

# CHAPTER 4

## WILD RODENTS

### LEARNING OBJECTIVES

After completely studying this chapter, you should:

- Be able to identify common wild rodent pests.
- Know the habitats, habits, and life cycles of wild rodent pests.
- Be able to describe situations in which wild rodents are considered pests.
- Know the public health concerns and precautions to take when attempting to control wild rodents.
- Know the lethal and non-lethal methods of wild rodent control and management.

Though rats and house mice are the rodents most commonly associated with urban environments, other “wild” rodents may also become pests when their activity damages valuable landscape plants, gardens, or lawns, or when they invade buildings. **Tree squirrels** commonly store food and find shelter in attics and garages. The burrowing activity of **ground squirrels, chipmunks, woodchucks,** and sometimes **muskrats** can cause significant damage in lawns, golf courses, homes, and gardens. **Voles** are known to cause significant damage to agricultural crops and often cause girdling damage to valuable landscape plants.

A variety of lethal and non-lethal techniques—including exclusion, habitat modification, and trapping—are available that may effectively control these pests.

### WILD RODENTS AS DISEASE CARRIERS

Wild rodents, like domestic rodents, are associated with the spread of disease. Category 7D pest control operators are at a particular risk because their work often brings them in contact with rodents, their droppings, urine, and nests, all of which are potential disease sources. One particular respiratory disease, hantavirus pulmonary syndrome (HPS), is an infrequent but often fatal disease that can be easily prevented. The wild rodents known to carry the disease are usually found in rural areas. However, when conditions are right, such as easily available food, water, and shelter, these rodents can be found in cities and in homes. The proper prevention techniques need to be applied to limit their contact with people.

### HANTAVIRUS PULMONARY SYNDROME (HPS)

An outbreak of HPS occurred in the southwestern United States in 1993. Since that time, cases of HPS have been reported in over half of the lower 48 states. Two wild rodents found in Michigan have been identified as carriers of the type of hantavirus that cause HPS in the United States. They are the deer mouse (*Peromyscus maniculatus*) and the white-footed mouse (*Peromyscus leucopus*). Other known carriers, the cotton rat (*Sigmodon hispidus*) and the rice rat (*Oryzomys palustris*) are more common in the southern United States. ***It is not known whether other rodent species are hosts to other types of hantaviruses. Therefore, avoiding close contact with rodents in general is advised. Pest control operators should treat all rodents as if they may be infected.***

## The Deer Mouse

The deer mouse, in particular, has been identified as a carrier of the HPS-causing hantavirus. The deer mouse body is about 2 to 3 inches long with a tail that adds another 2 to 3 inches. It is often described as a “cute” mouse with big ears and big eyes. They range in color from gray to reddish brown, depending on age. The underbelly is always white and the tail has sharply defined white sides. Deer mice are found almost everywhere in North America. They are frequently found in Michigan woodlands.



Figure 4.1. Deer mouse, *Peromyscus maniculatus*  
(L.L. Master, Mammal Images Library of the American Society of Mammalogists)

## The White-footed Mouse

The white-footed mouse has also been identified as a carrier of the HPS-causing hantavirus. It is often hard to distinguish from the deer mouse. The body is about 4 inches long and the tail is normally shorter than the body (about 2 to 4 inches long). These mice range from pale brown to reddish brown with a white underbelly and white feet. White-footed mice prefer wooded and brushy areas, although sometimes they are found in more open ground.

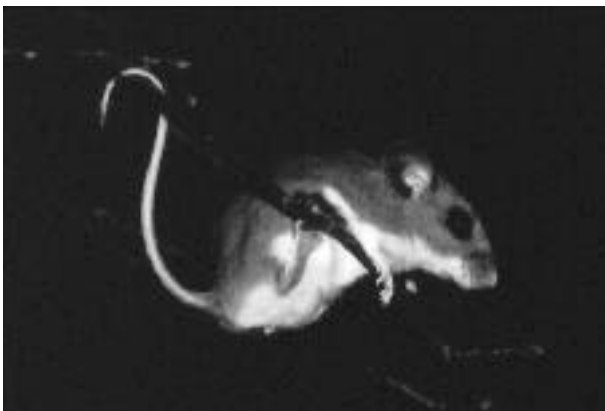


Figure 4.2. White-footed mouse, *Peromyscus leucopus*  
(L.L. Master, Mammal Images Library of the American Society of Mammalogists)

## How is Hantavirus Transmitted?

Transmission of the HPS-causing hantavirus can happen anywhere that infected rodents have infested. These rodents shed the virus in their urine, droppings, and saliva. The virus is mainly transmitted to people when they breathe in air contaminated with the virus. This happens when fresh rodent urine, droppings, or nesting materials are stirred up and tiny droplets containing the virus get into the air in a process known as aerosolization. Other possible but less common means of transmission are being bitten by a hantavirus-carrying rodent; touching contaminated rodent urine, droppings, or saliva and then touching your nose or mouth; or eating food contaminated with virus-infected rodent urine, droppings, or saliva.

## Symptoms

Early symptoms of hantavirus include fatigue, fever, and muscle aches. These symptoms have occurred in all cases. **At the first onset of symptoms, consult a doctor immediately.** Be sure to tell the doctor you have been working around rodents. The earlier the treatment in an intensive care unit, the greater the chance of recovery. Other possible early symptoms, appearing in about half of HPS patients, include headaches, dizziness, chills, and/or abdominal problems such as nausea, vomiting, diarrhea, and abdominal pain. These early symptoms may occur within one to five weeks after exposure.

Late symptoms of HPS occur 4 to 10 days later. Symptoms include coughing, shortness of breath, a tight feeling around the chest, and a suffocating feeling as lungs fill with fluid.

