both like cereals. The roof rat's home range is generally 100 to 150 feet.

The reproductive potential of roof rats is almost as high as that of Norway rats; an average of about 20 young per year are weaned by each female. Litter size averages six to eight young and an average of four to six litters are raised per year. The gestation period is about 22 days and the young may run about at three weeks of age. Sexual maturity is reached at three to five months and the average length of life is about one year. Like the Norway rat, much of the population dies out and is replaced in less than a year. Both rats breed year round.

Damage Prevention and Control Methods

Rat Damage Indicators: Droppings can be found along 'runways' in feeding areas, and near shelter. They may be as large as ¾ inch long, and ¼ inch wide. Fresh droppings are soft in texture.

Tracks can include footprints or tail marks, and can often be seen on dusty surfaces or mud. Rats can be tracked by placing a small amount of flour in a patch across a suspected runway area overnight. The presence of tracks indicates rodents.

Urine both wet and dry will fluoresce under unltraviolet light. Urine stains may occur along travelways or in feeding areas.

Runs or burrows can be found next to walls, along fences, next to buildings, under bushes or debris. Rats memorize pathways and use the same routes habitually.

Smudge marks (rub marks) can occur on beams, rafters, pipes, and walls due to oil and dirt rubbing off a rats fur as it frequently travels routes.

Gnawing is a basic rat activity. One way rats keep their paired incisor teeth worn down is by gnawing on hard surfaces. Size of entry holes differ from mice, rat entry holes are often 2 inches whereas mice are slightly smaller.

Rats can often be heard climbing in walls, gnawing, clawing, squeaking, and making fighting noises.

Exclusion: Physical barriers are an excellent way to prevent rats from gaining entry to structures where food and shelter are available.

Rats can be excluded by sealing all holes and openings larger than 1/2 inch. Use strong materials that will resist rodent gnawing; concrete mortar, galvanized sheet metal, steel wool, and heavy-gauge hardware cloth.

To prevent rodents from climbing or traveling along a particular route, install guards made of sheet metal or similar materials. Guards must be wide enough and positioned to keep rodents from reaching their outer margins by climbing or jumping.

Sheet metal band attached to a wall will prevent climbing by rodents. Rodent guards should be at least 12 inches to 18 inches wide. Inside buildings, such guards can prevent rats from climbing at corners. Guards also can be installed to prevent rodents from climbing the outside of buildings having rough exterior walls. When used in combination with hardware cloth or other suitable material, they can make a building essentially rodent-proof. This technique has been used to make corn cribs, barns, and other older buildings rat-proof.

Habitat Modification: Good sanitation is an excellent way to minimize any rat pest problems. The elimination of food and water through good warehouse sanitation can do much towards reducing rodent infestation. Proper garbage and refuse disposal containers along with an exterior sanitation program are also very helpful. Emphasis should be placed on the removal of as much harborage as is practical.

Dense shrubbery, vine-covered trees and fences, and vine ground cover all make ideal harborage for roof rats. Pruning and/or removal of certain ornamentals are often required to obtain a degree of lasting rat control.

Poor sanitation is one of the basic reasons for the continued existence of moderate to high rat populations in urban and suburban areas. In agricultural environments, proper sanitation cannot always eliminate rat populations, but it can often prevent rats from flourishing in large numbers.

Sanitation involves good housekeeping, including proper storage and handling of food materials, feed and edible garbage. Warehouses, granaries and grain mills, silos, port facilities, and similar structures may provide excellent habitat for rats. Store bulk foods in rodent-proof containers or rooms. Stack sacked or boxed foods in orderly rows on pallets in a way that allows thorough inspection for evidence of rats. In such storage areas, keep stored materials away from walls. A 12-inch white band painted on the floor adjacent to the wall will aid in detecting rodent droppings and other rat sign. Sweep floors frequently to permit ready detection of fresh rat presence..

Pet foods often are a source of food for rats in and around homes. Keep all such materials stored and subsequently removed for disposal. Proper refuse storage containers are rat-and damage-resistant, and equipped with a tight-fitting lid. Racks or stands prevent corrosion or rusting of containers, reduce rat shelter under containers, and minimize the chance of containers being overturned.

Bulk storage containers for refuse, such as those used at apartments, businesses, and housing projects, should be similarly rodent-proof. Large metal refuse containers (dumpsters) sometimes have drain holes to facilitate cleaning. These drain holes should be fitted with a wire mesh screen or a removable plug; otherwise, the container becomes a large feeding station for rodents.

Frightening: Naturally rats are wary and frighten easily when they encounter unfamiliar sounds. However, most rodents, including rats, rapidly become accustomed to new sounds when heard repeatedly. Temporary success may be achieved, and rats may be repelled from an immediate area, but they will ultimately return and resume their normal activities.

Many commercially available devices produce ultrasonic sound to frighten, claiming it controls rodents. Research shows that rodents may be repelled temporarily from an immediate area, but will return and resume normal activities in the same way any new sound will affect the rodents. Ultrasonic devices are often expensive and their effectiveness is questionable. They are not recommended as a solution to rodent problems.

Fumigants: Not generally recommended for roof rats although under some circumstances, they will burrow. In these situations, fumigation could be effective.

Repellents: Not a recommended method of control.

Toxicants:
CDFA labels

2% Zinc Phosphide grain bait

0.005% Chlorophacinone grain bait

0.005% Diphacinone grain bait

0.005% Diphacinone Rodent Bait Block

Toxicants (for Norway and Roof Rats):

Anticoagulants -- % on bait for:

Spot baiting -- (Bait stations or stations, bait trays, and paraffin blocks):

0.005% (chlorophacinone, diphacinone) grain baits.

Zinc phosphide -- % on bait for:

Spot baiting -- 2.00% zinc phosphide grain bait.

Toxicants for controlling rats (rodents) are best classified into two groups: anticoagulants and non-anticoagulants.

Anticoagulants are the preferred material for controlling rats. They do not cause bait shyness, are easy to apply, and when used properly are relatively safe to use around humans, livestock, and pets.

Rats poisoned with anticoagulants die from internal bleeding; the result of the loss of the blood's clotting ability and damage to the capillaries. Most anticoagulants (except bromadiolone and brodifacoum) require multiple feedings over several days to cause death. Normally, low chronic doses are fatal. Feeding does not always have to be on consecutive days, where it is, death may occur as early as the third or fourth day. For optimal effect, several feedings should occur within a 10 day period no longer than 48 hours apart.

Where highly accepted baits fail:

- The period of bait exposure is to short, or bait has not been replenished.
- There are too few bait stations, or bait stations are too far apart.
- The control area for treatment is too small. This allows rats to transfer from untreated areas.
- Genetic resistance. This is likely the case if the same amount of bait is taken daily for

several weeks.

Where anticoagulant baits are poorly accepted:

- Poor bait choice may be the reason, or bait is improperly formulated. Other food choices may be preferred by the rats.
- Bait may be tainted e.g. moldy, rancid, or insect infested. Replace periodically.
- Improperly placed bait stations.

Non Anticoagulants:

There are four non-anticoagulant rodenticides registered by the EPA for control of roof rats: bromethalin, cholecalciferol (vitamin D_3), red squill, and zinc phosphide. However, only zinc phosphide is registered for agricultrual use. All can be used for controlling anticoagulant-resistant populations of rats. Where rat numbers are large costs of baiting with non anticoagulants may reduce overall costs.

