Norway rat *(Rattus norvegicus)*

Size:

This exotic species may weight up to 1 pound. They're 12–18" long, from the nose to the tip of the tail. The tail is somewhat shorter than the body.

Signs of their presence:

- Sounds: Squeaking, scuttling, scratching, or gnawing inside the walls, ceilings, or between floors of buildings.
- Scat: $^1/_2$–$^3/_4$" long with blunt ends. Look in kitchen cabinets, drawers, and corners; on counters, under sinks, behind appliances, near food, and in cellars, attics, along walls in barns, warehouses, and feed storage areas. Use an ultraviolet light to look for their urine stains on woodwork (it glows blue-white). Rat urine smells musty and experienced NWCOs can distinguish it from mouse urine.
- Runs, smudge marks: Rats use the same route over and over. Eventually, a faint, dark "trail" of body oil and dirt may be noticeable on baseboards and along walls, on beams, rafters, and pipes. Look as well for smooth, worn paths in insulation.
- Nests and burrow holes: They will nest indoors and out. If outdoors, their burrows are usually about $1^1/_2$–2 ft. deep and 3 ft. long, with two or more entrances, and usually, a well-hidden escape route. Their outdoor burrows are often found in river banks and under sidewalks, platforms, boards, junk piles, foundations, and slabs. They may nest indoors in basements and the lower floors of a building, in crawl spaces, storage rooms, under floors, pallets, junk, and boards, or behind stored items. They may nest in sewers or storm drains. Rat nests are usually 8–12" in diameter, made of shredded paper, cardboard, insulation, and bits of fabric or plastic. Their burrow holes are usually 2–4" wide.
- Damage to stored goods and buildings: Gnaw marks are often seen on the bottoms and corners of doors, on ledges, in the corners of walls, and on stored materials. Look also for holes and piles of wood shavings. Check cabinets, electric cables, pipes, baseboards, window casings, and foundations. They will gnaw on almost any building material: wood, cinder blocks, aluminum, sheet metal, glass, adobe, asbestos. Their teeth grow constantly, so they gnaw to keep them trimmed.
- Evidence of their feeding: Rats are steady feeders, and will settle down and eat large quantities at a sitting. Their leftovers are usually half-eaten pieces of grain. Rats need water every day. May see and smell scat and urine.

Diet:

Opportunist. Norway rats prefer fresh food over garbage, but they'll make do with what's available. They prefer cereal grains and high-protein foods such as meats (sandwich meats, insects, mice, bird eggs, young birds), fish, nuts, insects, and pet food, and garbage. They'll eat some fruits (especially dried fruit), cheese, peanut butter, bird seed, potatoes, and vegetables, bacon, butter and lard, compost, and manure. They'll even eat paraffin wax, leather products, and the feces of dogs, cats, or horses.

Typical activity patterns:

Social style: Generally colonial, with an established hierarchy, although you may find solitary rats.
Daily activity: Nocturnal. If populations are very high, they may be active during the day, too.
Hibernator? No.
Migrates? No.

Where found:

Distribution in NY and the Northeast: Widespread, in urban, suburban, and rural areas. Rats are generally found near people. Though many people think of rats as an urban problem, about half of North America's rats live on farms.
Habitat: Any building that provides food and shelter, usually in the basement and on the lower floors of the building. They're found in apartment buildings, homes, kennels, warehouses, stores, slaughterhouses, barns, livestock buildings, silos, granaries, even sewers and dumpsters. Rats will nest underneath buildings and concrete slabs, along stream banks, around ponds, and in dumps. They like to nest near water.
Territory and home range: Territorial, especially among males. Daily, rats will travel through an area that's up to 100–150 feet in diameter, more than ten times the size of the foraging range of a house mouse. Rats generally stay within 300 feet of their burrows.

Breeding habits:

Pair bonding style: Rats are polygamous. Female raises the young alone.
Breeding dates: Peaks during the spring and fall. Females may breed again within a day or two of birthing and may produce 4–6 litters a year.
Litter size: 6–12. Gestation takes about 21–23 days.
Weaning dates: Between 3–4 weeks of age.
Amount of time young remain with parents beyond weaning date: Not long!