## Prevention

Any activity that puts a person in contact with rodent droppings, urine, or nest materials puts him/her at risk for HPS. These activities include opening up cabins or sheds, or cleaning outbuildings that have been closed during the winter, such as barns, garages, or storage facilities for farm and construction equipment. These activities encourage disease transmission by bringing people into direct contact with rodents or their droppings or by “stirring up the dust” so they then inhale the virus. Hikers and campers are also at risk for exposure when they use infested trail shelters or camp in other rodent habitats.

Overall, the chance of being exposed to hantavirus is greatest for people who work, play, or live in closed spaces where rodents are actively living. Pest control operators who work in crawlspaces under houses or other enclosed areas inhabited by rodents are at a particular risk. Research shows that many people who have become ill with HPS got the disease after having been in frequent contact with rodents and/or their droppings for some time. Also, many people who became ill reported that they had not seen rodents or their droppings at all. Therefore people living or working in areas where the carrier rodents such as the deer mouse are known to live should take sensible precautions before doing any of the activities described above—even when they don’t see the

rodents or their droppings. Some tips for preventing HPS:

- Put on latex rubber gloves before working or cleaning up in suspected rodent areas.
- Don't stir up dust by sweeping up or vacuuming droppings, urine, or nest materials. Instead, thoroughly wet contaminated areas with detergent or liquid to deactivate the virus. Most general-purpose disinfectants and household detergents are effective. However, a hypochlorite solution prepared by mixing 1 1/2 cups of household bleach in 1 gallon of water may be used in place of a commercial disinfectant. When using the chlorine solution, avoid spilling the mixture on clothing or other items that may be damaged.
- Once everything is wet, take up contaminated materials with a damp towel, then mop or sponge the area with disinfectant.
- Spray dead rodents with disinfectant, then double-bag along with all cleaning materials and bury or burn—or throw out in an appropriate waste disposal system. If burning or burying isn't feasible, contact your local or state health department about other disposal methods.
- Finally, disinfect gloves before taking them off with a disinfectant or soap and water. After taking off the clean gloves, thoroughly wash hands with soap and warm water.
- When going into cabins or outbuildings (or work areas) that have been closed for awhile, open them up and air out before cleaning.

Carefully wetting down dead rodents and areas where rodents have been will reduce the chance the virus will get into the air. Use of disinfectants such as ordinary household bleach and other fat solvents will actually kill the virus by destroying its outer lipid (fatty) envelope.

Some further precautions recommended by the Centers for Disease Control (CDC) for pest control workers and other persons frequently exposed to rodents are:

- A baseline serum sample, preferably drawn at the time of employment, should be available for all persons whose occupations involve frequent rodent contact. The serum sample should be stored at -20 degrees C.
- Workers in potentially high-risk settings should be informed about the symptoms of the disease and be given detailed guidance on prevention measures.
- Workers who develop a febrile or respiratory illness within 45 days of the last potential exposure should immediately seek medical attention and inform the attending physician of the potential occupational risk of hantavirus infection. The physician should contact local health authorities promptly if hantavirus-associated illness is suspected. A blood sample should be obtained and forwarded with the baseline serum through the state health department to the CDC for hantavirus antibody testing.
- Workers should wear a half-face air-purifying (or negative pressure) respirator or PAPR equipped

with the N-100 filters when removing rodents from traps or handling rodents in the affected area. (Please note: the HEPA classification recently has been discontinued. Under the new classification system, the N-100 filter type is recommended. Use of the N-100 filter should provide the same protection as the previous HEPA filter.) Refer to the federal Occupational Safety and Health Administration (OSHA) directive "OSHA Directives: CPL 2-0.120-Inspection Procedures for Respiratory Protection Standard."

- Respirators (including positive-pressure types) are not considered protective if facial hair interferes with the face seal because proper fit cannot be assured. Respirator use practices should be in accord with a comprehensive user program and should be supervised by a knowledgeable person.
- Workers should wear rubber or plastic gloves when handling rodents or handling traps containing rodents. Gloves should be washed and disinfected before removing them, as described above.
- Traps contaminated by rodent urine or feces or in which a rodent was captured should be disinfected with a commercial disinfectant or bleach solution. Dispose of dead rodents as described above.

For updates on the spread of hantavirus and recommendations for prevention and risk reduction, contact the CDC ([www.cdc.gov](http://www.cdc.gov)).

## VOLES

Voles (*Microtus* spp.) are also called meadow mice or field mice. They are compact rodents with stocky bodies, short legs, and short tails. Their eyes are small and their ears partially hidden. They are usually brown or gray.

Voles eat a wide variety of plants, most frequently grasses. In late summer and fall, they store seeds, tubers, and bulbs. They eat bark at times, primarily in fall and winter, and will eat crops, especially when their populations are high.

Voles are active day and night year round. They do not hibernate. Home range is usually 1/4 acre or less. They construct many tunnels and surface runways with numerous burrow entrances. A single burrow system may contain several adults and young.

Voles may breed throughout the year but most commonly in spring and summer. In the field they have one to five litters per year with average litter sizes of three to six. Life spans are short, ranging from 2 to 16 months. Large population fluctuations are characteristic of voles. Population levels generally peak every two to five years; however, these cycles are not predictable.

Voles may cause extensive damage to orchards, ornamentals, and tree plantings by girdling seedlings and mature trees. Girdling damage usually occurs in fall and winter. Field crops may be damaged or destroyed by voles. Voles eat crops and also damage them when they build extensive runways and tunnel systems.