Bromethalin (Assault®, Vengeance®) is formulated in ready-to-use bait as a chronic rodenticide, applied so that rats will have the opportunity to feed on the bait one or more times over a period of one to several days. Because it is a slow-acting compared to zinc phosphide or red squill, bait shyness is not usually a problem, nor is prebaiting necessary to get good control in most situations.

Cholecalciferol (vitamin D_3, Quintox®) is similarly formulated in ready-to-use bait, serving as a chronic rodenticide. Death occurs 3 or 4 days after ingestion of a lethal dose. Because the toxicant is slow-acting, bait shyness is not reported to occur. It is claimed that rodents cease feeding once a lethal dose has been ingested.

Red squill is a selective and relatively safe toxicant for use only against Norway rats. It acts as an emetic, which provides some degree of protection to certain nontarget species that might accidentally consume the bait. Rats, which cannot vomit, are unable to rid themselves of the toxicant once it is consumed. In the past, one problem was the variation in the quality of the material, which is derived from a plant. Red squill must be stored in a sealed container, as moisture will cause it to loss potency. Use for more than a few days at a time may result in bait shyness.

Zinc phosphide is a dark gray powder, insoluble, that has been used extensively in the control of rodents. It is available in ready-to-use dry baits and also in concentrates to prepare fresh baits. Its strong garlic-like odor appears to be attractive to rodents that are not bait-shy.

Baits: Baits are produced as pellets, treated grain or meal. Sugar, to five percent by weight, is sometimes added to improve bait acceptance by both roof rats and Norway rats.

Trapping: Trapping can be an effective method of controlling rats, but it requires more skill and labor than most other methods. Trapping is recommended where poisons are inadvisable. It is the preferred method to try first in homes, garages, and other small structures where there may be only a few rats present.

Trapping has several advantages: 1) it does not rely on inherently hazardous rodenticides; 2) it permits the user to view success; and 3) it allows for disposal of the rat carcasses, thereby

eliminating odor problems from decomposing carcasses which may remain when poisoning is done within buildings.

The simple, inexpensive, wood-based snap trap is available in most hardware and farm supply stores. Traps should be baited with a small piece of hot dog, bacon, or nutmeat tied securely to the trigger. Peanut butter or marshmallows also may be used as bait. Baits that become stale lose their effectiveness.

Set traps close to walls, behind objects, in dark corners, and in places where roof rat activity is seen. This will usually be in attic areas, along fences and possibly in trees. Place the traps so that when rats follow their natural course of travel (usually close to a wall) they will pass directly over the trigger. Set traps so that the trigger is sensitive and will spring easily. When traps can be set in runways or in travel routes, effectiveness can be increased by enlarging the trigger. This can be done with a square of cardboard, metal, or screen wire that fits just inside the wire deadfall. Some commercial traps come with enlarged triggers. If trapping outside, take care so that birds and small animals cannot enter the traps.

Use enough traps to make the campaign short and decisive. Leaving traps unset until the bait has been taken at least once reduces the chance of rats escaping the trap and becoming trap-shy.

Other kinds of traps are also effective in catching rats. Wire-mesh cage traps such as the Tomahawk® and Havahart® can be used effectively to capture rats alive. Wire funnel-entrance traps have also been used for this purpose. These live catch traps do present the problem of disposing of the trapped animal. Fish and Game regulations prevent the release of live animals without a permit. Euthanize with CO_2.

Keep traps clean and in good working condition. When dirty, clean them in a hot detergent solution with a stiff brush. Human and dead-rat odors on traps are not known to reduce trapping success.

An alternative to traps are glue boards, which catch and hold rats attempting to cross them much the same way flypaper catches flies. Place glue boards wherever rats travel -- along walls, or in established pathways. Do not use glue boards where children, pets, or wildlife can contact them. Glue boards lose their effectiveness in dusty areas unless covered, and temperature extremes may affect the tackiness of some glue. They are considered less effective for capturing rats than for mice. You can purchase ready-to-use glue boards, or you can buy glue to make your own boards or traps. Dispose of live trapped rodents in a humane manner; euthanize live, trapped rodents by asphyxiation with carbon dioxide, or use a stick to kill them with a sharp blow to the base of the skull.

Directions for Use (with reference primarily to farms and other agricultural or field use)

Spot Baiting (except anticoagulant baits): Follow label instructions. Generally, place a teaspoon quantity of bait (in each active burrow or scatter small amounts of bait in protected places frequented by rats, but inaccessible to livestock, poultry, wildlife and children. Whenever practical, prebaiting several days before applying acute or one-shot toxic bait will achieve better control and

will give an indication of how much toxic bait to put out. Prebaiting should always be conducted where natural food is abundant.

Bait should be picked up and disposed of upon completion of rodent control program. Do not retreat with zinc phosphide baits for at least three months.

Anticoagulant Baits:
NOTE: A single feeding of second generation anticoagulant baits may be lethal to rats. However, baits of first generation anticoagulants must be eaten over a period of several days to give adequate control.

Place 4 to 16 ounces of bait in bait box or shallow container, preferably in protected feeder stations. Place bait stations in dry locations such as in concealed places, in corners, or along walls where rats feed, drink or frequent. Inspect stations daily and add bait as needed; increase the amount when bait in feeder is entirely consumed overnight. Replace moldy or old bait with fresh bait. An uninterrupted supply of bait should be maintained as long as any bait is taken which may be two to four weeks. For roof rats, put bait at ground floor and top floor or attic levels. For Norway rats put bait at or near ground level and at burrows and harborages.

Where a continuous source of infestation is present, permanent bait stations should be established and the bait replenished as needed. Bait should be picked up and disposed of upon completion of rodent control program.

Paraffin bait blocks: Cereal baits embedded in paraffin are used in, outdoor placement or other excessively damp locations where unprotected bait would spoil rapidly. The bait blocks are reasonably weatherproof, eliminating the need for bait stations.

Paraffin bait blocks have been found particularly valuable in orchard situations where the blocks can be fastened to a branch near the damage site. Be sure to secure them well so they don't fall and present a hazard to domestic animals.

As old blocks are eaten away, replace with new ones. Bait should be picked up and disposed of upon completion of rodent control program.

Tracking Powder: Toxic dusts or powders have been used for many years to control rats and mice. When rats walk over a patch of toxic powder, they pick some of it up on their feet and fur and later ingest it while grooming. Tracking powders are useful in controlling rats where food is plentiful and good bait acceptance is difficult to achieve. Rats are more likely to ingest a lethal amount of a poorly-accepted toxicant applied by this method than if it is mixed into a bait material. There is little likelihood of toxicant shyness developing when using tracking powders.

Baiting Techniques: All baits should be placed in travel ways or near rat burrows and harborage. Do not expect rats to go out of their way to find bait. Placing bait under cover may assist as rats will feel more secure while feeding. Bait placement for roof rats differs from Norway rats because the two species nest and find shelter in different areas. Roof rat bait should be placed in elevated locations such as in the crotch of a tree, on the top of a fence, or high in a vine. If bait is placed above ground level make sure it is securely fastened so that it will not fall where children or pets may find it.

Bait Stations: Bait stations or boxes limit poison bait exposure and accessibility to rats, thereby providing a safeguard for children, pets, and other animals. The stations should be large enough to accommodate several rats at a time, and should contain a self feeding hopper or bait compartment for holding bait. Each station should have two 21/5 inch openings for rats. Commercially available bait stations are available either for rats or mice, and generally come in designs of plastic or metal. Self constructed bait stations are usually made of wood, and are hinged for ease of access, and have a clasp for locking to make them tamper resistant. An alternative to wood is to use corrugated 4 inch drainage tubing for constructing a bait station.

