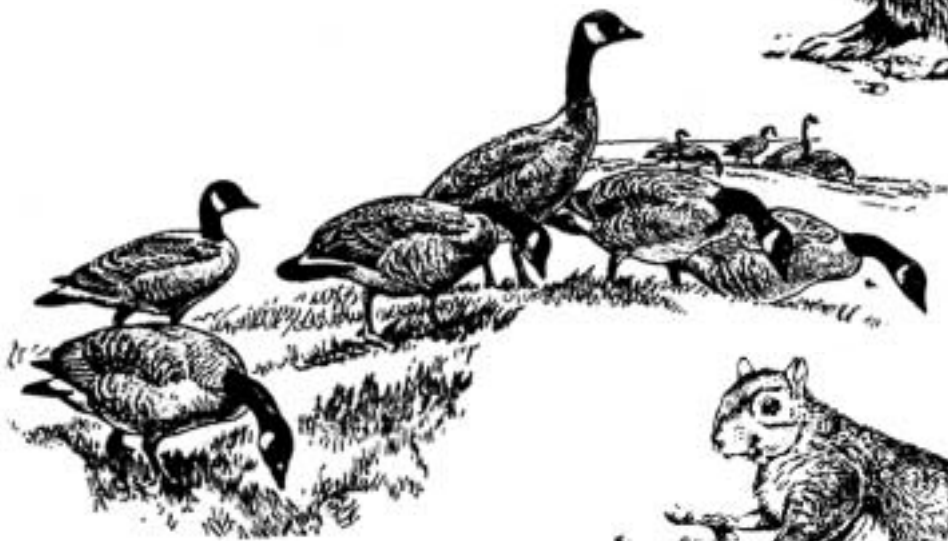
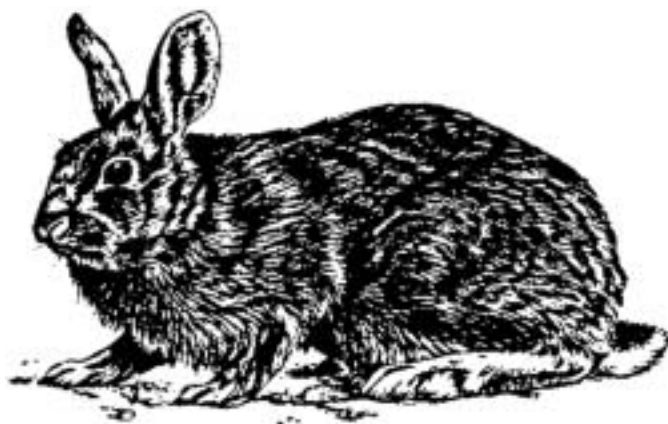




# Managing Nuisance Animals and Associated Damage Around the Home



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# Managing Nuisance Animals and Associated Damage Around the Home

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## Introduction

Managing wildlife damage is the opposite of traditional wildlife management where practices are implemented to attract wildlife. To attract wildlife, food, water and cover are made available for animals throughout the year. If unwanted wild animals are frequenting your home or garden, there is at least one source of food, water and/or cover that is attracting them. The solution is to remove or alter these resources so the area is no longer attractive. Most wildlife, like humans, are creatures of habit; thus, steps should be taken immediately upon observing damage.

When thinking through a wildlife damage problem, ask yourself the following questions:

*Is there some way to keep the animal(s) from getting to the problem site?*

Often, exclusion is the simplest, most effective solution in managing nuisance animals. This may involve using heavy-duty hardware cloth (not screen wire, because many animals can tear through screen), sheet metal, lumber, mortar or other materials. Regardless, once the animals are driven away and entrances closed, the problem is solved.

*Can the animal(s) be repelled from the site, or does it (they) need to be removed?*

One of the most effective tools used to repel animals from gardens and buildings is electric fencing. Sometimes chemical, visual or sound repellents will keep animals from reaching an area. If you can't put up an effective barrier or repel the animals from the site, the last step is to remove the problem animal(s). Animals can be removed by live trapping and/or killing the animal. Transporting live animals to another site requires permission from the

landowner or the Tennessee Wildlife Resources Agency (TWRA), depending upon where the animal is to be released. Common methods of euthanasia include shooting and the use of toxic baits. Rarely is one control method used alone most effective, but when used in conjunction with another method(s), your chances of successful control increase.

It is important to realize that many factors must be considered before deciding which control technique is most appropriate for the case in hand. For example, federal laws prohibit killing many bird species. In addition, the ecology and behavior must be understood before attempting a control program, in order to be as efficient and effective as possible. Also, it is wise to consider the opinions and emotions of people affected by the control program or the process could be viewed in a negative manner and all work might be ended prematurely.

The following animals are **unprotected** in Tennessee and can be trapped or killed at any time without a permit from the TWRA or the US Fish and Wildlife Service (USFWS): house mouse,

Norway rat, roof (or black) rat, pigeon, house (or English) sparrow and European starling. In addition, landowners may trap and/or kill any rodent or furbearer (if not threatened or endangered), or small game species without a permit if that animal is destroying or depredating property. A permit is required from the TWRA to kill native big game species (i.e., white-tailed deer, black bear, wild turkey, wild boar) outside of designated hunting seasons. A permit from the USFWS is required to trap or kill migratory species and all species listed as threatened or endangered. Following is a description of problems common with several wildlife species and options for preventing and managing these problems.

## **MAMMALS**

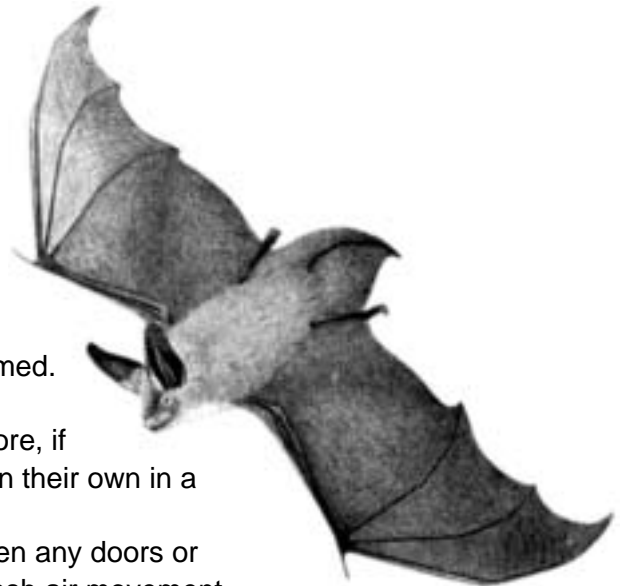
### **Bats**

Bats are insectivorous, flying mammals (animals with hair) that consume thousands of insects per night (often equaling one-third their body weight in 30 minutes!). Bats normally elicit a negative response from the general public; however, the presence of bats around your home should not cause concern, unless they get inside. Bats normally mate in the fall and winter; however, ovulation and fertilization are delayed until spring. It is at this time that bats may move into attics and wall spaces. Births typically occur in late spring and early summer, after which maternal colonies may be formed. These colonies typically disperse in late summer and bats begin to search for hibernating sites around the time of the first frost. Therefore, if bats are in your attic in late summer, they probably will be leaving on their own in a few weeks.

If bats are encountered in the living quarters of your home, open any doors or windows leading outside. Bats will find their way out by detecting fresh air movement. If bats are present at nightfall, turn off the lights so the bats can find the open doors and windows to get outside; otherwise, they may seek refuge behind drapes, curtains and wall hangings. Various devices that emit a high frequency sound have been tried for repelling bats, but in most instances, they have been ineffective.