Girdling and gnaw marks do not necessarily indicate the presence of voles because other animals, such as rab-

bits, may cause similar damage. Vole girdling can be differentiated from girdling by other animals by the non-uniform gnaw marks. They occur at various angles and in irregular patches. Rabbit gnaw marks are larger and they usually neatly clip the branches off, leaving slanting cuts. Examine girdling damage and accompanying signs (feces, tracks, and burrow systems) to identify the animal causing the damage. Voles are classified as non-game mammals and can be controlled without a permit when causing damage. However, check with local and state wildlife agencies for details regarding acceptable control methods.



**Figure 4.3. Meadow vole, *Microtus pennsylvanicus***  
(L.L. Master, Mammal Images Library of the American Society of Mammalogists)

## Control and Management of Voles

### Exclusion

Large-scale fencing of areas is not a cost-effective method of controlling voles. Use hardware cloth cylinders to exclude voles from seedlings and young trees.

- Use hardware cloth mesh that is  $\frac{1}{4}$  inch or less in size. Bury the wire 6 inches to keep voles from burrowing under the cylinder.
- Drift fences with pit traps may be used to monitor populations and can indicate when voles are migrating to crops, orchards, etc.

### Habitat Modification

Cultural and habitat modification practices can reduce the likelihood and severity of vole damage.

- Eliminate weeds, ground cover, and litter in and around crops, lawns, and cultivated areas.
- Lawn and turf should be mowed regularly.
- Mulch should be cleared 3 feet or more from the bases of trees.
- Soil tillage is effective in reducing vole damage because it removes cover, destroys existing runway-burrow systems, and kills some voles outright. Because of tillage, annual crops tend to have lower vole population levels than perennial crops.

### Repellents

Repellents using thiram (also a fungicide) or capsaicin (the “hot” in hot peppers) as an active ingredient are registered for meadow voles. These products may afford short-term protection, but their effectiveness is uncertain. Check with the Michigan Department of Agriculture for availability.

### Rodenticide

Zinc phosphide is the most commonly used toxicant for vole control. It is a single-dose toxicant available in pelleted and grain bait formulations and as a concentrate. Zinc phosphide baits generally are broadcast at rates of 6 to 10 pounds per acre, or are placed by hand in runways and burrow openings. Zinc phosphide baits are potentially hazardous to ground-feeding birds, especially waterfowl. Placing bait into burrow openings may reduce this hazard.

Anticoagulant baits are also effective in controlling voles. Anticoagulants are slow-acting toxicants requiring from 5 to 15 days to take effect. Multiple feedings are needed for most anticoagulants to be effective. Check with the Michigan Department of Agriculture to see which anticoagulant baits are registered.

In addition to broadcast and hand placement, anticoagulant baits also can be placed in various types of bait containers. Water-repellent paper tubes with an anticoagulant bait glued to the inside surface make effective disposable bait containers. Bait containers protect bait from moisture and reduce the likelihood of non-target animals and small children consuming bait.

### Trapping

Trapping is not effective for controlling large vole populations. Mouse snap traps can be used to control a small population by placing the traps perpendicular to the runway with the trigger end in the runway. A peanut butter-oatmeal mixture or apple slices make good bait. Many vole species are easiest to trap in fall and late winter.

Voles rarely invade houses. In the event they do, they can be controlled by setting snap traps or live traps as you would for house mice.

## TREE SQUIRRELS

Tree squirrels are found in forest areas throughout most of the United States. Many species have adapted well to suburban and city life. Occasionally, these squirrels enter buildings and cause damage or disturbance. The most common species that become pests are the gray squirrel, red squirrel, flying squirrel, and fox squirrel.

Tree squirrels usually build their nests in trees. They also may store food and find shelter in attics and garages. Probably the primary way squirrels become pests is by scrambling and scratching inside attics and in wall voids. They may travel on power lines and short out transformers. They like to gnaw on wires.

The legal status of squirrels varies greatly with geographic area and species. Many are classified as game animals. Some are protected. Be sure to check with local game conservation officers if you plan any kind of lethal control or trapping program.



Figure 4.4. Gray squirrel, *Sciurus* spp.



Figure 4.5. Fox squirrel, *Sciurus niger*

## Control and Management of Tree Squirrels

### Exclusion

**Squirrel-proofing.** Step one in eliminating a squirrel problem in a building is to find out where the squirrels are entering. Remember that squirrels will be coming and going each day. Common points of entry include damaged attic louvers, ventilators, soffits, joints of siding, knotholes, openings where utility wires or pipes enter, chimneys, and flashing. Squirrels may gnaw directly through siding and shingles, too.

- Use heavy gauge 1/2-inch hardware cloth or sheet metal to seal most openings.
- Make other suitable repairs as for rat-proofing.
- Squirrels can be stopped from travelling on wires by installing 2-foot sections of 2- to 3-inch diameter plastic pipe. Split the pipe lengthwise, spread the opening apart, and place it over the wire. The pipe

will rotate on the wire and the squirrel will tumble off. **Do not attempt to install on high-voltage wires. Contact your local electricity/utility company for assistance.**

Squirrels often use overhanging branches as highways to rooftops. Tree branches should be trimmed back 10 feet from the building. If the branches can't be trimmed, a 2-foot-wide band of metal fastened around a tree 6 to 8 feet off the ground keeps squirrels from climbing up the tree and jumping to the building.

### Repellents

Naphthalene has been used (in the same way as for bats) to keep squirrels out of attics, particularly in summer homes and camps that are unoccupied in winter. There is at least one sticky repellent product for squirrels. It is similar to the sticky repellents used in bird control. Apply it to ledges, gutters, windowsills, and the like to keep squirrels off.

### Trapping

Live trapping with box or wire traps can be used to remove one or a few squirrels from a building. Traps should be left open and unset for a few days, surrounded by bait, so that the squirrels get used to them. Good baits include peanuts, nutmeats, peanut butter, whole corn, sunflower seeds, and rolled oats. Good trap locations include on the roof, at the bases of nearby trees, or in the attic itself.