All bait stations should be clearly labeled with the appropriate warnings. To ensure that bait station used indoors is truly tamper resistant, it should be secured to the wall, floor, rafter, or some other part of the structure so that it cannot be tipped over, spilling the bait. If used outdoors, away from a building, the bait station should be securely staked to the structure or well anchored in a tree. When used outdoors, a bait station provides the additional advantage of keeping bait dry in inclement weather as well as safeguarding non target animals. When using bait stations, follow rodenticide labels carefully.

As with traps, bait stations must be placed where rodent sign is evident. Indoors, place them along walls, on rafters, within a cupboard, etc. Indoor baiting is not recommended as rodents may die in an inaccessible place, creating an unpleasant odor. Remember, roof rats may live inside a structure and travel out to feed in trees, vines and shrubs.

Other: Rats may have an initial aversion to some odors and tastes, but no repellents have been found to repel them for more than short time, if at all.

Predators such as owls, foxes, skunks, raccoons, opossums, and snakes do feed on rats, but because of the rats reproductive potential predators are not likely to keep rat numbers below damaging levels.

Sometimes cats and dogs are good rat catchers, but generally some rodents are clever enough to escape and thrive in their presence. In fact some studies suggest that owners of cats and dogs are more likely to have rodent problems, probably because of the availability of food i.e. pet food.

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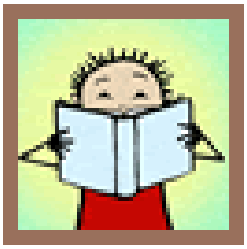
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Skunks

***Mephitis mephitis* Striped skunk**

***Spilogale gracilis* Western spotted skunk**

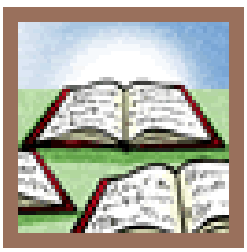
Family: Mephitidae



Introduction: Two species of skunk are found in California; the striped skunk and the rarer spotted skunk. Both are equipped with a powerful and protective scent gland that can spray a potent and pungent liquid up to 10 feet. The secretion is acrid enough to cause nausea and can produce severe burning and temporary blindness if it strikes the eyes. The spotted skunk is fewer in numbers throughout the state and less tolerant of human activity.

Identification: The striped skunk is about the size of an adult house cat, 2 to 3 feet long, including tail and weighing 10 to 15 pounds, with the familiar black fur and white coloring on the top of the head and neck. In most animals the white extends down the along the back, separating into two white stripes. Conversely, spotted skunks are black with white spots or short streaks of white. They are smaller than striped skunks by about 50%.

Because skunks are active at night, many people never see them as they travel through their neighborhoods or yards. Barking dogs may be the first apparent clue. If skunks travel through your yard or garden repeatedly, you should be able to detect a faint skunk odor, even if the skunk has not sprayed. The presence of skunk odor in late winter is a signal to keep an eye out for the presence of skunks. At this time appropriate measures may be necessary to deny pregnant females access to potential nesting sites underneath buildings.



Legal Status: The California Fish and Game Code classifies skunks as nongame mammals. The owner or tenant of premises may take at any time and in any legal manner nongame mammals injuring or threatening property. Fish and Game regulations prohibit the relocation of skunks and

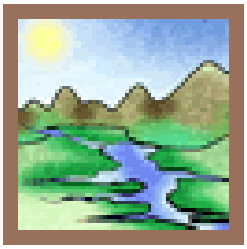
other wildlife without written permission of the DFG. The prevalence of rabies in the skunk population is one of several major reasons for denying relocation.

Damage: Primarily skunks are a nuisance, rather than causing damage. They are attracted to residential areas by the availability of food, water, and shelter. They become a nuisance when they live under open porches, decks, and garden sheds or if access is possible beneath homes. Ripening berries and fallen fruit are a skunk favorite. Many garden problems are caused by their digging activities while in search of grubs and other insects. In lawns they may dig small pits or cone shaped depressions from 3 to 5 inches in diameter in search of food. Also they may roll back sections of newly laid sod searching for insects. Obviously, their spray is quite objectionable.

Range:

Western Spotted Skunk

Striped Skunk



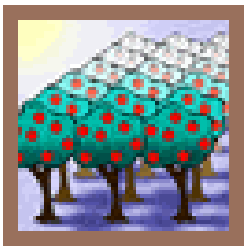
Habitat: Skunks are nocturnal, hunting for insects, grubs, and small rodents, snakes, frogs, mushrooms, berries and fruit, pet food, bird food, and garbage in urban and suburban areas. Skunks have a strong preference for eggs and are serious predators of ground nesting birds.

Biology: Skunks usually breed during February and March, with litters born about 9 weeks later. Litters range from 4 to 6 'kits.' Within a few months the young are seen following their mother as she makes nightly rounds searching for food. Skunks do not hibernate, but in those regions of colder weather females many assemble in communal dens during the winter.

Skunks often den in burrows but prefer to do as little digging as possible. They will use and enlarge an abandoned burrow dug by a ground squirrel, fox or coyote. If dens are scarce they will readily use brush piles, hollow logs and culverts. In urban areas they den under decks, porches or beneath buildings.

Skunks are a primary carrier of rabies in California. Thus their preference for urban and suburban settings is a cause for concern. Rabies is a viral disease transmitted by the bite of an infected animal. Skunks are also carriers of other diseases including leptospirosis, listeriosis, canine distemper, canine hepatitis, Q-fever, tularemia, and trypanosome. Recent research has focused on dispensing

oral vaccine to skunks.



Damage Prevention and Control Methods: Because rabies is endemic in the skunk population, some city and county health departments assist in their control by providing trappers to remove them from residential areas. Control methods focus on making the garden yard and residence less attractive to skunks; trapping can be used if these methods are not sufficient.

Exclusion: As with many other vertebrate pests, the best solution to skunks problems is to screen or block them out. To do this, close all potential entrances and openings under houses, garden sheds, mobile homes, porches, and decks with 1/4inch mesh hardware cloth. This small mesh will also doubly serve to exclude rats and mice if installed correctly. Note that skunks will work hard to get into a desirable denning space, so make sure the screen fits tightly. If there is soil underneath the screen, bury the screen 6 inches deep to make a good seal.

When skunks inhabit a building or den space, exclusion is more difficult because first you must make sure the animals, and their young if present, have left before blocking the opening. To do this sprinkle a smooth layer of flour or construction caulk about 1/8 inch thick in front of the point of the entrance to form a 'tracking patch.' This will allow you to examine the patch, shortly after dark. The presence of footprints indicates that the animal has left and the opening can be closed.

Where you are unsure if the skunks have left or there are young, install a one way outward swinging gate made from ½ inch mesh hardware cloth. Hinge the gate at the top and leave loose on the other three sides. Make the gate larger than the opening so that it can only swing outward. If the young are still immobile an alternative is the placing of one or more floodlights beneath the building opposite the entry point. A well lit area is not conducive to denning and skunks usually leave.

Habitat Modification: Cut back overgrown shrubbery and tightly stack firewood to reduce potential den sites. Remove and dispose of fallen fruit. Garbage cans should have tightly sealed lids. Do not place food items or table scraps outdoors. Food placed outdoors for pets should be removed by nightfall.