Estimating rat populations:

- There are probably about 10 rats in the area for each one spotted at night. Medium population: see one or two rats at night, but none seen during the day; or find old scat, or old gnaw marks. High population: see three or more rats at night, or see rats during the day; find fresh scat; gnaw marks and tracks are abundant.
- Another way to estimate populations: Put out food, then record how much is eaten by the rats to estimate the minimum number of rats in the area. Use finely ground grain, not whole grain or pellets, which the rats can carry off. Remember, rats are cautious, so give them some time to get used to this food source before you begin your data collection. When you're ready to collect data, weigh the food (in ounces) then place it where you believe the rats are active. The next day, weigh whatever's left. That tells you how much food they ate. Multiply that number by two, because one ounce of food/day typically supports two rats, and you'll have an estimate of how many rats are in the area. Of course, rats have other food sources, so this isn't exact.

  Example:

  a. Day one, place 40 oz. of grain near a rat hole
  b. Day two, measure what's left over: 12 ounces
  c. Subtract the amount left over from the total bait: 40 – 12 = 28 ounces eaten
  d. Multiply the amount of grain eaten by 2 (each ounce supports 2 rats): 28 x 2 = 56 rats

Common nuisance situations:

Time of year: Any time of year.

What are they doing?

- Rats can cause extensive damage to buildings and household goods as they seek food and nest sites. They'll gnaw on or foul siding (even aluminum), woodwork, sheet metal, sheetrock, insulation, plastic food containers (including garbage cans), papers, packaged goods, clothing, mattresses, furniture, even lead or copper pipes.
- Their nest materials might block a vent, causing a fire hazard.
- They also chew on wires, which in addition to creating a fire hazard, could also short-circuit electrical systems, causing alarm systems and refrigerators to fail.
- Their burrowing may cause roads and railroad beds to settle, or damage the banks of irrigation canals and levees. It may also undermine foundations and slabs.
- Rats bite and terrify some people. They transmit several diseases to people.
- Rats may damage crops in the field, in silos, granaries, and warehouses. They contaminate stored foods, especially grains, in commercial settings such as restaurants and warehouses and homes. Rats ruin a good chunk of the world's food supply.
- They'll raid bird feeders and pet dishes.
- Their noise and smell may drive you and your pets to distraction.
- They foul items in museums and libraries.
- Disease risks: The diseases that rats are more likely to transmit to people or livestock include murine typhus, leptospirosis, trichinosis, salmonellosis (food poisoning), and ratbite fever. Bubonic plague is more closely associated with roof rats *(Rattus rattus)*, which are not currently residents of New York, than it is with Norway rats. Rats are often infested with lice, fleas, and mites that transmit other diseases.

Legal status in New York:

Unprotected.

Best practices

It's critical to consider how well rats climb, jump, and swim when planning your control strategy. If you had the physical abilities of a rat, you might be an Olympic athlete. Here's what a Norway rat can do:

- Climb up: Brick buildings (or any building with a rough exterior), wires, conduit, pipes (inside and outside!), vines, shrubs, trees. Rats can climb inside a pipe that's $1\frac{1}{2}$–4" in diameter, or along the outside of any pipe that's within 3" of a wall or other support. Otherwise, rats can climb up an exterior pipe that's up to 3" in diameter (and if the surface is rough, they can climb up an even larger pipe).
- Run along: Telephone wires, power lines, pipes, conduit, and tree branches.
- An adult rat can squeeze through a hole that's about $\frac{3}{4}$" wide. A young rat can squeeze through a $\frac{1}{2}$" hole.
- Jump vertically about 3 feet and horizontally 4–8 feet, depending on whether they start on a flat or elevated surface. If people could match that, they'd be jumping about 18 feet up or 24–48 feet out, without poles or a running start.
- Stretch up about a foot on a smooth wall.
- Swim up to a half-mile in open water, underwater for about a half-minute; against strong currents; and up through toilet traps (water seals). Rats can tread water for up to 3 days.
- Burrow 4 feet into the soil.