Squirrels are nasty biters—handle them carefully. Experts differ on whether squirrels should be released or killed. If they are released, do so at least 5 miles away so that they do not return.

Where lethal control is permitted, rat snap traps are effective against the smaller squirrel species and can be used in attics. The bait should be tied to the trigger and the trap nailed or wired to a beam.

## GROUND SQUIRRELS AND CHIPMUNKS

A number of species of squirrels and chipmunks occasionally become pests in and around buildings. The major concern is that they burrow around foundations, in lawns, on golf courses, and in gardens. Ground squirrels, in particular, can have extensive burrows with large mounds, especially along roads and ditch banks. On occasion, burrows beneath buildings have caused structural damage.

One species of ground squirrel common to Michigan is the 13-lined ground squirrel (*Spermophilus tridecemlineatus*). It is a slender, rat-sized rodent about 10 inches long (including a tail of 3 inches). As its name implies, 13 stripes run the length of this ground squirrel's body. Five of the light-colored lines break up into a series of spots as they progress down the back and over the rump. Ground squirrels can transmit diseases (such as tularemia and plague) to people, particularly when populations are dense.



Figure 4.6. Thirteen-lined ground squirrel, *Spermophilus tridecemlineatus* (G.L. Twiest [top] and M.D. Carleton [below], Mammal Images Library of the American Society of Mammalogists)

The chipmunk is a small, brownish, ground-dwelling squirrel. The eastern chipmunk (*Tamias striatus*) is typically 5 to 6 inches long and has two tan and five blackish longitudinal stripes on its back, and two tan and two brownish stripes on each side of its face. The tail is 3 to 4 inches long and hairy but not bushy.

Both ground squirrels and chipmunks are active during the day and are easily seen when foraging. But they spend much of their time in their burrows. In winter, ground squirrels hibernate and chipmunks go underground and stay inactive. In some areas, ground squirrels will go into summer hibernation when temperatures are high.

Ground squirrels are primarily vegetarians, feeding on grasses. When vegetation dries up, they switch to seeds, grains, and nuts. Chipmunks eat both plant and animal material, from seeds, nuts, insects, and worms to songbirds and frogs.

## Control and Management of Ground Squirrels and Chipmunks

### Ground Squirrels

Control is usually required only in severe infestations. Several important steps must be taken if a control or management program is to succeed:

- Correctly identify the species causing the problem.
- Alter the habitat, if possible, to make the area less attractive to the squirrels.
- Use the most appropriate control method.
- Establish an inspection or monitoring program to detect reinfestation.

Ground squirrels are generally found in open areas. However, they usually need some kind of cover to survive. Removing brush piles and debris will make the area less attractive to the squirrels and will facilitate detection of burrows and improve access during the control program. Ground squirrels can be controlled with traps, rodenticides, and fumigants. Exclusion is expensive and generally practical only in situations where cost is not a primary concern. Certain cultural methods, such as deep soil cultivation, which destroys burrows and changes the habitat, will discourage activity in fields and gardens.



Figure 4.7. Ground squirrel, *Spermophilus* spp.

### Habitat Modification

Certain cultural methods will discourage ground squirrel activity in fields and gardens:

- Deep soil cultivation destroys burrows.
- Deter ground squirrels and other small mammals from feeding on crop seeds and seedlings by providing them with an alternative food source such as cracked corn.
- Plant crops as early as possible, before the squirrels emerge from hibernation, to reduce losses to seeds and seedlings.

### Trapping

Trapping is a practical means of controlling ground squirrels in limited areas where numbers are small. Live traps are effective but present the problem of disposal of a live squirrel. Because squirrels can carry disease, check state and local laws regarding their release at some new location.

For the smaller species, rat snap traps can be effective.

- Place traps near burrow entrances or runs and bait with nuts, oats, barley, or melon rind.

- Place traps under a box if any non-targets might be killed in the trap.

## Rodenticides

Rodenticides are the most cost-effective way of controlling large populations of ground squirrels. A number of products are registered for this use. Grain baits are most effective when squirrels are feeding on grains and seeds.

- Place rodenticides in burrows or in protected bait stations according to the label directions.

## Fumigation

Ground squirrels can also be killed by gassing their burrows. Aluminum phosphide tablets or smoke cartridges are most commonly used. Fumigation is most effective when soil moisture is high; moisture helps seal the tiny cracks in the burrow walls. Fumigation is not effective during periods of hibernation because the squirrels plug their burrows. Spring is normally considered to be the best time for burrow fumigation. Treat and plug all burrows, wait 24 to 48 hours, and re-treat any burrows that have reopened. Repeat this process until all burrows stay closed.

Fumigation is not a good choice adjacent to buildings because of the risk that the fumigant gas could find its way into the structure. Also do not use fumigants in places where people, livestock, or other non-target animals will come in contact with the gases. Aluminum phosphide is a restricted-use pesticide and can be applied only by a certified applicator. Be sure to read and follow all label instructions.



Figure 4.8. Chipmunk, *Tamias* spp.

## Chipmunks

Only rarely do chipmunks become a serious pest problem. When chipmunks are present in large numbers, they can cause structural damage by burrowing under patios, stairs, retention walls, or foundations. They may also consume flower bulbs, seeds, or seedlings as well as bird seed, grass seed, and pet food that is not stored in rodent-proof storage containers. In most cases, lethal control is unnecessary. Altering the habitat may cause the chipmunks to move.

## Exclusion

- Chipmunk-proof the building to prevent entrance. Use 1/4-inch mesh, caulking, or other appropriate materials to close openings where they could gain entry.
- Remove objects such as logs, stones, and debris close to a structure that may provide an attractive denning environment.
- Hardware cloth may also be used to exclude chipmunks from flower beds. Seeds and bulbs can be covered by 1/4-inch hardware cloth and the cloth covered with soil. The cloth should extend at least 1 foot past each edge of the planting.

