

Rats are some of the most troublesome and damaging rodents in the United States. They consume and contaminate food, damage structures and property, and transmit parasites and diseases to other animals and humans. Rats live and thrive under a wide variety of climates and conditions; they are often found in and around homes and other buildings, farms, gardens, and open fields.

## IDENTIFYING THE RAT

People do not often see rats, but signs of their presence are easy to detect (see sidebar). In California the most troublesome rats are two introduced species: the [roof rat](#) and the [Norway rat](#). It is important to know which species of rat is present in order to place traps or baits in the most effective locations.

**Norway Rats.** Norway rats (*Rattus norvegicus*), sometimes called brown or sewer rats, are stocky burrowing rodents that are larger than roof rats. Their [burrows](#) are found along building foundations, beneath rubbish or woodpiles, and in [moist areas in and around gardens and fields](#). Nests may be lined with shredded paper, cloth, or other fibrous material. When Norway rats invade buildings, they usually remain in the basement or ground floor. The Norway rat occurs throughout the 48 contiguous United States. Generally it is found at lower elevations but may occur wherever people live.

**Roof Rats.** 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; Table 1 summarizes identifying characteristics.

Table 1. Identifying Characteristics of Adult Rats.

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

While rats are much larger than the common house mouse or meadow vole, [a young rat is occasionally confused with a mouse](#). In general, very young rats have large feet and large heads in proportion to their bodies, whereas those of [adult mice](#) are much smaller in proportion to their body size. While both rats and mice [gnaw on wood](#), rats leave much larger tooth marks than those of a mouse. For additional information on mice, see *Pest Notes: [House Mouse](#)* and *Pest Notes: [Voles](#) (Meadow Mice)* listed in References.

## How to Spot a Rat Infestation

Because rats are active throughout the year, periodically check for signs of their presence. Once rats have invaded your garden or landscaping, unless your house is truly rodent proof, it is only a matter of time before you find evidence of them indoors. Experience has shown it is less time consuming to control rodents before their numbers get too high, and fewer traps and less bait will be required if control is started early.

Inspect your yard and home thoroughly. If the answer to any of the following questions is yes, you may have a rat problem.

- Do you find [rat droppings](#) around dog or cat dishes or pet food storage containers?
- Do you hear noises coming from the attic just after dusk?
- Have you found remnants of rat nests when dismantling your firewood stack?
- Does your dog or cat bring home dead rat carcasses?
- Is there evidence rodents are feeding on fruit/nuts that are in or falling from the trees in your yard?
- Do you see burrows among plants or damaged vegetables when working in the garden?
- Do you see rats traveling along utility lines or on the tops of fences at dusk or soon after?
- Have you found rat nests behind boxes or in drawers in the garage?
- Are there smudge marks caused by the rats rubbing their fur against beams, rafters, pipes, and walls?
- Do you see burrows beneath your compost pile or beneath the garbage can?
- Are there rat or mouse droppings in your recycle bins?
- Have you ever had to remove a drowned rat from your swimming pool or hot tub?
- Do you see evidence of something digging under your garden tool shed or doghouse?

## BIOLOGY AND LIFE CYCLE OF THE RAT

Rats, like house mice, are mostly active at night. They have poor eyesight, but they make up for this with their keen senses of hearing, smell, taste, and touch. Rats constantly explore and learn about their

environment, memorizing the locations of pathways, obstacles, food and water, shelter, and other elements in their domain. They quickly detect and tend to avoid new objects placed into a familiar environment. Thus, objects such as traps and baits often are avoided for several days or more following their initial placement. While both species exhibit this avoidance of new objects, it is usually more pronounced in roof rats than in Norway rats.

Both Norway and roof rats may gain entry to structures by gnawing, climbing, jumping, or swimming through sewers and entering through the toilet or broken drains. While Norway rats are more powerful swimmers, roof rats are more agile and are better climbers.

Norway and roof rats do not get along. The Norway rat is larger and the more dominant species; it will kill a roof rat in a fight. When the two species occupy the same building, Norway rats will dominate the basement and ground floors, with roof rats occupying the attic or second and third floors. Contrary to some conceptions, the two species cannot interbreed. Both species may share some of the same food resources but do not feed side-by-side. Rats may grab food and carry it off to feed elsewhere.

Rats of either species, especially young rats, can squeeze beneath a door with only a 1/2-inch gap. If the door is made of wood, the rat may gnaw to enlarge the gap, but this may not be necessary.