- Fall from a height of 50 ft. without serious injury.
- Gnaw through lead and aluminum sheets, cinder block, plastic, and other materials.

The best way to deal with a rat infestation is to clean up, get rid of the rats, and keep them from finding a way back in. Keep three words in mind: sanitation; eviction; and exile.

Remove artificial food sources (garbage, compost, bird seed, pet food):

- Garbage is usually the main food source for rats in urban areas. Ideally, garbage would be removed daily, before dusk. This often isn't possible, so make sure that garbage is kept in secure containers.
- Clean garbage cans, dumpsters, and chutes regularly, at least once a week.
- Screen the drainage holes in dumpsters with $^1/_2$" hardware cloth.
- Steel garbage cans are a better choice than plastic, which the rats may chew through.
- If rats, raccoons, or dogs tip over the garbage cans, either use a spring-loaded fastener or bungee cord to keep the lids on, or put the garbage cans on a platform that's 18" above the ground and 3 feet away from buildings.
- At a dump, cover the garbage with soil every day.
- Store food, birdseed, pet food, garbage, compost, and recyclables in metal, glass, ceramic, or heavy-duty plastic containers with tight-fitting lids.
- Near buildings, rake up and dispose of fruits and nuts that fall from trees. It's not a bad idea to wrap these trees with sheet metal, so the rats can't climb up and feed in them. Prune low-hanging branches, too.
- Put unfinished pet food in the refrigerator.
- Store large bags of flour, grain, pet food, or livestock feed on open-wire shelves. Bottom shelf should be at least 18" off the ground.
- Especially in kitchens and food storage areas, elevate equipment (mixers, stoves, refrigerators) so you can clean underneath it easily. If you can't elevate it, then close it off so the rats can't get underneath the equipment.
- Elevate compost heaps or enclose with $^1/_2$" hardware cloth or welded wire mesh.
- Keep livestock feeding areas and feed storage areas as secure as possible.
- Remove dog, cat, and horse feces daily; rats will eat them.
- Keep the area around and underneath bird feeders clean, especially of spilled seed. Use baffles to keep rats (and squirrels) out of feeders.

Remove their nesting sites:

- Keep stored items off the floor and away from walls. In a warehouse, paint a 12" white band on the floor all the way around the room to make inspections easier, and to remind people to keep items away from the walls.
- Reduce clutter and remove cardboard boxes.
- Move firewood, junk piles, and garbage cans away from the house.
- Maintain a foot-wide gravel border around the foundation that's free of vegetation (best), or keep the foundation plantings well trimmed. Don't stack anything (such as firewood) against the foundation.
- They find shelter in dense ground covers such as Algerian ivy. Either keep it well-trimmed or replace it with English ivy, which they don't like as well.
- Break up large expanses of dense ground cover with exposed pathways. Rats don't like to cross areas where they can easily be seen.

Prevent entry into building:

- Close the door! (Use screen doors.) Install mechanical door-closers in warehouses or other areas where people forget to close doors.
- Add metal kickplates (26-gauge sheet metal) to the bottoms of doors, especially those leading to warehouses and food storage areas.
- Repair every crack and hole that's more than $^1/_2$" wide. Seal openings beneath and behind sinks, stoves, and dishwashers with latex caulk. Fix cracks in foundations and floors with concrete or masonry grout. Remember to check around pipes, sewer outlets, cables, stairs (inside and out), roof joints, and the areas where chimneys and fireplaces come through the floor from the cellar or crawl space. Use strong materials to repair holes, such as $^1/_2$" hardware cloth, welded wire mesh, sheet metal plates, concrete mortar, or coarse steel wool with expanding foam (Stuf-Fit™) sprayed over it.
- Plug gaps around water, gas, and heating pipes, heat registers, air ducts, electrical chases, and false ceilings with latex caulk.
- For large holes around pipes, use galvanized metal pipe chase covers, sheet metal plates, mortar, plaster of paris, or cement.
- Wrap pipes that run along exterior walls with sheet metal guards that fit closely to the wall, sticking out 12" from the pipe.
- Check vents (sewer, stove, clothes dryers, roof, ridge-line, soffit, furnace, and air-conditioning ducts, attic fans). If it's damaged or dicey, replace the vent with