Naphthalene crystals or mothballs containing naphthalene may be useful in repelling bats in attics, between stud walls, crawl spaces or other areas with little air circulation. Naphthalene vapors are heavier than air; therefore, balls should be hung in baseball-size clumps in mesh bags or old panty hose in the area receiving damage. Naphthalene is not effective outside or other areas where there is adequate ventilation. Prolonged inhalation of naphthalene vapors may be harmful to humans; therefore, it is not recommended to place mothballs with naphthalene in a room you frequent.

Illumination can be effective in repelling bats. Lights strung throughout the attic illuminating all possible roost sites during the daytime may cause bats to leave. Installing windows in attics for increased light during the daytime will reduce the attractiveness for roosting. Once bats have left for the evening or have been removed, all holes allowing entry (3/8 inch or larger) should be covered with 1/4-inch hardware cloth, sheet metal, caulking or other building material. These openings can be found by: 1) observing bats leaving the building at dusk, 2) checking for light entering the attic during the daytime, and 3) checking for airflow with a smoke source



and flashlight at night. It is wise to close all possible points of entry except one (usually the main source of entry). This opening should be closed temporarily with removable material such as aluminum foil. Before closing permanently, check inside and make sure all bats have escaped or been removed and that none are trapped inside (which may die and create odor and sanitation problems). If a bat remains inside, the aluminum foil can be removed the next evening, allowing the bat to leave.

Other solutions to allow bats to exit openings, yet not come back in, include installing a PVC pipe leading outside with a 90-degree angle pointing downward. Bats will leave the attic through this structure but will not come back in. Leave the device in place for a few days, then remove it and close the final hole. Also, a long skirt of polypropylene bird netting can be attached above and on both sides of the hole, allowing bats to get out, but not get back in.

Rabies is the most serious health concern regarding bats. Bats rank third (behind raccoons and skunks) in incidence of wildlife rabies in the U.S. Bats found on the ground should not be handled. If a bite occurs, clean the wound with soap and water and seek medical attention at once. The suspect bat should be captured (without damaging the head) and taken to the local health department. Obviously, relatively few bats have rabies, however, if one is found on the ground, the likelihood of something being wrong with it greatly increases.

Bat guano (fecal waste) in attics may accumulate over time and present a real health hazard. Bat guano provides a growth medium for microorganisms, some of which are pathogenic. Histoplasmosis is a common lung disease caused by a microscopic fungus, *Histoplasma capsulatum*, which may be found in bat guano. It is important to remove fecal material as well as bat urine that has crystallized. This work should not be undertaken without wearing a respirator mask capable of filtering a particle size of 2 microns, which should prevent inhalation of *Histoplasma* spores. Contaminated surfaces should be cleaned with soap and water as well as a 1:20 solution of bleach water. If you discover accumulations of bat guano in your attic, you may wish to contact your local health department for further recommendations regarding waste removal.

## Chipmunks

Chipmunks are ground-dwelling squirrels that inhabit woodlands and woodlot edges. Chipmunks burrow under woodpiles, stumps and other such places surrounding the yard, and may become pests by burrowing under garages, basements, patios, retention walls and foundations. Chipmunk burrow systems may be extensive, reaching 30 feet or more, including a nesting chamber, food storage chambers and escape tunnels. Mounds of dirt usually are not evident around burrow entrances, because chipmunks transport this material away from entrance holes in their cheek pouches. Chipmunks are most active in the early morning and late afternoon and usually are not active during winter, when they enter a restless hibernation until temperatures begin to warm in early March.

Chipmunks occasionally find their way into an attic or garage where caches of nuts, fruits and seeds may be found near their center of activity. Additional problems with chipmunks include feeding on flower bulbs, seedlings, birdseed and pet food.



Exclusion is the best defense against chipmunks around your home. Heavy-duty hardware cloth with 1/4-inch mesh, caulking, mortar or additional boarding should be used to close up any access areas. Flower gardens can be protected by covering the seedbed with hardware cloth, then placing a layer of soil on top. Strips of woody vegetation and other ground cover that connect shrubbery around your home with an adjacent woodlot provide chipmunks a ready-made travel corridor. Woodpiles and groundcover can hide burrow entrances, making them hard to detect. Bird feeders and pet food should not be placed adjacent to the house if you have a problem with chipmunks or other rodents.

Naphthalene may repel chipmunks from attics, wall spaces and other areas with little air movement. Although chipmunks are susceptible to rodenticides used to control rats and mice, none are registered for such use and cannot be recommended. Fumigants generally are ineffective for controlling chipmunks because of their extensive, complex burrow systems. Fumigants should never be used to control animals under a house or any other dwelling where people are present.

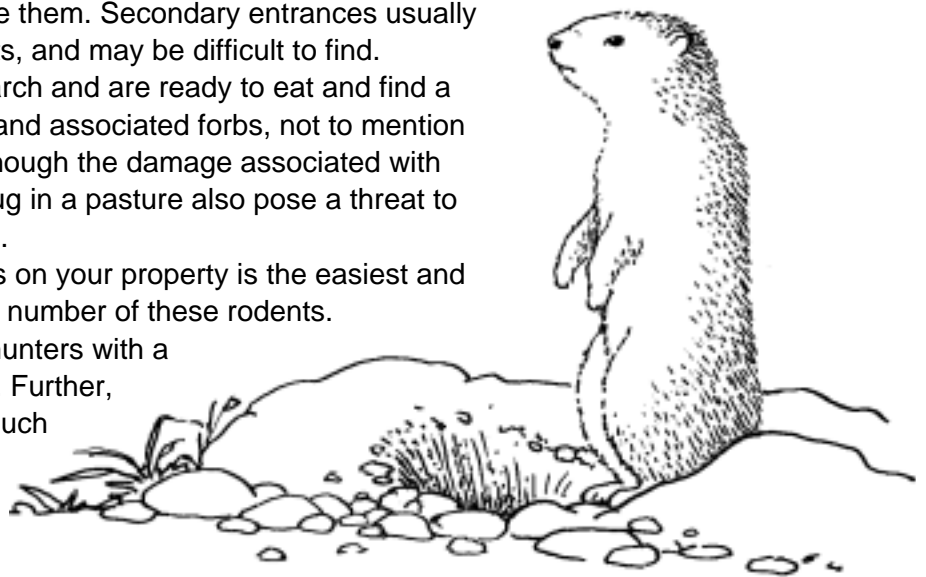
Shooting, where legal, may be an effective means of removing problem chipmunks. Trapping is another option. Both live traps and snap traps can be effective. Baits include peanut butter, nutmeats, seeds and fruits. A trapping tip is to prebait the trap without setting the trap and allow the animal(s) to feed at the trap for 2-3 days to condition themselves to take the bait without being spooked. When using a snap trap outside, it is recommended to place the trap under some type of tunnel covering, such as a small box with no ends — just be sure the trap has enough clearance to operate properly. Traps set adjacent to a wall or other structure should be covered by leaning a board against the wall. This allows the chipmunk to feel more secure when feeding and also helps to protect songbirds from being caught. Additional bait may be placed near the openings of the box or board to serve as an additional attractant.

## Groundhogs

Groundhogs, or woodchucks, can be a nuisance around gardens and pastures. Groundhogs tend to prefer open farmland, as evidenced by their burrows. The main entrance to each burrow is approximately 10-12 inches in diameter and distinguished by a large mound of dirt deposited at the main entrance. All burrows have at least two entrances. Secondary entrances may be dug from within the burrow and typically do not have a mound of dirt beside them. Secondary entrances usually are well hidden, serving as emergency exits, and may be difficult to find. Groundhogs come out of hibernation in March and are ready to eat and find a mate. Groundhogs relish pasture grasses and associated forbs, not to mention greens growing in a vegetable garden. Although the damage associated with groundhogs feeding is obvious, burrows dug in a pasture also pose a threat to livestock that may step in an entrance hole.