## Trapping

Live trapping and relocating chipmunks (where permitted) is considered a humane method of control. Effective baits include peanut butter, nuts, sunflowers, seeds, oats, bacon, and apple slices. Relocation should be done into forested areas at least 5 miles from the trap site.

Rat snap traps can also be used effectively. Traps should be placed at den entrances and baited with an apple slice or perhaps with some peanut butter. Seeds and nuts should not be used because they will attract ground-feeding birds.

Because chipmunk burrows are long, difficult to find, and often near buildings, burrow fumigation is not usually a recommended control tactic.

## WOODCHUCKS

The woodchuck (*Marmota monax*) is a member of the squirrel family. It is also known as the groundhog. It is usually brownish gray with a compact, chunky body supported by short, strong legs. Its forefeet have long, curved claws that are well adapted for digging burrows. Its tail is short, well furred, and dark brown. The total length of the head and body is 16 to 20 inches and the tail is 4 to 7 inches long. Males are usually slightly larger than females. Like other rodents, woodchucks have white, chisel-like incisor teeth. Though they are slow runners, woodchucks are alert and scurry quickly to their dens when they sense danger.

In general, woodchucks prefer open farmland and the surrounding wooded or brushy areas adjacent to open land. Burrows commonly are located in fields and pastures; along fencerows, stone walls, and roadsides; and near building foundations or the bases of trees. Woodchuck burrows are distinguished by a large mound of soil at the main entrance. The main opening is approximately 10 to 12 inches in diameter. Each burrow system has two or more entrances. Some secondary entrances are dug from below the ground and do not have mounds of earth beside them. They are usually well hidden and sometimes difficult to locate. The burrow system serves as home to the woodchuck for mating, weaning young, hibernating in winter, and protection when threatened.

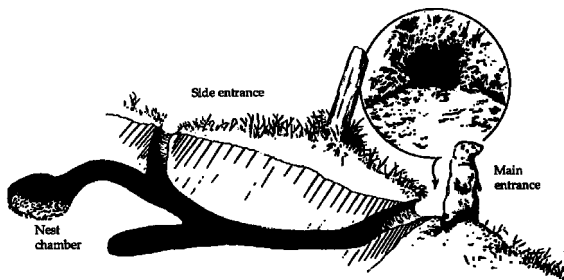


Figure 4.9. Burrow system of the woodchuck

Woodchucks prefer to feed in the early morning and evening hours. They eat vegetables, grasses, and legumes. Preferred foods include soybeans, beans, peas, carrot tops, alfalfa, clover, and grasses.

On occasion the woodchuck's feeding and burrowing habits conflict with human interests. Damage often occurs on farms, in home gardens, orchards, and nurseries, and around buildings. Damage to crops and structures can be costly and expensive. Gnawing on underground power cables has caused electrical outages. Fruit trees and ornamental shrubs are damaged by woodchucks as they gnaw or claw woody vegetation. Their burrowing, feeding, and gnawing habits may cause aesthetic damage to lawns, gardens, golf courses, etc. The most common methods of controlling woodchucks include exclusion, fumigants, and trapping.



Figure 4.10. Woodchuck, *Marmota monax*  
(G.L. Twiest, Mammal Images Library of the American Society of Mammalogists)

## Control and Management of Woodchucks

### Exclusion

Fences can help reduce woodchuck damage. Woodchucks, however, are good climbers and can easily scale wire fences if precautions are not taken.

- Fences should be at least 3 feet high and made of heavy woven wire.

- To prevent burrowing under the fence, bury the lower edge 10 to 12 inches in the ground or bend the lower edge at an L-shaped angle leading outwards and bury it in the ground 1 to 2 inches.
- An electric wire may be placed 4 to 5 inches off the ground and the same distance outside the fence to prevent climbing and burrowing.
- Bend the top 15 inches of a wire fence outward at 45 degree angle to prevent climbing over the fence.

Fencing is the most useful in protecting home gardens and has the added advantage of keeping rabbits, dogs, cats, and other animals out of the garden area. In some instances an electric wire alone, placed 4 to 5 inches above the ground, has deterred woodchucks from entering gardens. Vegetation in the vicinity of any electric fence should be removed regularly to prevent the system from shorting out.

### Fumigants

A common means of woodchuck control is the use of commercial gas cartridges. They are placed in burrow systems and all entrances are sealed. Directions for gas cartridge use are on the label—they should be carefully read and closely followed. Gas cartridges are ignited by lighting a fuse, so do not use gas cartridges in burrows located under wooden sheds, buildings, or near other combustible materials because of the potential fire hazard. Avoid prolonged breathing of fumes. Gas cartridges are general-use pesticides and are available from local farm supply stores.

Aluminum phosphide is a restricted-use pesticide that can be applied only by a certified applicator. Place two to four tablets deep into the main burrow. Plug the burrow openings with crumpled newspapers and then pack the opening with loose soil. All burrows must be sealed tightly, but avoid covering the tablets with soil. The treatment site should be inspected 24 to 48 hours later and opened burrows should be retreated.

Aluminum phosphide in the presence of moisture in the burrow produces hydrogen phosphide (phosphine) gas. Therefore, soil moisture and a tightly sealed burrow system are important. The tablets are approved for outdoor use on non-cropland and orchards for burrowing rodents. Storage of unused tablets is critical—they must be kept in their original container in a cool, dry, locked, and ventilated room. They must be protected from moisture, open flames, and heat.