Frightening: Not a recommended method.

Fumigants: Burrow fumigants, such as gas or smoke cartridges used on ground squirrels, may be used in rural areas providing the use is allowed on the product label. Ensure that the burrows used by skunks can be located and are not under or near buildings to avoid fire issues.

Repellents: Commercial products are available for repelling skunks. Unfortunately, they are not very effective. The odor of mothballs or ordinary household ammonia has been used as a home remedy repellent with some success in driving skunks from underneath buildings, although this is not recommended. Some have suggested spraying your lawn with an appropriate insecticide to control grubs and other insects, thereby reducing the food supply for skunks and discouraging them from further digging. If your lawn is infested with insects and grubs contact your local University of California Cooperative Extension office for information on

how to control these pests. UC Integrated Pest Management Program

Toxic Bait: None registered.

Trapping: Because rabies is endemic in the skunk population, some city and county health departments assist in their control by providing trappers to remove them from residential areas.

Skunks cannot be relocated without a permit, and it is unlikely the Department of Fish and Game would issue one because of the risk of the potential for spreading rabies.

Skunks can be trapped with an enclosed cage-type live-catch trap. Plastic box traps are superior to wire traps because they are completely enclosed, reducing the risk of getting sprayed while removing the trapped animal from the site. It is recommended that individuals who have no experience in trapping skunks should hire a professional wildlife control operator. They have the experience and all the necessary equipment to trap and dispatch the animal.

Other: In rural areas where it is safe to do so, skunks may be spotlighted and shot. Since they may spray in the process, be selective in the location chosen for this method.

Odor Removal: There are several options for odor removal. The chemical neutroleum-alpha is one of the most useful neutralizers for removing the unpleasant skunk scent on furniture or in buildings, but this material and products containing it are not readily available. There are also other commercial products sold for neutralizing or masking skunk odor. If you cannot find such products easily, contact a professional wildlife control operator, who may be able to provide neutroleum-alpha or can tell you where it can be purchased. Do not use neutroleum-alpha on pets or people. If your dog or cat has confronted a skunk, call your veterinarian to determine current recommendations for washing the animal to get rid of skunk odor.

A home remedy formulation reported by some to be effective is as follows:

- 1 quart 3% hydrogen peroxide
- 1/4 cup baking soda
- 1 teaspoon liquid soap.

Once the hydrogen peroxide is mixed with the baking soda, the mixture is unstable and generates oxygen, and thus cannot be bottled or stored. Apparently, oxidation changes the chemical composition of skunk scent so that it no longer smells. When the fresh mixture is applied to items contaminated by skunk odor, the smell diminishes quickly. Any leftover mixture should be diluted several fold with water and poured down the drain. Hydrogen peroxide mixtures can be used safely on pets and people as well as on clothing and furniture. Rinse pets thoroughly with water after treatment.

Skunk Bites: Rabies, an infectious disease caused by a virus organism, is found in the saliva of infected animals. It affects only mammals and is transmitted most commonly by a bite. The disease is almost always fatal if untreated. People can survive the bite of a rabid animal if medical

attention is received in time. A physician should attend to ALL skunk bites, no matter how minor, and the local health department should be notified of the incident.

Skunks that seem tame or listless and wander about during daylight hours should be treated with great caution because this behavior is symptomatic of rabies. Also, if they exhibit no fear of people or pets and show some aggressive behavior, chances are quite high that they are rabid.

If you live in an area where skunks occur, be sure your dogs and cats are routinely vaccinated against rabies. Some dogs will confront skunks whenever they get an opportunity. Even though they suffer when they get sprayed, some dogs never learn.

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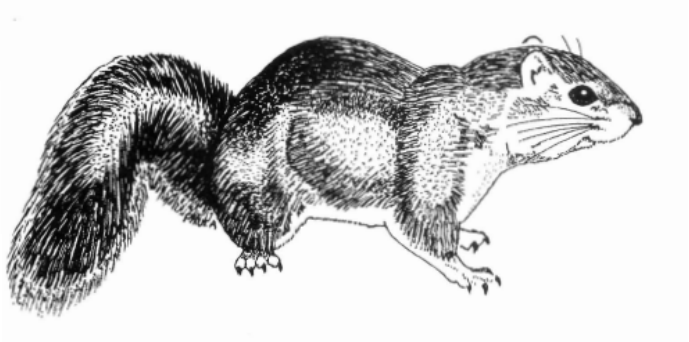
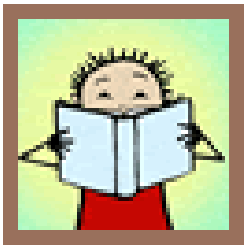
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Tree Squirrels

***Sciurus griseus,* Western Gray Squirrel**
***Sciurus niger,* Eastern Fox Squirrel**
***Tamiasciurus douglasii,* Douglas Squirrel or Chickaree**
***Sciurus carolinensis,* Eastern Gray Squirrel**
Family: Sciuridae





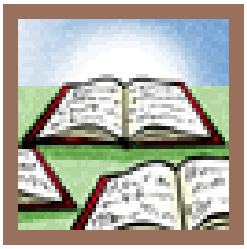
Introduction: There are four species of tree squirrels in California, excluding the small nocturnal flying squirrel, which is not considered a pest. Of the four, two species are native and two are introduced from the eastern part of the United States. In their natural habitats they eat a variety of foods including fungi, insects, bird eggs and young birds, pine nuts, and acorns, plus a wide range of other seeds. Squirrels sometimes cause damage around homes and gardens, where they feed on immature and mature almonds, English and black walnuts, oranges, avocados, apples, apricots, and a variety of other plants. During ground foraging they may feed on strawberries, tomatoes, corn, and other crops. They also have a habit, principally in the fall, of digging holes in garden soil or in turf, where they bury nuts, acorns, or other seeds. This 'caching' of food, which they may or may not ever retrieve, raises havoc in the garden and tears up a well-groomed lawn. They sometimes gnaw on telephone cables and may chew their way into wooden buildings or invade attics through gaps or broken vent screens. Tree squirrels carry certain diseases such as tularemia and ringworm that are transmissible to people. They are frequently infested with fleas, mites, and other ectoparasites.

Identification: Tree squirrels are active during the day and are frequently seen in trees, running on utility lines, and foraging on the ground. Tree squirrels are easily distinguished from ground squirrels and chipmunks by their long bushy tails and lack of fleck like spots or stripes, and the fact that they escape by climbing trees and other structures. All are chiefly arboreal, although the fox and western grey squirrels spend considerable time foraging on the ground. Tree squirrels do not hibernate and are active year-round. They are most active in early morning and late afternoon.

Of the four tree squirrels, the eastern fox squirrel, sometimes called the red fox squirrel, is by far the most serious pest to homes and gardens in urban and suburban situations, and is becoming an agricultural pest in some areas. This squirrel can be differentiated from the others by its brownish red-orange fur. Tree squirrels naturally nest in tree cavities, enlarged woodpecker holes, or high in a tree in a spherical nest they construct of twigs, leaves, and shredded bark.

Eastern fox squirrels (*Sciurus niger*) were introduced from the eastern part of the United States and are well established in most major cities of California. In some cities eastern fox squirrels have moved outward into agricultural land, especially in the southern part of the state, where they have become a pest of commercial crops. Eastern grey squirrels (*S. carolinensis*) were originally introduced from the eastern United States into Golden Gate Park in San Francisco, California. They are also established in areas of Calaveras and San Joaquin counties in California and may be expanding their range.