Allowing a hunter to shoot groundhogs on your property is the easiest and most cost-effective method of reducing the number of these rodents.

Groundhogs present excellent targets for hunters with a small-bore rifle, shotgun or bow and arrow. Further, groundhogs provide excellent table fare, much the same as rabbits and deer. Hunting will not, however, eliminate groundhogs from a farm. Recruitment, through increased



births and emigration from surrounding areas, is a constant battle for the landowner trying to control groundhogs.

Groundhogs can be trapped with several different trap designs. No. 2 steel leghold traps placed near burrow entrances and runways can be effective. Live trapping can be more difficult, especially if food resources are abundant. Baits that may attract groundhogs are listed in Appendix A; however, as with any animal, keep in mind what the groundhog is feeding on naturally — it may be the best bait to use at that time. Conibear® traps (body-gripping traps) also are successful when set properly. Place a Conibear® 110 or 220 (depending on the size of the groundhog) near the burrow entrance and guide the animal with a log, rocks or boards — directing the groundhog into the trap while blocking other travelways.

Fencing may reduce groundhog activity in gardens, until the groundhog learns to climb over or dig under. Fencing made of chicken wire or hardware cloth should be buried 10 to 12 inches. Electric fences with strands at 5-inch intervals also can be effective for excluding groundhogs as well as rabbits and other mid-sized mammals. There are no registered toxicants or repellents for groundhogs, and those repellents designed for deer and rabbits have not been found effective in repelling groundhogs.

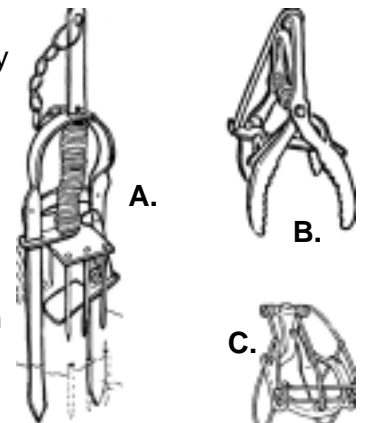
## Moles

Moles are small mammals that spend most of their lives in underground burrows, seldom seen by humans. They have tiny eyes and no external ears. Moles have strong legs with enlarged front feet that are used to travel through the soil in a swimming-type motion. The hind-quarters are small, allowing moles to turn around within their tunnels. Moles average 4 to 7 inches in length and the tail measures about 1<sup>1</sup>/<sub>4</sub> inches long. They are somewhat similar in appearance to mice, voles and shrews.

Moles have a seemingly insatiable appetite and feed actively day and night at all times of the year. Moles are insectivores, eating 70 to 100 percent of their weight daily in insects, grubs and earthworms. The tunneling activity of moles requires a high-energy diet, including many insect pests that can cause damage to your yard or other plantings. Moles do not eat grass, flowers or any other plant part.

Moles are common around homes, lawns and flower gardens, as evidenced by their tunnels near the surface of the soil. Mole activity may be considered beneficial, as tunneling loosens hard-packed soil, increasing water infiltration and air exchange between the soil and atmosphere. Tunneling, however, leaves raised, linear ridges along the ground's surface that many people find unattractive. During dry periods, vegetation growing over tunnels may die from lack of water, leaving brown streaks in lawns. In addition to shallow tunnels, moles dig deeper ones, 5 to 8 inches deep, to escape periods of extreme drought, heat and cold. These deep tunnels represent runways between quart-sized dens and nesting cavities to systems of shallow tunnels where the moles hunt for food. The only evidence of the deeper tunnels is a mound of deposited soil — a molehill.

Trapping is the most effective method of controlling moles, with best results during spring and fall while the soil is moist and temperatures most favorable. There are three types of mole traps: harpoon, pincher, and choker. All are set in a similar manner. To determine where to set traps, walk down small sections (the width of



Three types of mole traps:  
A. harpoon trap  
B. pincher trap  
C. choker trap

your shoe) of several tunnels during the afternoon or early evening, then check the next morning to see which tunnels are raised — this is where traps should be set. Dig out a portion of the tunnel slightly larger than the trap, place the trap so the mole will travel through it, then replace the soil in the hole, packing it firmly where the trigger pan will rest. Do not, however, tear up large or numerous sections of the tunnel, and be careful not to include foreign material (e.g., leaves, twigs or rocks) in the fill material. Moles are very suspicious. If a mole detects anything unusual in its tunnel, it will immediately back up and burrow around or under the set trap. Fortunately, moles are not suspicious of soil blocking the runway and usually will push their way into a soil blockade to reopen the tunnel and continue on their way. Traps are triggered when a mole reopens the tunnel. If the mole is not caught in two days, identify other active runways and move your traps. Similar methodology can be used to trap moles in deep tunnels. Probe areas around molehills. When tunnels are located, dig down and set the trap as described above.

No repellents are registered for moles, and the use of toxicants has not been reliable. Success with fumigants (e.g., aluminum phosphide and gas cartridges) has been limited, though best results have been achieved when placed into deep tunnels. Exclusion has been an effective method of avoiding mole damage from small areas by burying 24-inch flashing or hardware cloth 12 inches deep around the area concerned.

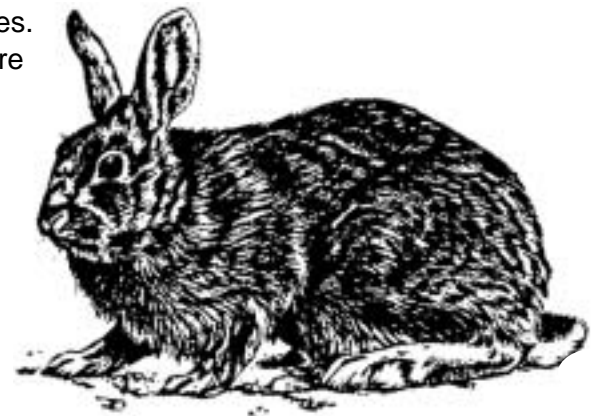
Although mole populations rarely exceed 3-5 per acre, trapping or killing a mole otherwise leaves a ready-built home for other moles to move into. A continuing trapping effort may be necessary to keep an area mole free.

## **Rabbits**

Rabbits are familiar inhabitants of brushy fence rows and gullies, old fields, brushpiles and other areas where habitats converge and “edge” is abundant. Rabbits also frequent backyards and gardens with adjacent woodlots and brushy habitats, providing food and cover resources in close proximity. Most people consider viewing rabbits pleasurable; however, that cute bunny quickly becomes a @#&% rabbit when the vegetable garden or flower garden begins to suffer! Rabbits can cause a considerable amount of damage to ornamental flowers and tree seedlings as well.

The most effective method for controlling rabbit damage to gardens and other plantings is fencing. Rabbits can be excluded easily with a fence of 2-foot tall chicken wire tight to the ground or buried a few inches. An electric fence with two or three strands approximately 4 or 5 inches apart with the bottom strand about 3 inches aboveground also is an excellent barrier for rabbits. Although fencing can be relatively expensive, it can last for several years if properly taken care of. Rabbits occasionally damage woody plants by clipping or gnawing the bark off stems, branches and buds. Seedlings can be protected by wrapping hardware cloth around the stem or by using “tree shelters” available at lawn and garden, nursery and farm supply stores. Several taste repellents that are sprayed directly on the vegetation are available and have been used with varying success.

The rabbit population can be reduced through hunting and trapping; however, continued removal may be necessary because of the rabbits’ reproductive rate. Although few rabbits live longer than one year, a pair of rabbits can produce up to six litters per year with two to three young per litter. In many rural areas, sportsmen are always looking for new areas to hunt. When trapping rabbits, live traps are generally most effective with several baits possible (see Appendix A).