### Trapping

Trapping with live traps may be used to reduce woodchuck damage, especially in or near buildings. Bait traps with apple slices or vegetables such as carrots and lettuce, and change baits daily. Locate traps at main entrances or on major travel lanes. Placing guide logs on each side of the path between the burrow opening and the trap will help funnel the animal into the trap. Check all traps twice daily, morning and evening, so that captured animals may be quickly removed. A captured animal may be relocated to an area with suitable habitat

where no additional damage can be caused. Disposing of the animal through lethal means—i.e., shooting, lethal injection by a veterinarian, etc.—might also be considered.

## Shooting

If shooting can be accomplished safely and legally, it is an effective means of keeping woodchuck populations low. Generally a .22-caliber centerfire rifle is used. Shooting is not recommended in populated areas. Check local regulations before discharging any firearm.

## MUSKRATS

The muskrat (*Ondatra zibethicus*) is a large rodent that spends its life in aquatic habitats and is well adapted for swimming. The fur varies from dark tan to reddish brown, dark brown, and black. The belly fur is generally light gray to silver to tan. Its large hind feet are partially webbed, and its laterally flattened tail is almost as long as its body. The muskrat is stocky-looking with small eyes and very short, rounded ears. Its front feet, which are much smaller than its hind feet, are adapted primarily for digging and feeding. The overall length of adult muskrats is usually from 18 to 24 inches. Large males, however, will sometimes be more than 30 inches long, 10 to 12 inches of which is tail.



Figure 4.11. Muskrat, *Ondatra zibethicus*  
(R.B. Forbes, Mammal Images Library of the American Society of Mammalogists)

Tail mark sometimes shows

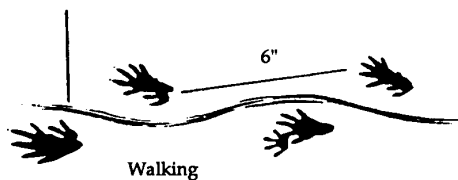


Figure 4.12. Muskrat tracks

Muskrats can live almost anywhere where water and food are available year round—streams, ponds, lakes, marshes, canals, roadside ditches, swamps, beaver ponds, and other wetland areas. In shallow water areas with plentiful vegetation, they use plant materials to construct houses, generally conical or mound-shaped (Figures 13 and 14). Elsewhere, they prefer bank dens, and in many habitats, they construct both bank dens and houses of vegetation. Both the houses of vegetation and the bank burrows or dens have several underwater entrances via “runs” or trails. Muskrats often have feeding houses, platforms, and chambers that are somewhat smaller than houses used for dens. Muskrats prefer to feed on aquatic plants but will sometimes leave the pond to feed on field crops. They are also known to eat frogs, mussels, turtles, crayfish, and fish in ponds where vegetation is scarce.

Burrowing activity is the source of the greatest damage caused by muskrats. They damage pond dams, floating Styrofoam marinas, docks and boathouses, and lake shorelines. In waterfowl marshes, large populations of feeding muskrats may eliminate much of the vegetation. One way to observe early burrowing in farm ponds or reservoirs is to walk along the edge of the dam or shorelines when the water is clear and look for “runs” or trails from just below the normal water surface to as deep as 3 feet. If no burrow entrances are observed, look for droppings along the bank or on logs or structures that a muskrat can easily climb on. Sometimes muskrat dens are exposed when water levels drop—burrows can be filled in at these times.

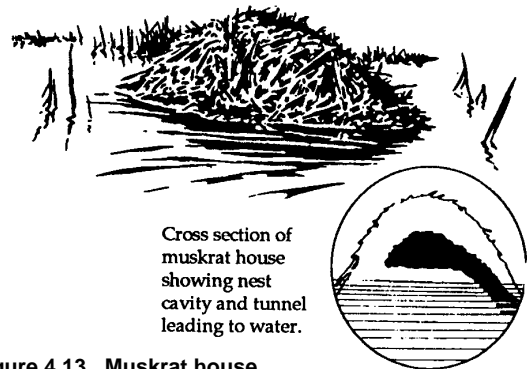
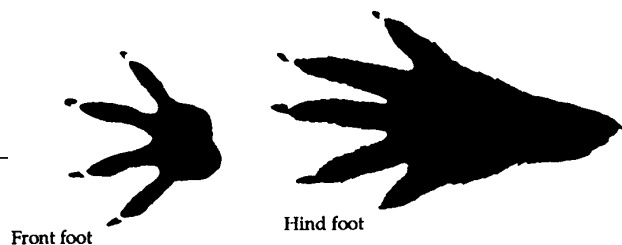


Figure 4.13. Muskrat house





**Figure 4.14. Muskrat emerging from house**  
(R.B. Forbes, Mammal Images Library of the American Society of Mammalogists)

## Control and Management of Muskrats

### Exclusion

Muskrats in some situations can be prevented from digging into farm pond dams by stone riprapping of the dam. Serious damage can be prevented by constructing dams to the following specifications:

- The inside face of the dam should be built at a 3 to 1 slope with a top width of not less than 8 feet, preferably 10 to 12 feet.
- The normal water level in the pond should be at least 3 feet below the top of the dam and the spillway should be wide enough that heavy rainfalls will not increase the level of the water for any length of time (see Figure 4.15).

These specifications are often referred to as overbuilding, but they will generally prevent serious damage from burrowing muskrats.

Fencing can be used in situations where muskrats may be leaving a pond or lake to cut valuable garden plants or crops.

### Habitat Modification

The best ways to modify habitat are to eliminate aquatic or other suitable foods eaten by muskrats, and where possible, to construct farm pond dams. If farm pond dams or levees are being damaged, one of the ways that damage can be reduced is to draw the pond down at least 2 feet below normal levels during the winter, then fill dens, burrows, and runs, and riprapp the dam with stone. Once the water is drawn down, trap or otherwise remove all muskrats.