Native western grey squirrels (*Sciurus griseus*) are found throughout much of California, primarily in oak woodlands of the foothills and valleys and in pine/oak forests, where they feed on a variety of seeds, fungi, and other plant materials. They also have a tendency to strip bark in order to access and feed on the cambium layer, causing injury to trees. Native Douglas squirrel (*Tamiasciurus douglasii*), sometimes called chickarees, is found in mostly conifer-forested regions of the north coastal area and along the Sierra Nevada Mountain region. Because of the habitat in which they thrive, these two native tree squirrels are not usually pests, except for the damage they can do in forest regeneration projects. They may, however, become garden or home pests in some of the more remote rural areas.



Legal Status: Tree squirrels, *Sciurus* spp. and *Tamiasciurus* spp. are classified as game mammals by the Fish and Game Code and can be taken only as provided by the hunting regulations. Except, (1) red fox squirrels, which are found to be injuring growing crops or other property, may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests, and (2) any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by gray squirrels may apply to the Department of Fish and Game for a permit to kill such mammals. The Department, upon satisfactory evidence of such damage or destruction, actual or immediately threatened, shall issue a revocable permit for the taking and disposition of such mammals under regulations promulgated by the Fish and Game Commission. Mammals so taken shall not be sold, nor shipped from the premises on which they are taken, except under instructions from the Department. No poison of any type may be used to take any gray squirrel. The Department shall designate the type of trap to be used to insure the

most humane method is used to trap gray squirrels. The Department may require trapped squirrels to be released in parks or other nonagricultural areas.

Damage: Green and ripe walnuts, almonds, oranges, avocados, apples, strawberries, tomatoes, and grain. Tree squirrels sometimes gnaw on lead covered telephone cables and they may gnaw into wooden buildings or invade attics through knotholes, etc. The Douglas squirrel's pine cone diet limits his potential for agricultural depredations. Squirrels may carry rabies, toxoplasmosis, sylvatic plague, western encephalitis, encephalomyocarditis, murine typhus fever, tularemia, endemic relapsing fever, and ringworm, all of which are transmissible to man.

Range: *Sciurus griseus* is a native tree squirrel found from the Mexican border north through the coast ranges to the Oregon border, and from the Tehachapi mountains north along the western slope of the Sierra Nevada. Eastern fox, *Sciurus niger* is an introduced species established in city parks and adjacent areas in Fresno, San Diego, San Mateo, Santa Cruz, San Fernando, Sacramento, San Francisco, and the South Bay area and in agricultural land east of Ventura and Oxnard in Los Angeles County. *Tamiasciurus douglasii* is a native of the north coastal area and the Sierra Nevada. *Sciurus carolinensis* (Eastern grey) has been introduced from the east into Golden Gate Park in San Francisco and is established in a small portion of Calaveras and San Joaquin Counties.

Douglas Squirrel

Eastern Fox Squirrel

Eastern Gray Squirrel

Western Gray Squirrel

Habitat: Western gray squirrels live in oak woodland areas in the foothills and valleys and in pine-oak forests in the mountains. The native habitat of the Eastern fox squirrel is open hardwood forests in the northern states and pine forests of the south. Douglas squirrel inhabits coniferous forests of the upper pine belt and fir, spruce and hemlock forests. Eastern gray squirrels live in hardwood forests with nut trees and in river bottoms in its native

region.

Biology: All tree squirrels are diurnal, except for the flying squirrel which is not an economic pest. Tree squirrels are easily distinguished from ground squirrels and chipmunks by their long bushy tails, the lack of dorsal spots or stripes, and the absence of internal cheek pouches. Although they are chiefly arboreal, some tree squirrels spend considerable time foraging on the ground, particularly the fox squirrel and the western gray squirrel. Tree squirrels do not hibernate; they are active year-round except in inclement or very cold weather. They are most active in early morning and late afternoon.

Food: The western gray squirrel is primarily an acorn eater, supplementing this diet with conifer seeds, nuts, mushrooms, tender twigs and shoots, and grain if it is available. He spends much time in autumn burying fallen acorns singly in holes three to four inches deep; mushrooms and nuts are also stored for winter use. The eastern gray squirrel feeds on a variety of nuts, seeds, mushrooms, fruits, and the cambium layer beneath the bark of trees. Like his western cousin, they bury nuts and acorns in the ground, many of which are never recovered; some of these sprout into trees. Buried acorns are retrieved by the sense of smell.

The eastern fox squirrel's diet includes bird eggs and insects as well as various nuts, acorns, seeds, fungi, bulbs, and roots and cambium tissue. Sometimes, nuts are buried.. The Douglas squirrel lives largely on conifer seeds, which are harvested in the cones in early autumn. Each squirrel usually cuts off a number of cones before coming to the ground and gathering them. Ingles (1965) states that most cones are stored in large caches in moist places or in stumps (some Jeffrey pine cones are shucked immediately at the base of the tree, while Orr (1971) maintains that the cones are shucked forming conspicuous piles of cone scales, the seeds then being stored in various places. Douglas squirrels tunnel through the snow to reach their caches in winter.

Nesting and Territory: The western gray squirrel usually enlarges an old woodpecker or flicker hole for its brood den, or it may construct a nest of twigs and shredded bark far out on the branches of a large tree; the nest is usually 20 feet or more above the ground. The home range is 1/2 to 2 acres, and populations do not usually exceed two squirrels per acre. Female display territorial behavior when young are in the nest.

The eastern gray squirrel also nests in holes in trees, or constructs a nest of leaves in an outer tree branch. The nest is usually 25 feet or more from the ground. The home range is two to seven acres, and populations may range from two to 20 squirrels per acre.

The eastern fox squirrel nests in tree cavities or builds a twig and leaf nest in a crotch or branch, usually 30 feet or more from the ground. The home range is 10 to 40 acres. Populations range from 1/2 to 3 squirrels per acre.

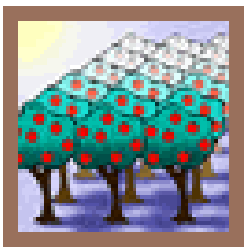
The Douglas squirrel nests in a woodpecker hole or other small tree cavity, in a slope of rocks or in a nest of leaves, twigs and shredded bark in a tree branch, usually near the tree trunk. The home range is less than 200 yards across. Populations of two squirrels per three acres are probably average, but it may be as high as 10 per acre. The Douglas squirrel displays territorial behavior by protecting its food supply.

Breeding and Longevity: The western gray squirrel produces one litter of three to five young born between February and June. The gestation period is 44 days and the young remain in the nest at least six weeks before going out on their own. Western gray squirrels have lived 11 years in captivity. Its main enemies are the coyote, fox, owl, and large hawks, who usually catch the squirrel on the ground. It is fairly safe in trees, except when it extends its range into the higher mountain zones where the marten lives. Deep snow limits the gray squirrel's range because he has difficulty in retrieving his buried single acorns under the snow.

The eastern gray squirrel bears two litters of three to five young annually, in late winter and in late summer. The gestation period is 44 days, and the young are weaned at two months. It has lived 15 years in captivity.

The young of the eastern fox squirrel are born between January and April and between July and September. Yearling females have one litter and older females have two litters per year. The gestation period is 44 days and the young are weaned at two to three months. The eastern fox squirrel may live ten years or more in captivity; six years is the longevity record in the wild.