# Raccoons

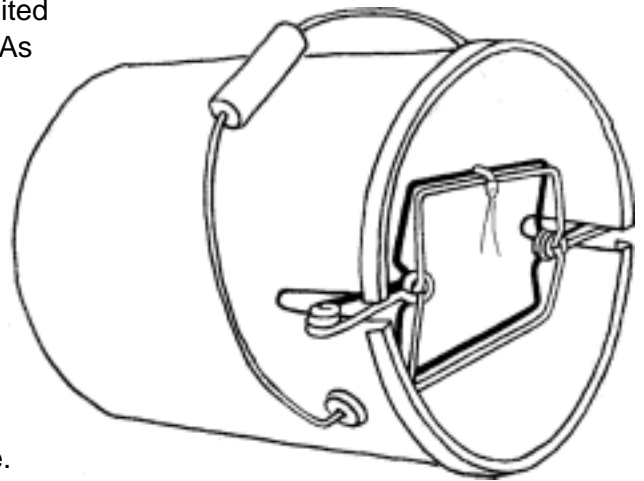
“Coons” are omnivorous mammals, eating both plant and animal foods, including fruits, berries, nuts, corn, crawdads, fish, clams, frogs, snails, insects, turtles, eggs, small rodents and birds (including many game bird poults). Raccoons are active at night and frequent back porches and garages where trashcans and dog or cat food is kept outside. Raccoons also become problematic in the garden about the time sweet corn reaches the milk stage while ripening.



Many problems caused by raccoons can be cured with common sense. Raccoons can be kept from getting into crawl spaces under houses, attics, out buildings and garages by excluding the unwanted guests with boards or hardware cloth. Pet food should be brought inside at night or pets may be fed in the morning so that no food is left outside overnight. Raccoons are less attracted to garbage if table scraps are not included.

Electric fencing is the most effective method in keeping raccoons out of patches of sweet corn. Small gardens do not require a lot of fencing material, making this method quite efficient, especially since the materials can be used year after year. Two-strand electric fences, with one strand 5 inches above ground and the other 10 inches above ground, are recommended.

Raccoons can be trapped using cage-type live traps baited with sweet corn, sardines or canned, fish-flavored cat food. As with other animals, place a small amount of the bait outside of the trap and just inside the trap. The rest of the bait should be placed in the back of the trap behind the treadle. Tying the trap door open and allowing the coons to enter and feed for a couple of nights will reduce wariness of trap-shy coons. Landowners also can trap damage-causing raccoons by using a No. 1 or No. 1½ leghold trap, or a Conibear® 160 (body-gripping) trap. Conibear® traps can be set inside a 5-gallon bucket placed on its side with bait inside.



Conibear® traps also can be used in a leaning-pole set. When using this set-up, place the trigger of the trap on top so squirrels cannot trip the trap. A few drops of fish oil will entice the coon up the log or pole. Bait should be placed above the trap and out of sight of birds.

Conibear® trap set inside a five gallon bucket placed on its side with bait inside

Where raccoons are a problem, hunting should be encouraged when possible. There are no repellents, toxicants or fumigants registered for raccoons. All coons should be handled with caution — especially those that appear lethargic or unusually aggressive, as raccoons have been identified as the major host of rabies in the United States.

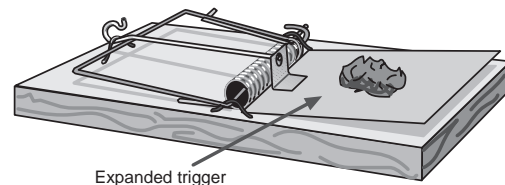
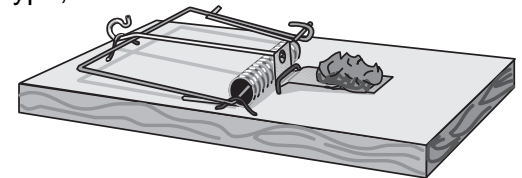
# Rats and Mice

Successful rat and mouse control involves two steps: 1) killing rats and mice already present, and 2) removing conditions that attracted the pests. The most important step is to destroy their hiding places and eliminate their food and water supply. Rats like to find shelter in refuse and lumber piles, burrow under floors and nest inside double walls and attics. Rats get their food from garbage cans, feed bins, granaries, corncribs and other food-storage facilities that are not rodent-proof. These rodents also feed on dog and cat food remaining after your pet has finished eating. Rats get water from puddles of surface water around homes and farms, streams, ponds, stock watering tanks and ditches.

Anything you can do to create a less favorable environment for rats and mice will aid in their control. For example, sites with food, cover and water available in close proximity are more attractive than sites where these resources are separated by 100 yards or more. Heavy-duty 1/4-inch mesh hardware cloth or sheet metal is effective in excluding rats and mice from cracks and holes leading to areas where they are not wanted. Store dog and cat food in rodent-proof containers, such as those made of metal. If feasible, remove any available water source.

Rats and mice can be killed with traps and toxic baits. These are easy to obtain and can be used safely and effectively if directions are followed. There are two basic types of toxicants for rats and mice. One kills the animal after one dose and is referred to as a single-dose poison (e.g., zinc phosphide). The second type, anticoagulants, are multiple-dose rodenticides and must be eaten several times to be effective in killing rats and mice. Anticoagulants sometimes have an advantage over single-dose poisons because rats and mice are able to detect some single-dose poisons before consuming a lethal dose; thus, the rodents can become bait-shy. Because anticoagulants are slow-acting, the pests do not associate becoming sick with the poisoned food. Anticoagulants should be provided in plentiful supply for at least two weeks to be effective. Several anticoagulant baits are available at lawn and garden and farm supply stores.

Trapping is another method of rat and mouse control and many trap types are available. Snap traps are simple, inexpensive, and can be very effective. Some of the newer snap traps have been improved by increasing the size of the trigger mechanism. The trigger of other snap traps can be expanded with screen wire, cardboard or metal to increase their



Expanded trigger

<p>Single trap set with trigger next to wall</p>	<p>The double set increases your success</p>	<p>Double set placed parallel to the wall with triggers to the outside</p>
<p><b>Wrong</b> Trigger <b>not</b> next to wall</p>	<p><b>Wrong</b> Parallel set with triggers on the <b>inside</b></p>	<p><b>Wrong</b> Trap <b>too far</b> from wall</p>

effectiveness. Trap placement is very important for success. Traps should be placed along walls in the area of mouse activity. They may be placed perpendicular to the wall with the trigger end next to the wall or in pairs parallel to the wall with the triggers facing outward. Cheese, oatmeal, nutmeat, dried fruit, candy, peanut butter, bacon and a host of other foods can be used as bait. Bait is not essential on snap traps with expanded triggers.

Various types of multiple-capture and box traps are available and most can be effective. These traps should be kept clean and free of human and mouse odors. These traps also should be placed parallel to walls where the rodents travel.

Glue boards are alternatives to snap traps. Rats and mice are caught and held as they try to cross the sticky cardboard surface. As with traps, glue boards also should be placed along walls or in doorways where the rodents travel. Creating “funnels” with boards or other materials can help guide the rodent to travel across or into the trap. Glue boards are available at most lawn and garden and farm supply stores.

Devices that emit ultrasonic sound are sold claiming to control rodents. There is little evidence that these devices are effective.

## Skunks

Two species of skunks are found in Tennessee, the striped skunk and the spotted skunk. Striped skunks are typically, but not always, black with two white stripes extending from the head down the back. Spotted skunks are black with random white spots and short, broken white stripes all over the body. Striped skunks are about the size of a house cat (~8 pounds) while spotted skunks are much smaller (~2 pounds). Skunks are chiefly nocturnal omnivores, feeding on just about anything they can find, including mice, eggs, insects, carrion, berries, table scraps and dog and cat food. Skunks mate in February-March and the young are born in May-June. Skunks do not hibernate; however, they may den for an extended period during especially cold periods.