**Norway Rats.** Norway rats eat a wide variety of foods but mostly prefer cereal grains, meats, fish, nuts, and some fruits. When searching for food and water, Norway rats usually travel an area of about 100 to 150 feet in diameter; seldom do they travel any further than 300 feet from their burrows or nests. The average female Norway rat has four to six litters per year and may successfully wean 20 or more offspring annually.

**Roof Rats.** Like Norway rats, roof rats eat a wide variety of foods, but their food preferences are primarily fruits, nuts, berries, slugs, and snails. Roof rats are especially fond of avocados and citrus and often eat fruit that is still on the tree. When feeding on a mature orange, they make a small hole through which they completely remove the contents of the fruit, leaving only the hollowed out rind hanging on the tree. The rind of a lemon is often eaten, leaving the flesh of the sour fruit still hanging. Their favorite habitats are attics, trees, and overgrown shrubbery or vines. Residential or industrial areas with mature landscaping provide good habitat, as does riparian vegetation of riverbanks and streams. Roof rats prefer to nest in locations off the ground and rarely dig burrows for living quarters if off-the-ground sites exist.

Roof rats routinely travel up to 300 feet for food. They may live in the landscaping of one residence and feed at another. They can often be seen at night running along overhead utility lines or fence tops. They have an excellent sense of balance and use their long tails for balance while traveling along overhead utility lines. They move faster than Norway rats and are very agile climbers, which enables them to quickly escape predators. They may live in trees or in attics and climb down to a food source. The average number of litters a female roof rat has per year depends on many factors, but generally is three to five with from five to eight young in each litter.

## **DAMAGE CAUSED BY RATS**

Rats consume and contaminate foodstuffs and animal feed. They also damage containers and packaging materials in which foods and feed are stored. Both species of rats cause problems by gnawing on electrical wires and wooden structures (doors, ledges, in corners, and in wall material) and tearing up insulation in walls and ceilings for nesting.

Norway rats may undermine building foundations and slabs with their burrowing activities. They may also gnaw on all types of materials, including soft metals such as copper and lead as well as plastic and wood. If roof rats are living in the attic of a residence, they can cause considerable damage with their gnawing and nest-building activities. They also damage garden crops and [ornamental plantings](#).

Among the diseases rats may transmit to humans or livestock are murine typhus, leptospirosis, trichinosis, salmonellosis (food poisoning), and ratbite fever. Plague is a disease that can be carried by both roof and Norway rats, but in California it is more commonly associated with ground squirrels, chipmunks, and native wood rats.

## **MANAGING A RAT PROBLEM**

Three elements are necessary for a successful rat management program: sanitation measures, building construction and rodent proofing, and, if necessary, population control.

### **Sanitation**

Sanitation is fundamental to rat control and must be continuous. If sanitation measures are not properly maintained, the benefits of other measures will be lost, and rats will quickly return. Good housekeeping in and around buildings will reduce available shelter and food sources for Norway and, to some extent, roof rats. Neat, off-the-ground storage of pipes, lumber, firewood, crates, boxes, gardening equipment, and other household goods will help reduce the suitability of the area for rats and will also make their detection easier. Garbage, trash, and garden debris should be collected frequently, and all garbage receptacles should have tight-fitting covers. Where dogs are kept and fed outdoors, rats may become a problem if there is a ready supply of dog food. Feed your pet only the amount of food it will eat at a feeding, and store pet food in rodent-proof containers.

For roof rats in particular, thinning dense vegetation will make the habitat less desirable. Climbing hedges such as Algerian or English ivy, star jasmine, and honeysuckle on fences or buildings are very conducive to roof rat infestations and should be thinned or removed if possible, as should overhanging tree limbs within 3 feet of the roof. Separate the canopy of densely growing plants such as pyracantha and juniper from each other and from buildings by a distance of 2 feet or more to make it more difficult for rats to move between them.

### **Building Construction and Rodent Proofing**

The most successful and long lasting form of rat control in buildings is to "build them out." Seal cracks and openings in building foundations, and any openings for water pipes, electric wires, sewer pipes, drain spouts, and vents. No hole larger than 1/4 inch should be left unsealed to exclude both rats and house mice. Make sure doors, windows, and screens fit tightly. Their edges can be covered with sheet metal if gnawing is a problem. Coarse steel wool, wire screen, and lightweight sheet metal are excellent materials for plugging gaps and holes. Plastic sheeting, wood, caulking, and other less sturdy materials are likely to be gnawed away.