The Douglas squirrel apparently has two litters per year, as young are born in June and October. The average litter size is five (range four to eight) and the gestation period is about 38 days. They may live ten years. Coyotes, foxes, bobcats, goshawks and horned owls are probably successful predators.



Damage Prevention and Control Methods

Exclusion: Prevent squirrels from climbing isolated trees and power poles by encircling them with a two-foot wide collar of metal six feet off the ground. Attach metal using encircling wires held together with springs to allow for tree growth. Trim trees appropriately to prevent squirrels from jumping onto roofs. Close openings to buildings with heavy 1/2-inch wire mesh or make other suitable repairs. This method has limited effectiveness because squirrels are such good climbers and they can jump 10 feet or more from one tree to another.

Habitat Modification:
Trees that overhang roofs or are close to telephone lines should be cut back to slow the movement of squirrels about garden, home areas. However, squirrels can jump quite a distance.

Frightening:
A number of devices are available commercially; however, none have proven to be effective. Tree squirrels quickly become accustomed to both visual and sound devices intended to frighten. Any effect is usually very temporary.

Fumigants:
None are registered.

Repellents:
Some chemical repellents are registered for repelling tree squirrels. Their effectiveness is questionable. Similarly repellents are available which may be added to birdseed that prevents the squirrels from feeding on the seeds, these to have shown little effectiveness.

Toxic Bait:
None are registered.

Trapping: One means of controlling Eastern fox squirrels is through the use of a modified wood box type gopher trap. These traps are effective and more economical to use than live catch traps.

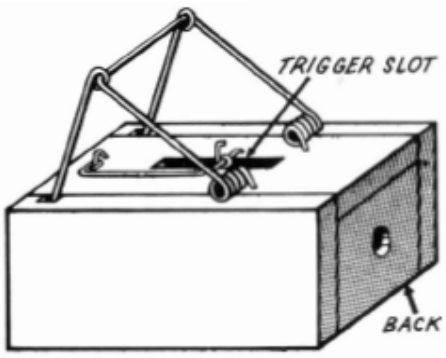


FIGURE 1

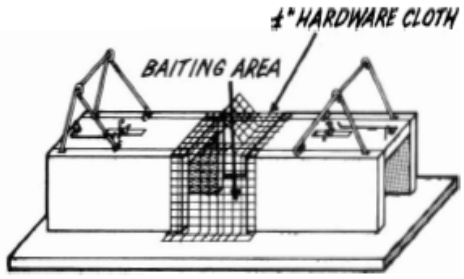


FIGURE 2

Trapping tree squirrels requires a trapping license issued by the Department of Fish and Game.


FIGURE 3

Trap construction: Remove the back of a gopher trap (Figure 1). Lengthen the trigger slot with a rat tail file or pocket knife to permit unhindered trigger swing. This makes it possible for the animal to pass beneath the swinging loop of the unset trap.

A single trap is constructed by the use of hardware cloth to extend and close the open end. This provides additional baiting area and allows the bait to be observed from both ends but prevents the animal from entering except from the front. The trap is secured to a board for placement in a tree.

Dual assembly utilized two modified traps (Figure 2) placed back to back and secured to a board (1" x 4" x 18"). A small strip of hardware cloth connects the two and forms a baiting area. Baiting is accomplished by placing a handful of walnut meats through a

small door cut in the wire or through the open end of the trap.

Commercially available traps such as the tunnel trap are available and could be used in trees to catch fox squirrels.

Placement of traps: Attach the trap assembly with nails driven through the base board into a horizontal limb in a tree where damage is occurring (Figure 3).

Baiting and setting traps: A handful of nut meats placed well behind the trigger mechanism will attract the squirrels. A few may be scattered at the trap entrance also. For best results, baited traps are left unset for several days until the squirrels become accustomed to pushing back the swinging trigger loop to reach the bait. After the squirrels have become familiar with the traps, rebait and set all the triggers. A considerable number of fox squirrels can be taken with relatively few traps if they are kept in continuous operation while damage is occurring. Trapping should be commenced as soon as the first damage is observed.

Other:

Shooting where legal can be effective. Shotgun with No.6 shot or .22 caliber rifle is suitable.

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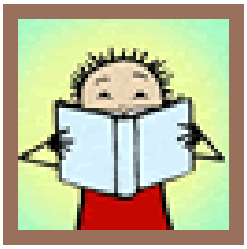
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Wild Pig

Sus scrofa

Family: Suidae



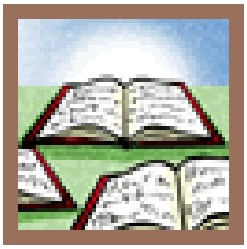
Introduction: Wild pigs in the United States are referred to by many names, mainly because of their mixed ancestry. Wild pigs are not native to the United States. They were first introduced to the United States in 1500's by European settlers. Many years later, sport hunters introduced true Eurasian wild boars into certain areas of the United States. The feral swine population that exists today is a combination of domestic, escaped, or neglected domestic swine.

Wild pigs are highly adaptable, prolific animals. Wild pigs are environmental and agricultural pests. They cause damage to the environment through wallowing, rooting for food and selective feeding. They destroy habitat for native plants and animals and spread environmental weeds. Feral pigs destroy crops and pasture and they potentially may spread exotic diseases should there be an outbreak. Thus, wild pig control requires a sustained and integrated approach, which may include various forms of exclusion, fencing and cage traps, plus ground shooting, trained hunting dogs, and aerial hunting (where legal). Check State laws and regulations concerning feral or wild pig hunting permits

In California, feral pigs were restricted to a few coastal counties prior to the 1950s (Mansfield 1986). As of 1994, the feral pig population was estimated at 133,000 and animals were present in 49 counties (Waithman et al. 1999). The northern and central coast regions of California host 81.7% of the state's feral pigs, who depend on permanent water sources and prefer oak (*Quercus*

spp.) woodlands (Sweeney and Sweeney 1982, Waithman et al. 1999). Very dry conditions limit range expansion into eastern and southeastern portions of California. However, recent viticultural trends in low lying mountain ranges in Central California have allowed feral pig populations to increase.

Identification: Wild pigs, because of their varied ancestry come in all shapes and colors from gray, red, black, blond, spotted and belted. Some look like domestic pigs, others resemble wild boars. All have small eyes, large, triangular ears and a long snout ending in a large, round nose. Wild pigs have a thick coat of coarse, bristly fur; some are able to erect the fur along their spine, lending them the common name "razorback." Most wild pigs have longer bristles than their domestic ancestors. Wild pigs are about 3 feet in height, 5 feet in length and weigh over 400 pounds. However, most sows average 110 pounds and most boars average 130 pounds. Boars have four sharp tusks that grow continuously, often reaching 5 inches before they break or become worn from use. The bottom tusks make formidable weapons. Boars use them for defense and to establish dominance.



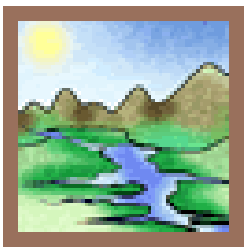
Legal Status: Wild pigs are classified as game animals by the California Department of Fish and Game. When wild pigs are encountered while in the act of inflicting injury to, molesting, or killing, livestock they may be taken immediately by the owner of the livestock or the owner's employee if the taking is reported no later than the next working day to the department of Fish and Game and the carcass is made available to the Fish and Game department.