Skunks frequently dig and den under houses and other buildings. To remedy this situation, seal or cover all foundation openings with hardware cloth, sheet metal or concrete. Burying hardware cloth vertically 1½ to 2 feet deep around foundations will help prevent digging activity. The following steps are suggested for removing skunks under buildings:

- Seal all possible entrances, except one – the main one.
- Sprinkle a layer of flour 2 feet wide on the ground in front of the opening.
- Place a light under the building (skunks don't like bright light).
- After dark, check for tracks.
- When tracks indicate the skunk has left, close the last entrance.

Skunks may be trapped in live cage traps by baiting with sardines or cat food. If the trap is covered with burlap, captured skunks cannot see the handler and should not spray. They then can be carried carefully to another location where they may be released or killed (which is preferable because of the risk of spreading rabies from one location to another).



If the skunk sprays, it may be possible to remove the odor with various solutions. Ecosorb® and neutroleum alpha are solutions commonly used to mask skunk odor. Neutroleum alpha sometimes is available from commercial cleaning suppliers; however, both can be obtained by contacting USDA Wildlife Services (see Appendix B). Homemade solutions include vinegar and tomato juice and a mixture of 2 quarts hydrogen peroxide, 1 cup of baking soda and 1 tablespoon of dish soap. Sponge this mixture on the affected area, rinse thoroughly and allow to air dry. There are several commercial products available for removing skunk odors (see Appendix C).

## **Tree Squirrels**

Tree squirrels (e.g., the common gray squirrel found throughout Tennessee) often become a nuisance for homeowners by gaining entrance into attics, gnawing wires and wood decks, and dominating bird feeders. Several solutions are possible when combating these rodents.

Undoubtedly, shooting is the most effective method of eliminating troublesome squirrels. Naphthalene can be used to discourage squirrels from using attics temporarily, but the best way to keep squirrels out of a building or attic is to exclude them by closing off all available openings. To locate entrances, keep an eye on the travel routes of squirrels. Be sure to look for eave openings, unscreened attic vents, knot-holes, loose flashing around chimneys and vent pipes, and openings around cables. Cover openings with 1/4-inch mesh hardware cloth or 26-gauge metal. When squirrels (like other rodents) find entrance holes, they usually will go in and investigate. If the holes are not big enough, they will gnaw at the holes until they are large enough. Be aware that squirrels not killed or forced to vacate attics prior to exclusion may damage the old entrance site while attempting to re-enter by gnawing.

Trapping squirrels with live cage traps baited with peanut butter, walnuts, pecans or shelled corn is a possibility. Leg-hold traps or small conibear traps also may be used in some cases for squirrel control. Squirrel traps can be purchased at your local lawn and garden and farm supply stores.

Squirrels can be repelled from wood decks and other structures by smearing polybutenes (e.g., 4 the Squirrels Repellent®) on the surface where squirrels are climbing onto the structure. Polybutenes are sticky substances that stick to squirrels' feet. Two types of taste repellents are available to deter squirrels from gnawing. Ro-pel® has a bitter taste and capsaicin (the natural ingredient that makes peppers hot) burns the mouth. Success varies with all of these repellents.

Although unsightly, squirrels can be kept out of trees by putting a metal band around the tree, 2 feet wide and 6 feet off the ground. These bands should be adjustable to allow for tree growth. Obviously, this tactic will not work if squirrels can jump from one tree to another, or gain access from a powerline or other structure. To keep squirrels from jumping from one tree to another, prune trees so limbs are no closer than 8 feet. Branches less than 6 feet off the ground also should be removed. In addition, it is a good idea to prune trees that are close to the house to discourage squirrels from using a tree to get into the attic.



## Voles

Voles, sometimes called meadow mice or field mice, are small rodents with stocky bodies, short legs and short tails. Voles common to Tennessee include the pine vole (*Microtus pinetorum*), meadow vole (*M. pennsylvanicus*) and prairie vole (*M. ochrogaster*). Voles are active year-round (they do not hibernate), day and night. Activity of meadow and prairie voles is evident from a network of ground-surface runways with numerous burrow openings. Pine voles typically do not use surface runways, but an extensive system of underground tunnels. Small holes leading to a network of underground burrows are evidence of pine voles.

Fresh shoots of grasses and forbs growing in or near runway systems and burrow openings make up most of the diet during the growing season. During the dormant season, voles feed more intensively on tubers, bulbs, bark, rhizomes and seed. These feeding habits can cause extensive damage to lawns, flower gardens, orchards and vegetable gardens.

Several steps can be taken to minimize vole damage. The most effective method of reducing vole damage is the use of toxicants. Zinc phosphide, a single-dose rodenticide, is used commonly to control voles. Zinc phosphide is a restricted-use pesticide and is available as impregnated bait on grains such as oats, corn, wheat and peanuts. Several anticoagulants also are approved for vole control. Steps should be taken to reduce danger to non-target animals when using either zinc phosphide or anticoagulants. Using a funnel to place either type of rodenticide into the tunnel system through the burrow opening is one method. Another is to use bait stations made of waterproof paper tubes, 5 inches long and 1½ inches wide, with bait blocks glued inside.

To make an area unattractive to voles, reduce or remove overhead cover (e.g., grass, leaves and mulch) and mow close to the ground. Overhead cover allows for establishment of surface runways and provides voles protection from predators (e.g., foxes, skunks, hawks and owls). Removing mulch from a 3-foot radius around vulnerable plants will make the plants less susceptible to vole damage. Individual tree seedlings can be protected with hardware cloth. The mesh should be ¼-inch or smaller in size and buried 6 inches deep to prevent voles from crawling through or digging under.

Another method for controlling voles in small areas is via snap traps. Trapping generally is the most labor-intensive control method. Traps should be placed perpendicular to the runways with the trigger end in the runway. Peanut butter, oatmeal (or a mixture of these) or apple slices make good baits. Bait may not be needed for traps with expanded triggers.

Voles are prolific and will readily move into vacant burrow systems. Therefore, monitoring sites left vacant following control measures is essential.



# BIRDS

## House Sparrows

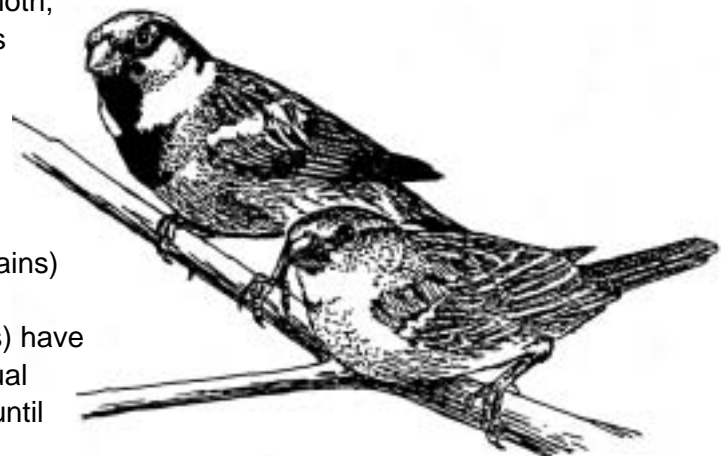
The house sparrow (or English sparrow) is an exotic pest that was introduced into Brooklyn, New York from England in 1850 and has spread across the United States, Canada and Mexico. Because the house sparrow is an exotic pest, it is afforded no legal protection from the federal or state government. However, legal protection may be provided through local ordinances (i.e., city bird sanctuaries). House sparrows prefer human-altered habitats, especially around farms. House sparrows also are found in great numbers in urban environments, oftentimes surviving on garbage, crumbs and refuse from restaurants. House sparrows nest in or under protected areas such as building ledges and eaves, bridges, open warehouses, sign and light fixtures and birdhouses. House sparrows typically breed from March through August, though breeding may occur in any month. The male house sparrow typically chooses the nest site and establishes his territory centered on it. The normal clutch is comprised of 4-5 eggs and 2-3 broods may be produced each year.