Because rats (and house mice) are excellent climbers, openings above ground level must also be plugged. Rodent proofing against roof rats usually requires more time to find entry points than for Norway rats because of their greater climbing ability. Roof rats often enter buildings at the roof line area so be sure that all access points in the roof are sealed. If roof rats are travelling on overhead utility wires, contact a pest control professional or the utility company for information and assistance with measures that can be taken to prevent this.

## **Rodent Proofing Your Home**

- Repair or replace damaged ventilation screen around the foundation and under eaves.
- Provide a tight fitting cover for the crawl space.
- Seal all openings around pipes, cables, and wires that enter through walls or the foundation.
- Be sure all windows that can be opened are screened and that the screens are in good condition.
- Cover all chimneys with a spark arrester.
- Make sure internal screens on roof and attic air vents are in good repair.
- Cover rooftop plumbing vent pipes in excess of 2 inches in diameter with screens over their tops.
- Make sure all exterior doors are tight fitting and weatherproofed at the bottom.
- Seal gaps beneath garage doors with a gasket or weatherstripping.
- Install self-closing exits or screening to clothes dryer vents to the outside.
- Remember that pet doors into the house or garage provide an easy entrance for rodents.
- Keep side doors to the garage closed, especially at night.

## **Population Control**

When food, water, and shelter are available, rat populations can reproduce and grow quickly. While the most permanent form of control is to limit food, water, shelter, and access to buildings, direct population control is often necessary.

For controlling rats indoors, use traps. Baiting is best done outdoors only, otherwise rats may die behind a wall. In hot weather, the stench of a dead rat can be unbearable and may necessitate cutting a hole in the wall to remove the carcass. Also, ectoparasites such as fleas and mites often leave dead rat carcasses and may infest the entire house if the carcass is not removed promptly.

**Trapping.** Trapping is the safest and most effective method for controlling rats in and around homes, garages, and other structures. Because traps can be used over and over again, trapping is less costly than poison baits but more labor intensive. Traps can be set and left indefinitely in areas where rats have been a problem in the past, such as an attic. The simple wooden rat-size snap trap is commonly used for rats, and the newer rat traps with large plastic treadles are especially effective. Generally young rats cannot be trapped until they are about a month old, which is when they leave the nest to venture out for food.

The kind of bait used for the trap is important. Nut meat, dried fruit, or bacon make excellent baits for rats. The bait should be fastened securely to the trigger of the trap with light string, thread, or fine wire so the rodent will spring the trap in attempting to remove the food. Even glue can be used to secure the bait to the trigger. Soft baits such as peanut butter and cheese can be used, but rats sometimes take soft baits without setting off the trap. Leaving traps baited but unset until the bait has been taken at least once improves trapping success by making the rodents more accustomed to the traps. Set traps so the trigger is sensitive and will spring easily.

The best places to set traps are in secluded areas where rats are likely to travel and seek shelter. Droppings, gnawings, and damage indicate the presence of rodents, and areas where such evidence is found are usually the best places to set traps, especially when these areas are located between their nests and food sources. Place traps in natural travel ways, such as along walls, so the rodents will pass directly over the trigger of the trap. If a rat sets off a trap without getting caught, it will be very difficult to catch the rat with a trap again.

For *Norway rats*, set traps close to walls, behind objects, in dark corners, and in places where rat signs, such as droppings, have been seen. [Position traps](#) along a wall so that they extend from the wall at right angles, with the trigger end nearly touching the wall. If traps are set parallel to the wall, they should be set in pairs to intercept rodents traveling from either direction.

For *roof rats*, the best places for traps are off the ground in locations where rats may be coming down from their nests to find food such as on ledges, shelves, branches, fences, pipes, or overhead beams [where they can be fastened with screws or wire](#). In homes, the [attic and garage rafters](#) close to the infestation are good trapping sites. In areas where children, pets, or birds might contact traps, place the trap in a box or use a barrier to keep them away.

Use as many traps as are practical so trapping time will be short and decisive. A dozen or more traps for a heavily infested home may be necessary. Place rat traps about 10 to 20 feet apart. Dispose of dead rats by burying or placing them in plastic bags, sealing, and putting them in the trash. Do not touch the rodent with bare hands and wash thoroughly after handling traps.

*Glue Boards.* One of the alternatives to a snap trap is a glue board. Glue boards work on the same principle as flypaper: when a rat or mouse attempts to cross the glue board, the rodent gets stuck. Glue boards are much more effective for mice than for rats. Also, one of the major drawbacks with glue

boards (and other live-catch type traps) is that the trapped rat may not die quickly, and you will need to kill it. For this reason, glue boards are not a good alternative for many people and their use is not recommended. Also, cats and dogs may get into the glue and track it around the house, creating additional problems.