an animal-proof design, or screen it with $^1/_2$" hardware cloth or welded wire. End caps on ridge vents may loosen, providing access to the attic. Soffit vents are best protected with metal louvers.
- Add guards to power lines to keep rats from traveling along them (consult with your power company first).
- Paint a foot-wide band around the perimeter of block or concrete buildings at a height of three feet. Use hard, glossy (slippery!) paint. This technique may also be used to make it harder for rats to climb up vertical pipes.
- Monitor structures routinely for structural cracks and openings. Places that might be overlooked, and yet are attractive to rats, include elevator shafts, laundry chutes, the compressors of refrigerators or freezers, and the insulated walls of large coolers.
- Trim branches at least 3 feet back from buildings.
- Rats can live in sewers, and may enter buildings through toilets or water pipes. A toilet can be rat-proofed by adding a one-way flap valve called a "rat guard" or by feeding the pipe from the toilet bowl into a wider pipe. Screen drains in basements and shower rooms with $^1/_2$" hardware cloth or welded wire.
- Repair broken sewer pipes.
- Add "rat wall" barriers underneath floors, around foundations and footings, or as linings for walls and ceilings. Use $^1/_2$" hardware cloth or welded wire. Bury it 6–12" deep, then bend the bottom edge outward into a "L" shape that sticks out one foot to prevent the rats from burrowing underneath it. Or install a concrete curtain wall.
- In double-wall construction, add a barrier between the exterior and interior wall. Nail galvanized sheet metal between the studs, joists, floor, and sill.

Rat-proofing tips for new construction:
- Fit pieces together carefully so all joints are tight. These are vulnerable areas that may warrant protection with sheet metal.
- Use concrete when building new grain storage facilities. If you need to build with wood, line the floors, walls, and ceiling with welded wire ($^1/_4$" mesh) or hardware cloth (19 gauge).
- Ground floors should be $1^1/_2$ ft. above grade, or made of concrete, stone and mortar, or brick and mortar.
- Footings should be buried to a depth of 2 ft., and be protected by "rat walls" and "termite shields," a metal cone that's attached upside-down to footings and building piers.
- Build "rat wall" barriers underneath floors, around foundations and footings, or as linings for walls and ceilings (see previous description).
- Install metal kick plates on the outside of doors, and protect door casings with sheet metal. Fasten metal thresholds to floors.
- Steel pipes embedded in concrete create a strong metal door threshold that allows the door to swing freely. This is a good option wherever heavy equipment or livestock travel through the doorway.
- Corrugated metal siding can provide many entry holes. You can butt the siding against a solid material, such as concrete or metal flashing, to seal these holes. (This may cause the metal to rust faster).
- In double-wall construction, add a barrier between the exterior and interior wall. Fireproof stops of concrete or brick are best.

Trapping strategies:
- The Norway rat is an exotic species, so please do not release any into the wild (chapter two explains why).
- Rats avoid new objects. Place baited, unset traps for up to a week, until the rats are used to the sight of the traps.
- To increase your success, trap intensively for several days. More is better. A good rule-of-thumb is to place one trap for every rat. In homes with moderate to heavy infestations, use 12–24 traps. In barns or large buildings, 50–100 traps may be in order.
- Place the traps in their runways, in dark corners, along rafters, near food sources, nests, or holes—whereever the rats are most active (look for droppings and gnaw marks). You may be able to lift some ceiling tiles to place traps in a dropped ceiling.
- Set traps at night, when rats are most active, and check them in the morning.