House sparrows are very aggressive, territorial and gregarious, oftentimes forming flocks of several hundred. House sparrows do not migrate. All of these factors help the house sparrow out-compete and displace native bird species, especially from birdhouses (e.g., bluebirds, purple martins and Carolina wrens) and feeders prepared and erected specifically for native species. House sparrows may be repelled from feeders by installing monofilament line vertically at 2-foot intervals around the feeders. Studies have shown the monofilament line does not affect many other species of birds. Where legal, house sparrows, their nests and young should be destroyed because of their competitive nature with our native birds.

House sparrows often cause severe damage to grain crops and grain kept in storage. House sparrows damage crops by perching and pecking seeds, seedlings, buds, flowers and vegetables. In grain storage facilities, grain is lost both from feeding by house sparrows and through contamination from fecal material. This causes unsanitary conditions and may lead to the spread of several diseases (e.g., chlamydiosis, salmonellosis, transmissible gastroenteritis, tuberculosis and encephalitis), internal parasites (e.g., toxoplasmosis and trichomoniasis) and household pests (e.g., ticks, mites, fleas and lice).

House sparrows can be excluded from buildings, barns and other structures by closing openings (e.g., cracks; spaces between boards, signs and air conditioners; eaves; and windows) with hardware cloth, screening or some other material. Open doorways, such as those found in warehouses and other storage facilities, should be "blocked" by hanging strips of 4- to 6-inch plastic strips in front of the openings. House sparrows can be excluded from vegetation around the house (e.g., shrubbery and ivy-covered walls) and small crop areas of high value (e.g., grapes, berries and experimental small grains) by using plastic bird netting.

Frightening agents (especially alarm and distress calls) have been used to repel house sparrows with little success. Visual frightening agents have been successful for short periods until



the birds become accustomed to them. Avitrol® is a restricted-use chemical frightening agent (4-aminopyridine) that has been effective in repelling house sparrows because the affected birds react so violently the other birds are frightened away. Although registered as a frightening agent, Avitrol® causes mortality in birds that ingest the treated bait. When using Avitrol®, it is common for many birds to die before the others are frightened or repelled. It is important to pick up and/or bury all dead birds found because these birds pose a potential hazard to non-target species, such as hawks and owls. The dilution rate and mortality may vary for different species and in different situations. Always refer to the product label for treatment of each bird species. Higher bait concentrations and increased mortality is usually required to repel house sparrows. Also, because of their territorial nature, numerous bait sites may be needed for effective control of house sparrows. For best results with Avitrol®, pre-bait with non-poisonous bait that resembles the toxic bait until the birds readily feed on the pre-bait. This accustoms the birds to feeding in a particular area(s) and renders them more susceptible to the toxic bait. USDA Wildlife Services supervision is **not** required for Avitrol® use; however, the applicator must have a Tennessee Department of Agriculture state pesticide certification in Category 7: *Industrial, Institutional, Structural and Health Related Pest Control* (Category 8: *Public Health* is also acceptable for government employees).

Polybutenes and sharp metal projections (e.g., Nixalite® and Cat Claw®) are useful in preventing house sparrows and other birds from perching or roosting on structures. There are no toxicants or fumigants registered for use against house sparrows.

Trapping is another commonly used technique in controlling house sparrows. Several different types of traps are used. Funnel traps and mist nets may be the most effective. Federal permits may be required when using mist nets. Shooting house sparrows may make the landowner feel good; however, shooting sparrows is not particularly efficient, as sparrows quickly become wary of humans after being shot at.

## European Starlings

Starlings are non-native pests that were introduced into New York City from Europe in 1890 and 1891 by an individual who wanted to introduce all of the birds listed in Shakespeare's writings into the United States. Today, these pests are found in all states in the lower 48 and number in the hundreds of millions. Because starlings are exotic pests, they are afforded no legal protection from the federal or state government. However, legal protection may be provided through local ordinances (i.e., city bird sanctuaries). Starlings cause problems around homes, farms and urbanized areas. Many people confuse starlings with blackbirds. Starlings are robin-sized birds, dark-colored with light speckles on their feathers. Starlings are chunky in appearance and their flight is direct and swift, not rising and falling like many blackbirds (e.g., common grackle). Starlings nest in tree cavities, birdhouses and holes in buildings, oftentimes replacing native nesters, such as the bluebird and various woodpeckers. Starlings lay 4-7 eggs in a clutch and may produce two broods per year.

Starlings usually feed on the ground and may travel up to 70 miles per day from roost sites to feeding sites. Starlings cause considerable damage at livestock facilities where they are attracted



by the food and water available. This can be a dangerous situation, because starlings have the potential of transferring diseases from one livestock facility to another. Starlings also may damage cultivated fruits and other crops such as corn and winter wheat. Large winter flocks can pose a serious threat when found near airports. Droppings from these winter flocks often accumulate at roost sites and harbor *Histoplasma capsulatum*, the fungus that causes histoplasmosis. As one might imagine, roost sites are often problem areas because of the health concerns, filth, odor and noise.

Avitrol® has been used successfully as a frightening agent to control starling problems (please refer to section on house sparrows for additional information concerning the use of Avitrol®). Starlicide® has been used in the past by landowners confronted with large-scale problems associated with industrial structural roosts and at livestock feedlots. Although this product is no longer available, landowners suffering large-scale problems are encouraged to contact USDA Wildlife Services (see Appendix B), who can supervise and implement a toxic-baiting program using DRC-1339, the active ingredient in Starlicide® that is now restricted to USDA Wildlife Services personnel or people under their supervision. Neither Avitrol® or DRC-1339 baiting is an effective or realistic solution for urban starling roost problems, but best used to combat large-scale problems such as those mentioned above.

Starlings can be a nuisance around the house by congregating in large numbers and roosting in trees. Starlings normally perch on telephone wires, buildings, bridges or trees before flying around the roost site several times and eventually settling down. It is at this time that frightening is the most effective method in dispersing these birds. Pyrotechnics (fireworks), firearms, gas-operated exploders, alarms and banging on pots and pans have been used in dispersing these roosts. To be successful, scare tactics should begin when the birds show up in the evening and a combination of techniques should be used for five or six consecutive days, or until the birds no longer return — persistence pays! Scaring operations should conclude at dark. This entire problem can be circumvented by **not topping the trees in your yard**, especially maple trees. Starlings and blackbirds are attracted to the increased density of limbs that is promoted by topping. If your trees have been topped already, thinning the limbs will make the trees less attractive to the roosting birds.

The best preventive strategy to keep starlings from nesting is to close all openings that provide a nest cavity, most notably around barns and other buildings. Starlings can be kept from roosting in barns by stapling nylon or plastic netting across the underside of rafters and roof beams. Plastic or nylon netting also is useful in covering fruit trees and grapevines to keep starlings and other birds from ripening fruit. Starlings can be discouraged from watering at livestock troughs by keeping the water level low enough so the birds cannot reach the water when perched on the edge of the trough. At the same time, the water level should not be so shallow that the birds can stand in the trough.

During spring, starlings compete with native cavity-nesting birds, such as bluebirds, woodpeckers and purple martins, for available nesting cavities (including nest boxes). To help keep starlings out of bluebird boxes, the entrance hole should be 1½ inches in diameter. All starlings seen competing with nesting native birds should be killed if possible. Starlings found nesting can be discouraged by removing and destroying nests and young. It may be necessary to repeat this process throughout the breeding season (i.e., spring and summer).