*Live Traps.* Live traps are not recommended because trapped rats must either be killed or released elsewhere. Releasing rats outdoors is not recommended because of health concerns to people, pets, and other domestic animals. Because neither the roof nor Norway rat is native to this country, their presence in the wild is very detrimental to native ecosystems. They have been known to decimate some bird populations.

**Toxic Bait.** While trapping is generally recommended for controlling rats indoors, when the number of rats around a building is high, you may need to use toxic baits to achieve adequate control, especially if there is a continuous reinfestation from surrounding areas. If this is the case, consider hiring a licensed pest control applicator, who is trained to use rodenticides safely.

Toxic baits contain active ingredients that work as either an anticoagulant, causing death by internal bleeding or as a direct toxin (Table 2).

Table 2. Types of Baits Used in Rat Control and Their Active Ingredients.

Type of bait	Active ingredients	Use restrictions
<b>multiple-feeding anticoagulant</b>	warfarin, chlorophacinone, diphacinonene	for use in and around buildings and in gardens and landscaped areas
<b>single-feeding anticoagulant</b>	brodifacoum, bromadiolone, difethialone	for use in and around buildings only
<b>nonanticoagulant</b>	bromethalin, cholecalciferol	for use in and around buildings only
<b>nonanticoagulant</b>	zinc phosphide	for use in and around buildings and in gardens and landscaped areas

It is important to note that some of the baits on the market may only be used in and around buildings and are not registered for use in the garden and landscape. These include the newer, single-feeding anticoagulants (brodifacoum, bromadiolone, and difethialone) and two of the nonanticoagulants (bromethalin and cholecalciferol). The multiple-feeding anticoagulant baits and zinc phosphide may be used both in and around structures as well as in gardens and landscapes.

*Anticoagulant Baits.* Anticoagulant baits used to be thought of as relatively safe baits to use around the house and garden because they required multiple feedings to be effective. Newer anticoagulant baits,

however, have been developed that only require a single feeding to be effective and are, therefore, more hazardous than the older type of anticoagulant bait to pets and children. Baits that require multiple feedings over a period of several days contain warfarin, chlorophacinone, or diphacinone as their active ingredient, whereas the single-feeding anticoagulants contain brodifacoum, bromadiolone, or difethialone. Whether a bait actually requires multiple feedings or not depends on how much is consumed at each feeding—even the newer, single-feeding baits must be consumed in adequate amounts to be effective. With all anticoagulants, death is generally delayed 2 to 6 days after a lethal dose of bait has been consumed. While both types of anticoagulant toxicants are effective against Norway and roof rats when formulated in acceptable baits, roof rats tend to need a few more feedings to obtain a lethal dose than Norway rats do. This is particularly true with the multiple-feeding anticoagulants, as compared to the single-feeding ones.

Anticoagulant baits are available in meal, pellet, kernel, or block form. Pelleted or meal baits are frequently sold in small packets called "place packs." Also, a wide variety of paraffin block baits are marketed and convenient to use. Most of these blocks must be placed in a tamper-resistant bait station to prevent dogs and other animals from chewing on them.

*Nonanticoagulant Baits.* Nonanticoagulant baits are usually lethal after one feeding if the rat ingested an adequate amount of toxin. Bromethalin, cholecalciferol, and zinc phosphide are common active ingredients in this group of baits used for rats. These baits are placed in runways or next to burrows where rats will find them. Nonanticoagulant baits are generally more rapid acting than anticoagulant baits and you may find dead rodents within 12 hours of baiting. Because the toxins in these baits do not accumulate in the tissue of the rodent, predators or scavengers such as dogs and cats are not likely to be adversely affected by eating poisoned carcasses (see sidebar, *Pets and Rat Control*). However, they, as well as other animals and children, can be affected by eating the bait so it must be stored and used carefully.

### ***Pets and Rat Control***

Many of the methods and materials used to control rats can affect pets as well. All rodent baits are toxic to dogs and cats, so be cautious in their use. Because the anticoagulants are cumulative and slow acting (to various degrees, depending on whether it is multiple or single feeding), dead rats may contain several lethal doses of toxicant, and secondary poisoning of pets and wildlife is possible if several rat carcasses are consumed over a few days. While this secondary poisoning is possible, it is not common. Most fatalities in pets involve dogs and are due to the animal consuming the bait directly (primary poisoning) or a combination of direct bait consumption and secondary poisoning. Use extra caution with the single-feeding anticoagulant baits; exposure to even a single dead rodent killed by these might be enough to cause poisoning in the pet. The great advantage of multiple-feeding anticoagulants is that a good antidote, vitamin K<sub>1</sub>, as well as whole blood transfusions are available if medical attention is received early enough.