In cases other than above, any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by wild pigs may apply to the department of Fish and Game for a permit to kill any such animals. In addition, where applicable, landowners can hunt wild pigs to reduce populations after obtaining a hunting license and wild pig hunting tags. Currently, the wild pig hunting season is year-round. Consult the Fish and Game Hunting regulations for further information.

Damage: Wild pigs damage field crops through rooting and consuming barley, corn, milo, watermelons, rice, peanuts, pastures and hay. They also damage vineyards, tree seedlings in reforestation projects and landscape plantings. They are known to prey on young sheep and goats. Damage to livestock production occurs through damage and destruction to feeding facilities and fences, creation of wallows and fouling of water sources, and destruction of pasture grasses and forage. Currently, diseases of wild pigs in California appear to pose little threat to domestic livestock with exceptions of Brucellosis and Pseudorabies. Damage to turkey production has also been caused by destruction of pens with the birds escaping, feeders destroyed, and turkey feed consumed.

Range: Wild pigs are reportedly distributed in over 30 California counties primarily in the oak woodland and chaparral areas of the state. Currently surveys are being conducted by the California Department of Fish and Game to map their distribution range through the hunting tag program.

Wild Pig



Habitat: Wild pigs prefer dense cover provided by overgrowth in river bottoms, bottomlands, conifer and hardwood forests, and in other remote areas where human activities are minimal. They are found in areas of livestock production where forage, moisture and cover are present.

Biology: Wild pigs are intelligent and are very adaptable to changing conditions. With sufficient food sources they are capable of doubling their population in four months. They can breed at 6 months and can have 1 to 2 litters per year. The litter size can range from 4 to 6 piglets with 13 piglets being reported as a high. Their primary predators are humans and in some areas of the state mountain lions. In addition to agricultural products, they consume acorns, underground plant materials, invertebrates and other herbaceous plants.

Damage Prevention and Control Methods:

Exclusion: Fencing can be used to exclude wild pigs from causing damage. The fence should be constructed from heavy posts and wire. Fencing in this manner can be very expensive and is not cost effective for large areas. Electric fencing has been documented as being effective, but again somewhat impractical for large areas.

Habitat Modification:
None

Frightening:
No methods have proven effective

Fumigants:

None registered.

Repellents:

None are registered

Toxic Baits: Currently there are no toxicants registered for use on wild pigs.

Trapping: Trapping is cited as being the most effective way to control wild pigs. Individual traps can be constructed so they are stationary or portable. Corral type permanent traps with a one way gate can also be constructed, but must be of sturdy construction to contain the trapped animals. To obtain maximum results, the traps should be pre-baited with fresh bait such as grains, (barley, corn, oats), fermented corn mash, carrion, vegetables or fruits. The success of any baiting program will vary with seasonal changes, availability of natural food sources (acorn masts), agricultural crops and presentation.

Hunting: The use of sport hunting to reduce the wild pig populations and thus reduce their damage is widespread in California. Farmers throughout the state are encouraged by California Fish & Game to allow hunters onto their property for "hunts". Hunting is not always an option due to the proximity of residents, livestock, liability restrictions and other considerations that include the season, weather conditions, etc. Removal of large numbers of wild pigs is limited by the bag limit restrictions imposed by hunting regulations. All hunters must be licensed.

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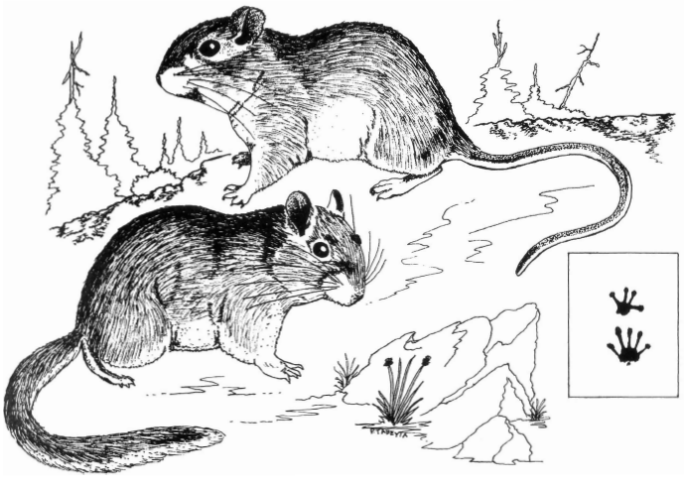
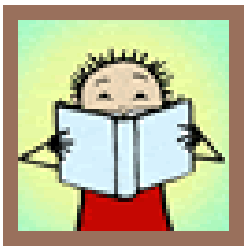
BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Wood Rat

Neotoma spp., Pack rat

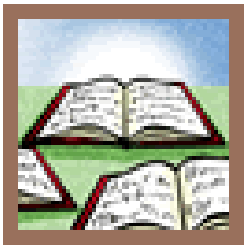
Family: Cricetidae





Introduction: Woodrats are known as "pack rats" or "trade rats" and are found throughout most of the United States. There common name comes from their disposition to collect or "pack-around" various objects, and their collection of material to deposit in, or use in the construction of their nests. Woodrats are especially fond of small, bright, shiny objects which they will readily confiscate, but bones, cow chips, and bits of wood are all common. When Woodrats encounter an interesting object they drop or trade what they are carrying for the new item, consequently the name "trade rat." Nationally woodrats are a minor pest. They only occasionally become numerous enough to cause significant agricultural damage. Most often they are a nuisance around vacation homes, cabins, and other outbuildings. Close association with humans is undesirable since they can carry diseases and ectoparasites e.g. Lyme disease.

Identification: Eight species of woodrat occur in North America. The woodrat is about the size of the common Norway rat. They are distinguishable from Norway rats by their hairy rather soft, fine, fur, and large ears. They usually have light colored feet and bellies.



Legal Status: Woodrats are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. Woodrats may also be taken by officers or employees of the Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.

Damage: Woodrat populations are generally fairly dispersed but economic damage to agricultural crops can occur in limited areas. Agricultural damage occurs when woodrats clip small twigs and branches, and debark citrus and other fruit trees, seedling and sapling conifers, especially redwoods. Occasionally woodrats become numerous enough to damage and carry off grain and other crops. They sometimes take up residence in cabins, causing annoyance by their noise and theft of small articles in the dwelling. They may also shred upholstered furniture and mattresses for lining their nests, and may take up residence in parked vehicles, gnawing on wires and other mechanical components. Woodrat nests are frequently inhabited by conenose bugs capable of transmitting Chagas' disease and causing allergic reactions. Wood rat populations in certain high-risk areas in California are periodically reduced by outbreaks of sylvatic (bubonic) plague; these outbreaks coincide with plague epidemics in ground squirrel populations.

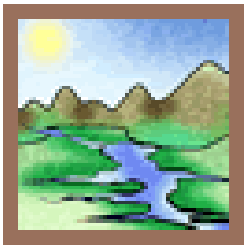
Range: Virtually every area of the state is occupied by one or more of the four species represented. White-throated woodrat is restricted to the southeastern corner of the state; Dusky-footed woodrat is found all along the coast and in a broad band inland; Bushy-tailed woodrat occupies the central Sierra and westward into northwestern California; Desert woodrat is found south of the San Joaquin River and in a small zone in Lassen County.