## **Blackbirds (including Grackles and Cowbirds)**

“Blackbirds” refers to common grackles, red-winged blackbirds and brown-headed cowbirds. These are year-round residents in Tennessee and commonly encountered. The Brewer’s blackbird and rusty blackbird also may occur in Tennessee during winter. All have common traits. Male blackbirds are predominantly black or iridescent, and all blackbirds have an omnivorous diet, consisting of grains, weed seeds, fruits and insects. After the nesting season, blackbirds form large flocks, sometimes numbering in the millions. Winter flocks and roosts may be comprised of one species of blackbirds, several blackbird species or blackbirds with non-blackbird species, such as starlings and American robins.

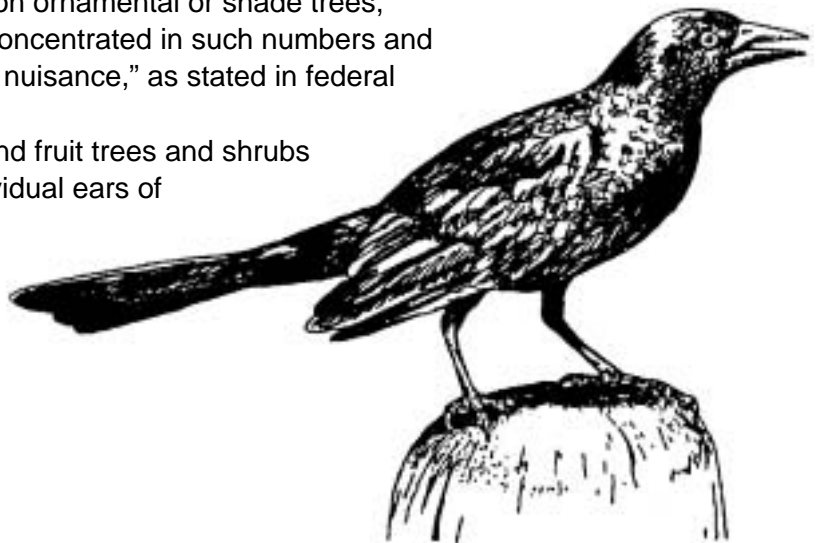
Red-winged blackbirds generally nest in hayfields and marshes, while common grackles might nest in fields, marshes, towns and barnyards. Brown-headed cowbirds do not nest or incubate. The female cowbird lays one or two eggs in the nest of a songbird after removing an egg from the songbird’s clutch. One female cowbird may parasitize up to 20 songbird nests per nesting season. The cowbird nestling generally hatches one day before the songbird eggs. By hatching earlier and being larger in size, the cowbird nestling gets a disproportionately larger amount of food and care than the other nestlings.

Although redwings primarily eat insects during the nesting season, the diet shifts to grain and weed seeds in fall and winter. Redwings can cause severe damage to ripening corn, sunflowers, sorghum and oats. Grackles are more predatory and may eat small fish, field mice, songbird nestlings and eggs. Grackles also feed on sprouting corn and mature field corn. Cowbirds may damage ripening sorghum, sunflower and millet; however, cowbirds often feed on waste grain and seed in manure. Overall crop damage from cowbirds usually is minor when compared to other blackbirds.

It is very important to be able to discern blackbird damage from that of other species, such as raccoons. Normally, the presence of blackbirds is obvious, with their large flocks and loud noise. However, starlings may be confused as blackbirds while feeding on insects in a field of corn or sorghum. Red-winged blackbirds seen in a cornfield might actually be feeding on concentrations of beetles instead of corn. Redwings generally do not bother corn until it is in the milk stage.

Because blackbirds are native, migratory birds, they are protected under the Federal Migratory Bird Treaty Act; however, they may be harassed or killed when “committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance,” as stated in federal laws regarding migratory birds.

Blackbirds can be excluded from gardens and fruit trees and shrubs in a small area by using plastic bird netting. Individual ears of sweet corn may be protected by placing net “socks” over the ears and attaching the socks to the corn stalk.



Crop damage is most severe when planted within five miles of roosts. If fields are located within five miles of a large roost site, alternative plantings less susceptible to depredation (e.g., soybeans, wheat, potatoes or hay) may be more successful. Frightening agents, such as propane exploders, 12-gauge shotgun shells containing fire-cracker projectiles, electronic noise systems, helium-filled balloons, distress calls and strips of mylar reflective tape, can be quite effective in protecting crops from blackbirds. The success of these techniques, however, is highly variable and depends upon the persistence and determination of the landowner. Using a variety of frightening agents and moving them around to different locations in a field every few days will make the effort more successful.

Avitrol® also has been used to frighten blackbirds from crops (please refer to section on house sparrows for additional information concerning the use of Avitrol®). As with other bird species, a prebaiting program has proven to be instrumental when using Avitrol® in blackbird control. Starlicide® has been used in the past to control blackbirds; however, this product is no longer available. The active ingredient in Starlicide®, DRC-1339, is still used by USDA Wildlife Services. Please refer to the section on starlings for further information concerning DRC-1339.

Blackbirds can be trapped in decoy traps; however, a permit for use is necessary. Trapping blackbirds is not efficient for large problems, but can help in reducing blackbird populations in small, localized areas. Shooting, by itself, is not cost-effective in frightening or eliminating large numbers of blackbirds.

## Crows

The American crow (hereafter crow) is found throughout Tennessee and is familiar to virtually everyone in the state. Crows are found in a wide variety of habitats, both rural and urban. Crows eat just about everything and obtain their food by hunting, pirating and scavenging. Approximately one-third of the crow's diet is animal matter and the rest vegetable or plant material. Crows typically nest in trees and begin nesting in early spring. Crows may produce one or two broods per year, and a mating pair generally remains together throughout the year. After the nesting season, family units join larger groups and these larger groups sometimes join other groups, forming huge flocks. These large flocks roost together but disperse during the day to feed; often travelling 12 miles or more.

Historically, the most common damage complaint with crows is associated with the birds pulling up seedling corn plants and eating the kernels. Crows also have been reported to damage ripening grain sorghum, sunflowers, various fruits and watermelons. Recently, the majority of crow complaints have been problems associated with large crow roosts in urban areas. Most folks find the odor and noise associated with these large roosts unacceptable and are concerned about possible health problems. Not unlike roosts of other species (e.g., pigeons, blackbirds and starlings), crow roosts that have been in place for several years may harbor *Histoplasma capsulatum*, the fungus that causes histoplasmosis. When the soil and accumulated droppings at a roost site are disturbed, spores of the fungus may be released. People may contract the disease by breathing in the spores.



Years ago, a bounty was placed on crows in many areas and total eradication was the goal. The crow survived. Most of these efforts involved the use of pesticides that are no longer available. Crows are very wary, intelligent birds. Studies involving American crows have demonstrated their ability to count, solve puzzles, associate noises and symbols with food, mimic sounds and retain knowledge through memory. Given this information, it is obvious why it is difficult to control crow problems — they are smart!