The best precaution is to keep pets away from bait and dead or dying rodents. Dispose of dead rodents by burying or placing in a plastic bag, sealing, and placing in the trash. Do not handle them with bare



hands. Read all label directions on the bait and only place it in areas that are specified on the label. Put bait in locations out of the reach of children, pets, domestic animals, and nontarget wildlife or in tamper-resistant bait stations. These bait stations must be resistant to destruction by dogs and by children under 6 years of age and must be constructed in a manner that prevents a child from reaching into the bait compartments and obtaining bait. If bait can be shaken from stations when lifted or tipped, stations must be secured or otherwise immobilized. As you would with any poison, take care to ensure safety to children and pets by limiting their access to the bait. Clearly label all bait stations with appropriate warnings, and store unused bait in a locked cabinet or other areas inaccessible to children and domestic animals.

**Bait Stations.** [Bait stations](#) or boxes are often used with baits of all kinds. These enclosures protect the bait from weather and restrict accessibility to rodents, providing a safeguard for people, pets, and other animals. Bait stations should be large enough to accommodate several rats at a time and should contain a bait-holding compartment. Each station should have at least two openings for rats to enter and exit. Place bait stations next to walls or in places where rats will encounter them. Commercial bait stations are available in a variety of sizes and shapes. Stations that may be accessible to children or pets must be made of sturdy, tamper-resistant material and be secured in a way that they cannot be tipped. See the product label for additional information. All bait stations should be clearly labeled.

**Bait Placement.** It is best to place bait in a bait station. In addition to increasing the safety of the bait, the use of bait stations also helps the rats to feel secure while feeding. Place all bait stations in rat travel-ways or near their burrows and harborage. Do not expect rats to go out of their way to find the bait. For Norway rats, place bait stations near rodent burrows or suspected nest sites, against walls, or along travel routes. For roof rats, place baits in elevated locations, such as in the crotch of a tree, on top of a fence, or high in a vine. If you place bait stations above ground level, take care that they are securely fastened and will not fall to the ground where children or pets could find them.

Because rats are often suspicious of new or unfamiliar objects, it may take several days for them to enter and feed in bait stations. For best results, make sure there is a continuous supply of bait until feeding stops. With the older anticoagulant baits it usually takes 5 days or more once the rats start feeding for them to succumb.

During the baiting process, dispose of dead rodents by burying them or placing them in plastic bags and putting them in the trash. Use gloves and wash hands thoroughly after handling dead rodents, traps, or bait stations. Additionally, poisoned rats often die in inaccessible locations within a building, leading to persistent and unpleasant odors, so rodent-proof the building before you use toxic baits outside.

## Other Control Methods

Rats are wary animals, easily frightened by unfamiliar or strange noises. However, they quickly become accustomed to repeated sounds, making the use of frightening sounds, including high frequency and ultrasonic sounds, ineffective for controlling rats in home and garden situations.

Traps that kill rats by electrocution are available on the market. These traps are considerably more expensive than the common snap trap and can be used safely and effectively only in limited situations. Like the snap traps, these traps catch only one rat at a time and then must be emptied. Twenty or more snap traps can be purchased and put to use for the price of one of the electrocution units. When compared with snap traps, electrocution traps have not shown sufficient advantages to promote their use.

Rats have an initial aversion to some odors and tastes, but no repellents have been found to solve a rat problem for more than a very short time. There are no truly effective rat repellents registered for use in California.

Smoke or gas cartridges are registered and sold for the control of burrowing rodents. When placed into the burrows and ignited, these cartridges produce toxic and suffocating smoke/gases. Norway rat burrows may extend beneath a residence and have several open entrances, however, permitting toxic gases to permeate the dwelling. For this reason and because some fire hazard is associated with their use, smoke and gas cartridges are not recommended for rat control around homes.

Norway rats may be drowned or flushed from their burrows by flooding them out with water from a garden hose and then closing the holes with dirt.

Predators, especially cats and owls, eat rats and mice. However, much of the time these predators are unable to keep rodent numbers below levels that are acceptable to most people.

[HEALTH AND ENVIRONMENTAL IMPACTS OF MANAGEMENT ALTERNATIVES](#)—from California Department of Pesticide Regulation

[WARNING ON THE USE OF CHEMICALS](#)