Bushy-Tailed Woodrat

Desert Woodrat

Dusky-footed Woodrat

White-throated Woodrat



Habitat: White-throated woodrats lives in brush land and rocky cliffs with shallow caves; Dusky-footed woodrat inhabits heavy chaparral, streamside thickets, and is closely associated with the presence of oaks; Bushy-tailed woodrat occupies the pine forest, rim rock and rockslide areas of high mountains; Desert woodrat lives on desert floors or rocky slopes with scattered cactus, yucca, or other low vegetation.

Biology: Wood rats are mostly nocturnal and usually do not venture out of their homes on bright moonlit nights. Woodrats are good climbers, but as a group they are not especially arboreal in habit. Woodrats are chiefly vegetarians, feeding on whatever is available. Bushy-tailed woodrats of the high mountains feeds on twigs, shoots, and other green vegetation; its lowland relatives feed on a variety of seeds, nuts, acorns, fruits, green vegetation, fungi and cactus. Woodrats do not hibernate.

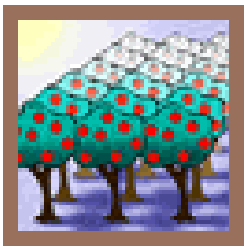
The unmistakable trademark of woodrat presence in the wild is the large nest (or house) built of sticks, rocks, tin cans, dried manure, or cactus. Ball-shaped or conical, the nest may be built in a tree or bush, on a cliff, in a rock crevice or cactus patch, or around a stump or old log. Nest diameters and heights to three to five feet are common for dusky-footed woodrats, slightly smaller nests being the rule for the other species. Bark stripping and removal of small side branches of conifers is for nest construction rather than food, as the nest of forest-dwelling species is usually lined with finely shredded bark or other material. The nest has several entrances and it contains several chambers including a food storage room and a waste disposal area. Some wood rats build an auxiliary nest in a tree adjacent to the ground house. The home range of dusky-footed woodrat is fairly small, not over 150 feet across. The home range of white-throated woodrat is probably less than 100 feet across and populations of 10 to 20 adults per acre may occur.

The breeding season varies with elevation, but the young are born in spring and summer. Desert woodrat has four or more litters per year, and white-throated woodrat probably has more than one per year. Bushy-tailed woodrat has one litter per year. One to five young are born, usually two or three (average four for bushy-tailed woodrat), in a litter. Gestation period is 23 to 38 days, depending on the species.

The young are completely dependent on the mother for several weeks. They remain attached to her teats while she is in the nest during the early weeks, and cling tenaciously to her if she is driven from the nest. The young often live in the nest until they are nearly full grown. They may move to some nearby unoccupied nest, or the mother may move elsewhere, leaving the house to the young. The young of desert woodrat are sexually mature at 60 days.

Woodrats have many enemies, including owls, foxes, coyotes, weasels, and large snakes.

Individuals of dusky-footed woodrat have been known to live four years in the wild, but trapping data in Oregon (Hooven, 1959) indicated a high mortality of young dusky-footed woodrats by the end of summer.



Damage Prevention and Control Methods

Exclusion: Whenever nuisance problems occur around buildings, exclusion is the most effective method of eliminating damage. Wood rats maybe excluded from buildings by the same methods used to exclude Norway and roof rats. Several species of wood rat are agile climbers; all entrances to buildings including those at attic level should be closed. Cracks in foundations, openings for water pipes, electric wires, sewer pipes, drain spouts, and vents must be sealed. Also check attic vents and broke roof tiles. Openings larger than ½ inch should be sealed. Ensure doors, windows, and screens fit tightly. Coarse steel wool, , wire screen, lightweight sheet metal are excellent tools for plugging small gaps and holes. Plastic sheeting, wood, or similar materials will likely be gnawed away. When rodent proofing always make sure the rodent is not trapped inside the building to avoid excessive damage and gnawing. One way to accomplish this is to install a temporary gravity door made of sheet metal or rigid mesh wire, hinged at the top, over entrance holes. So that it can only work one way similar to the commercially available cat flaps.

Habitat Modification: See Norway Rats

Frightening: Not a practical method for rodent control.

Fumigants: None registered.

Repellents: No woodrat repellents are registered with the EPA. Generally chemical repellents are not considered a practical solution to woodrat problems. Objectionable odors. e.g. mothballs, or tacky substances may make an enclosed area temporarily undesirable for woodrats. However, as with other mammals, it will not have a permanent effect. Toxic Bait: Toxicants available for woodrat control include anticoagulants and zinc phosphide. When using toxic baits, follow label instructions carefully.

Anticoagulants are effective for woodrat control. Anticoagulants work by interfering with the blood clotting mechanism. Death usually occurs 4 to 5 days after feeding on bait begins. With the anticoagulant baits, clorophacinone or diphacinone, feeding must occur daily for 4 to 5 days. Finely ground or meal type anticoagulants are recommended, since woodrats have a tendency to pack away items, pellet bait should be avoided since it is often cached away at nest sites, making it ineffective and a potential danger to nontarget species.

Toxic baits:

CDFA labels 0.005% Diphacinone Rodent Bait Block

0.005% Chlorophacinone and Diphacinone grain bait

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Anticoagulant baits: NOTE: A single feeding of first generation anticoagulant baits will not control wood rats. Baits of first generation anticoagulants must be eaten over a period of several days to give adequate control.

Closed-box type anticoagulant bait stations are often filled with sticks and other debris by the wood rat. Open bait containers protected by inverting a crate or something similar over the bait may prove more practical.

Bait stations: Place 4 to 16 ounces of bait in a bait box or if in a shallow container cover with a protective crate or box. Bait stations should be located near existing wood rat runways or dens. Inspect bait stations daily and add bait as needed. Bait should be picked up and disposed of upon completion of rodent control program.

In agricultural situations, zinc phosphide, a Restricted Use Pesticide, requires permits to be used. Oat groats treated with 2% zinc phosphide are generally very effective on wooodrats. Usually a table spoon should be scattered near nest site runways. Best time to apply is late afternoon prior to the woodrats night time feeding. Zinc phosphide can result in bait shyness, often caused by sub lethal amounts being used. For this reason do not use zinc phosphide more than once in a 6 month period.

Trapping: Wood rats can usually be trapped quite easily. Bait a wooden-base rat trap with a whole prune, raisin or nut meat and place the trap near signs of fresh activity near nests or pathways. Live catch traps such as Havahart No. 2 are also effective in catching wood rats using the same baits described above. Release of trapped animals is not recommend and may be against local fish and game regulations. Research shows that animals released in a new area often die from exposure, predation, or competition with resident animals.

Burrow entrance traps (lethal) such as the Conibear trap may also be useful for woodrat control. The trap is placed in nest openings or other restricted travelways and is triggered when the woodrat passes through the trap opening. When traps are used in this manner no baiting is required, be careful to avoid nontarget animals.

Remember, all traps should be placed so that children, pets, and other nontarget animals do not have access to them. Trapping woodrats requires a trapping license issued by the Department of Fish and Game.

Other:
Shooting: Shooting can effectively reduce wood rats on a very limited scale. Kicking, stomping or poking the nest will usually cause the wood rat to run out where they may be taken.

Destroying woodrat nests has been suggested as a method of control. When a nest is destroyed, the animals may run for cover, thus exposing them to predation by humans or dogs. This method of control is time consuming and probably of limited value. Once the woodrats in an area are controlled, destroying their nests may reduce invasion by other woodrats.

REFERENCES AND ADDITIONAL READING

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