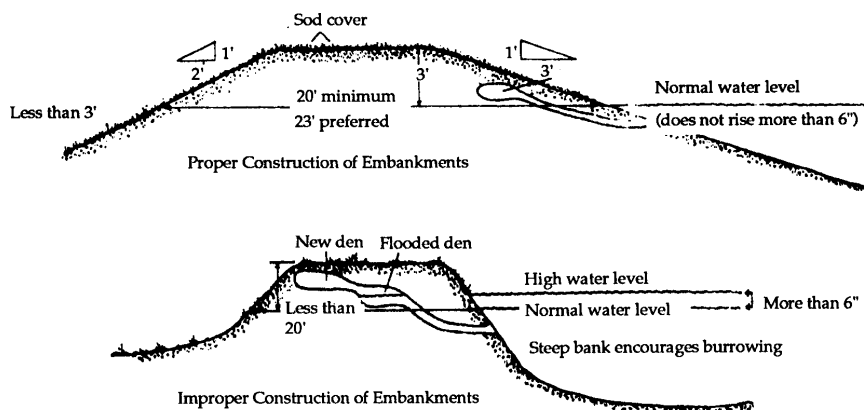
### Rodenticides

Zinc phosphide as a 63 percent concentrate is federally registered for muskrat control. It is a restricted-use pesticide for making baits. Zinc phosphide baits for muskrats generally are made by applying a vegetable oil sticker to cubes of apples, sweet potatoes, or carrots; sprinkling on the toxicant, and mixing thoroughly. The bait is then placed on floating platforms, in burrow entrances, or on feeding houses. Use caution when mixing and applying baits treated with zinc phosphide. Follow label instructions carefully.

Some anticoagulant baits, similar to those registered for domestic rodent control, may be available for controlling muskrats. These baits are often made of paraffin mixed with grain and pesticide. They are placed in the burrows or feeding houses, or the pesticide may be in a grain mixture placed inside floating bait boxes.

### Trapping

Muskrats are probably the easiest aquatic furbearer to trap. A special type of body-gripping trap is available for muskrats that will kill them quickly and humanely in 6 inches of water or more. A stake is used to set the trap in place. Leghold traps are also available for catching muskrats. These traps can be set in the run, the house or den entrance, or even under a feeding house. Muskrats are usually caught in one or two nights.



**Figure 4.15. Proper dam construction can reduce muskrat damage to the structure.**

CHAPTER  
4

# Review Questions

## Chapter 4: Wild Rodents

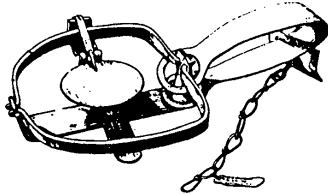


Figure 4.16. Body-gripping trap (top) and leghold trap (below)

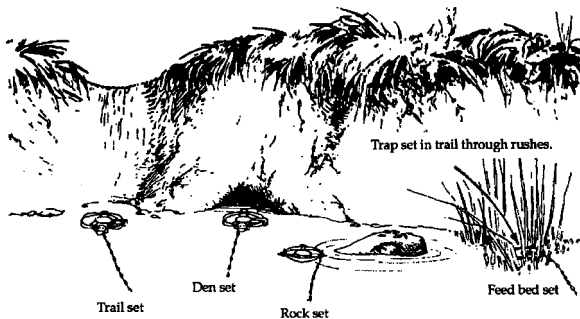


Figure 4.17. Four leghold trap sets for muskrats. Note: all traps are set under water. Chains are wired to anchors in deep water.

### Shooting

Where it can be done safely and legally, shooting may be used to eliminate one or two individuals in small farm ponds.

### SUMMARY

Wild rodents become pests when they damage crops and landscape plants and invade buildings. Exclusion is often the preferred method for controlling the damage caused by these pests. Use of rodenticides may be more practical to control some of the smaller rodent pests such as voles, but care must be taken to protect non-target animals and children from consuming bait. Live trapping is a more practical method for controlling larger rodent pests such as tree squirrels and woodchucks.

- Which is true of hantavirus pulmonary syndrome (HPS)?
  - It is difficult to prevent.
  - It is easily cured.
  - It is an infrequent but often fatal disease.
  - It primarily affects people who are very young or very old.
  - So far, it has appeared only in the southwestern United States.
- Which rodent species would most likely be carriers of the hantavirus in Michigan?
  - Deer mouse and white-footed mouse
  - Deer mouse and rice rat
  - Cotton rat and rice rat
  - Rice rat and white-footed mouse
  - Cotton rat and deer mouse
- Which are considered the *common early* symptoms of HPS infection?
  - Fatigue, fever, and chills
  - Coughing and shortness of breath
  - Rash and sore throat
  - All of the above
- Which is the correct series of steps to take when cleaning out a shed that had been closed for the winter?
  - Sweep out all debris, then disinfect the area with a bleach solution, and air out the building.
  - Put on latex gloves, wet down the area with a bleach solution, sweep out all debris, and air out the building.
  - Air out the building first, put on latex gloves, sweep out the area and disinfect with bleach.
  - Air out the building first, put on latex gloves, wet down the area with a bleach solution, then clean area by mopping or sponging with disinfectant.
  - Put on latex gloves, sweep out all debris, mop and sponge with disinfectant, then air out the building.