Live traps:
- Use a squirrel-sized cage trap (6x6x24") for adults. You may be able to capture younger rats in a chipmunk-sized cage trap (16x6x6").
- Set live traps parallel to the wall.

Lethal traps:
- The familiar mouse trap is called a "snap-back trap." There are larger models for rats. Don't try to use the mouse-sized traps because they're too small. Look for some of the newer designs, such as traps that have bait covers, which are triggered when that lid is lifted; traps with expanded "triggers" or a clothes-

pin design (shown). The design with the bait cover is more selective, while all of these newer models are easier to set than the traditional mouse trap.

- Place traps right against the wall, every 5–10 feet.
- Set snap traps in pairs. This is much more effective. Two sets work well:
  - Side-by-side, perpendicular to the wall, with the trigger snapping towards the wall
  - Parallel to the wall, with the triggers snapping to the outside (not into the center)
- Traps may be attached to rafters with nails, or to pipes with wire or "Velcro" strips.
- Bait with bacon, hot dog, liver, peanut butter, or nut meats. You can sprinkle oatmeal around the trap to make it even more attractive. You may want to put the bait on the bottom of the trigger, which increases the chance that the rats will spring the trap.
- To protect young children and pets, place traps in bait stations, a cage trap with 1x2" mesh, a coffee can with both ends cut out, or in PVC pipe (remember to test that the trap will spring within its container). Alternatively, keep your pets locked in a safe room at night and don't release them until you've sprung all of the traps.
- Body-gripping trap, #55. Use a one-way trigger to increase the selectivity of the trap.
- In severe situations, glue boards may be needed as an additional tool to knock down rat populations quickly. In general, snap-back traps are preferred; they are often as effective and are more humane. If using glue boards, set them in protected areas, such as within a dropped ceiling. Check them frequently (at least every twelve hours) and kill any captured rats by stunning them. Do not leave dead rats to rot on glue boards because the carcasses will stink and likely attract other pests.
- Wildlife rehabilitators may appreciate donations of rats, which are used to feed some snakes, birds of prey, and other animals. Be sure that no poisons (rodenticides, poisonous tracking powder) have been used in the building during previous control efforts. You can double-bag the rats and freeze them.

Other lethal techniques, for NWCOs with a commercial pesticide applicator license:

- Poisons (in various forms, such as baits, fumigants, and tracking powder) can be effective and may be warranted in some situations. Rodenticides can be hazardous to children, pets, and animals that eat poisoned rats. The rats may die in walls and stink, while providing a fine breeding place for flies. Trapping is often a better solution.
- Rats are generally cautious when approaching a new food, including poison baits. They sample just a bit at first, and it takes several days for them to overcome their fear. Nor is any bait a universal favorite. Young rats may imitate their mother's food preferences, so if their mother avoids poison baits, the young may, too. This can lead to bait shyness in large populations of rats. (This is why testing various baits and prebaiting with nontoxic baits is so helpful in controlling rats.)
- There's a fair amount to consider when using rodenticides. You'll learn the details during your pesticide applicator training, and can also refer to the Norway rat chapter in *Prevention and Control of Wildlife Damage* (for full citation, see the resource list).

Preferred killing methods:

- Lethal traps
- CO_2 chamber
- Shooting, using an air rifle or .22 caliber rifle

Acceptable killing methods:

- Stunning and chest compression
- Pesticides (with the proper license)

Control strategies that don't work well or aren't legal in New York:

- Ultrasonic and electromagnetic devices don't work against rats. (Loud or unusual noises will frighten them and may drive them off for a short time.)
- Mothballs and ammonia don't do much, either. Ammonia isn't a registered pesticide in New York, and mothballs can only be used by NWCOs who also have a commercial pesticide applicator license.
- Cats may kill some rats, but the rats may also kill the cat, especially if it's vastly outnumbered. Other predators that kill rats include snakes, owls, dogs, coyotes, and birds of prey. They'll help to reduce rat populations but shouldn't be relied on as the sole source of control. You may wish to encourage any predators to stay in the area by providing roost sites, for example.