5. Always disinfect gloves after taking them off.
- True
  - False
6. If rodents or their droppings are not seen in crawlspaces or outbuildings, there is no danger of hantavirus infection.
- True
  - False
7. Which are precautions to take to prevent hantavirus infection?
- Wear a respirator when working in crawlspaces or other potentially rodent-infested areas.
  - Disinfect used rodent traps with a commercial disinfectant or bleach solution.
  - Dispose of dead rodents by spraying with a disinfectant and double bagging.
  - A & B.
  - All of the above.
- 8-13. Match the following to the appropriate description:
- Vole
  - Tree squirrel
  - Ground squirrel
  - Chipmunk
  - Woodchuck
  - Muskrat
- \_\_\_\_\_ 8. Also referred to as a groundhog; head and body measure 16 to 20 inches long.
- \_\_\_\_\_ 9. Also referred to as a field mouse; tail is shorter than that of a house mouse.
- \_\_\_\_\_ 10. Nests are usually built in trees; often a problem in attics and garages.
- \_\_\_\_\_ 11. Spends most of its life in aquatic habitats; overall length is usually 18 to 24 inches long.
- \_\_\_\_\_ 12. Thirteen-lined is one type; a rat-sized rodent.
- \_\_\_\_\_ 13. A type of ground-dwelling squirrel, 5 to 6 inches long; the eastern type has two tan and five blackish longitudinal stripes on its back.
14. Which is NOT true about voles?
- A vole's home range is usually about 1 acre.
  - In the field, voles have one to five litters per year with an average litter size of three to six.
  - Voles do not hibernate.
  - Voles are active day and night all year long.
  - Voles can cause extensive crop loss.
15. Vole populations are relatively stable from year to year.
- True
  - False
16. Vole damage can be distinguished by neatly clipped-off branches, uniform gnaw marks, and slanting cuts.
- True
  - False
17. Which is NOT true concerning control of voles?
- Hardware mesh 1/4 inch in size may be used to exclude voles from seedlings and young trees.
  - Large-scale fencing is an effective means of controlling voles.
  - Hardware mesh should be buried 6 inches deep to keep moles from burrowing under.
  - Fencing with pit traps may be used to monitor vole populations and indicate when voles are migrating.
  - Repellents such as thiram and capsaicin may be used to help manage voles.
18. List some habitat modifications that would help manage vole problems.
19. How may zinc phosphide and anticoagulant baits be applied to control voles? What is the advantage of using bait containers?
20. Which of the following control methods is never used against tree squirrels?
- Trimming tree branches that hang over a house
  - Squirrel-death bait blocks
  - Squirrel-proofing with 1/2-inch hardware cloth
  - Naphthalene repellent
  - Live trapping

21. What can be done to squirrel-proof a building? How can squirrels be prevented from entering buildings by climbing on wires or on tree branches?
- When populations are high and in the winter during hibernation.
  - When populations are low and in the spring when conditions are dry.
  - When burrows are located near buildings.
22. Ground squirrels can transmit plague to people.
- True
  - False
23. When necessary, and if not prohibited by law, ground squirrels can be controlled with traps, rodenticides, and fumigants.
- True
  - False
24. Release trapped squirrels or chipmunks at least \_\_\_\_\_ miles away.
- 2
  - 3
  - 5
  - 10
25. A small ground squirrel population has made burrows near a building. The best control method is:
- Fumigate in the spring when soil moisture is high.
  - Fumigate during hibernation periods.
  - Trap them.
  - Use rodenticides.
  - A & D
26. Which is the best method for controlling chipmunks?
- Fumigate in the spring when soil moisture is high.
  - Fumigate during hibernation periods.
  - Trap them.
  - Habitat alteration.
  - C & D
27. Under what circumstances might you consider fumigation for control of ground squirrels?
- When populations are high and in the spring when soil moisture is high.
  - When populations are low and in winter during hibernation.
  - When populations are high and in the winter during hibernation.
  - When populations are low and in the spring when conditions are dry.
  - When burrows are located near buildings.
28. What is the primary damage caused by woodchucks?
- Invade attics and garages.
  - Girdling young trees and landscape plants.
  - Their burrowing damages pond dams, docks, shorelines, etc.
  - Their burrowing, feeding, and gnawing habits damage lawns, gardens, golf courses, etc.
  - A&B
29. Which characterizes a woodchuck burrow?
- A large mound of earth at the main entrance, with an opening 10 to 12 inches in diameter.
  - A single burrow system containing several adults and young and numerous entrances.
  - Some secondary entrances may be hard to locate because they were dug from below ground.
  - Burrows are built along banks with several underwater entrances.
  - A & C
30. What are the specifications for building a fence to exclude woodchucks?
31. Gas cartridges are general-use pesticides that may be placed in woodchuck burrows under wooden sheds and other buildings.
- True
  - False
32. Describe the procedure for using aluminum phosphide tablets to fumigate woodchuck burrows. What precautions should be taken when using the tablets?

33. Which is NOT a correct procedure for trapping woodchucks?
- A. Bait traps with apple slices or vegetables.
  - B. Locate traps at main burrow entrances or major travel lanes.
  - C. Place guide logs to help funnel the animal into the trap.
  - D. Check the traps every 48 hours.
  - E. Release the trapped woodchuck in a suitable habitat were no additional damage can be caused.
34. What is the primary damage caused by muskrats?
- A. Invade attics and garages.
  - B. Girdling young trees and landscape plants.
  - C. Their burrowing damages pond dams, docks, shorelines, etc.
  - D. Their burrowing, feeding, and gnawing habits damage lawns, gardens, golf courses, etc.
  - E. A & B
35. Which is characteristic of muskrats?
- A. Conical houses constructed of plant material in shallow water areas.
  - B. Have feeding houses, platforms, and chambers that are smaller than houses used for dens.
  - C. Prefer to feed on aquatic plants but will sometimes leave the pond to feed on field crops.
  - D. Burrows are built along banks with several underwater entrances.
  - E. All of the above.
36. What are the specifications of a dam built to prevent muskrat damage?
37. After drawing a farm pond down at least 2 feet below the normal levels in the winter, what should be done to prevent muskrat damage?
38. Describe how baits may be used to control muskrats.
39. Describe how traps may be used to control muskrats.