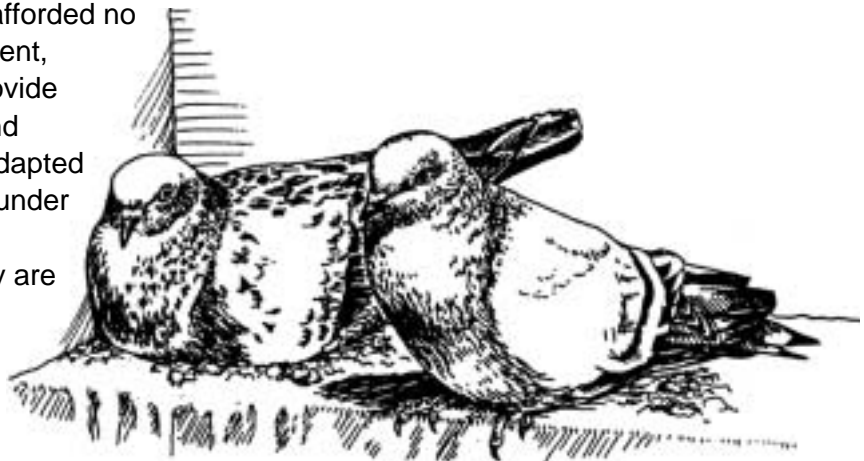
The most common method to reduce crow problems associated with agriculture is frightening agents. “Lining” a field with cord, fine wire, cloth strips or aluminum pie pans in a grid pattern has been successful in some areas. Wires or cord, in particular, may represent an obstacle for the crows when rapid escape is necessary. Where crows are pulling up corn seedlings, some have had success by scattering whole-kernel corn that has been softened with water across the field for the crows to feed on until the seedlings have grown to the point that the crows will not bother them. Recorded distress or alarm calls, gas-operated exploders, battery-operated alarms, pyrotechnics and various other noisemakers have been used to keep crows out of crops. The key to success with these techniques is moving them around from time to time and varying the intensity and type of scare device.

Shooting and hunting is quite effective in supplementing and reinforcing these frightening agents as a dispersal technique; however, shooting and/or hunting alone generally is not effective in reducing the crow population. Although Avitrol® is a restricted-use chemical frightening agent (4-aminopyridine), it is unlikely to be effective for crow control because of the crows’ behavior and because of the type of damage problems associated with crows. There are no repellents or toxicants registered for crow control. Although crows are native migratory birds protected under the Federal Migratory Bird Treaty Act, they may be harassed or killed when “committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance,” as stated in federal laws regarding migratory birds.

Communal crow roosts are typically in dense pine stands. Crows can be dispersed from roost sites by thinning approximately one-third of the trees from the site. Thinning these stands not only disperses the crow roost, but usually helps improve habitat for many species of songbirds, game birds and mammals.

## Pigeons

Pigeons are exotic, non-native birds common in urban areas and are renowned pest species. They are afforded no legal protection from the federal or state government, however, local bird sanctuary ordinances may provide protection. Pigeons are successful at surviving and increasing their populations because they have adapted to urban conditions over the years. Pigeons nest under bridges, on building ledges and rafters in barns, warehouses and other open buildings, where they are protected from predators and nest disturbance. Generally, 1-2 eggs comprise the clutch and pigeons may produce 2-5 broods per year. Most pigeons are non-migratory, giving them an



advantage over migratory species when competing for nest sites. Also, food is available in cities year-round; whereas wild birds in native habitats have to contend with winter food shortages.

Pigeons cause problems around industrial and city buildings, farms and homes by roosting and nesting on ledges and in barns. Droppings are messy and quite acidic, causing damage to equipment, and defacing building surfaces and other structures. In addition, pigeon manure may harbor a variety of disease-causing bacteria and fungi, posing a serious disease problem when coming in contact with unprocessed grain.

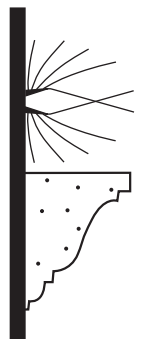
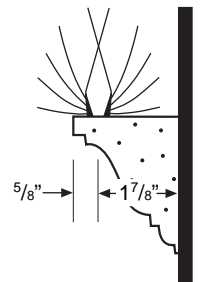
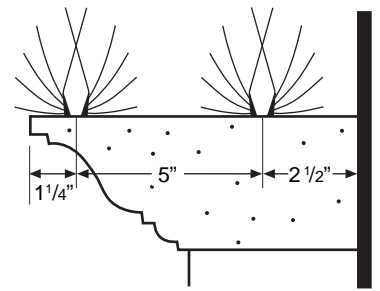
Measures to eliminate roosting and nesting sites appear costly, but permanent methods of control are worthwhile in the long run. Openings in attics, lofts and under eaves can be screened with rustproof wire of 3/4-inch mesh. This also will keep sparrows and starlings out. Prevent roosting on ledges by covering them with wire netting or installing wood or metal sheathing at a sharp angle. Some companies make metal wire or spike strips (e.g., Nixalite® and Cat Claw®) that can be glued or attached otherwise on ledges. Other companies make sticky repellents (polybutenes) and irritants that discourage birds from perching on structures. Polybutenes are spread on ledges or other structures with a caulking gun and may last from three to six months. Wires or spikes are more permanent, of course, but cost more.

The ability of pigeons to use buildings sometimes is a result of building design and poor construction. Some commercial and residential buildings have proven to be excellent roosting and/or nesting sites. Pigeons like ledges 2 to 4 inches or more wide to roost and build nests. Unboxed eaves and small openings beneath the roof provide attractive nesting sites for pigeons, as well as starlings and house sparrows. The best prevention is to design the building properly, incorporating narrow ledges.

Trapping is an effective means of removing problem pigeons. Cage traps, such as a bob-type trap, work well and can catch several pigeons at one time. These traps may be bought commercially or built at home. Trapping areas should be pre-baited for about a week before traps are placed. Baits include whole corn or a mixture of one part wheat to five parts cracked corn. Traps should be checked every day. Trapped pigeons should be killed, because released birds return to their former hangout or become problems elsewhere.

Another control method includes killing pigeons by shooting. Shooting pigeons on the roost at night using a flashlight and pellet gun can be extremely effective. Avitrol® has been used with success in repelling pigeons (see section on house sparrows for more information on Avitrol® and its use). Always refer to the label for information regarding bait concentrations for particular bird species. DRC-1339 also has been used with success in controlling pigeons; however, its use is restricted to USDA Wildlife Services personnel or people under their supervision only.

Arguably, the most important element in a toxicant program (including the use of Avitrol®) aimed at pigeons is pre-baiting. Pre-baiting is used to train the target birds to eat a specific food at a specific place. Bait should mimic the toxicant as closely as possible and should be removed before the toxicant is distributed. Bait and toxicant should be distributed in the same manner. Always observe bait sites for non-target birds and take steps to reduce danger to them.



Methods of placing spike strips to ledges.

## Woodpeckers

Seven species of woodpeckers are found in Tennessee, including one sapsucker (yellow-bellied sapsucker) and one flicker (northern flicker, or “yellow hammer”). All of Tennessee’s woodpeckers are cavity nesters, commonly using snags and partially dead trees for nesting sites. It is common for some woodpeckers to produce two broods per year, with both parents tending to the young until they leave the nest.

Homeowners have problems with woodpeckers pecking holes in their homes each spring. Most of the damage occurs from February through June, corresponding with the breeding season and the period of territory establishment. Woodpeckers hammer at TV antennas, guttering and columns, but wood siding is the surface that seems to be preferred. There is some disagreement as to why woodpeckers hammer at houses, but most biologists believe they are seeking food (insects in the wood) or establishing a breeding territory. Excavating a nest cavity is another potential motivation for woodpecker activity. As the name implies, sapsuckers drill evenly spaced rows of holes in healthy trees, collecting sap and insects entrapped by the sap.

Control measures should be initiated as soon as the problem begins, because woodpeckers have trouble breaking the habit. When wood is involved, always check for insects. If insects are present, treat with an approved chemical. If insects are not present, there are a few ways to deal with the woodpeckers’ habit. There are no effective chemicals and no registered toxicants for use on woodpeckers. Visual repellents have been used with some success, though they are not a guaranteed solution. One such device is a small, concave shaving mirror hung in a damaged area. The enlarged image appears to frighten the territorial birds. Other devices include metallic pinwheels and 1- by 12-inch strips of aluminum foil hung from string so they move in the wind. Strips of mylar tape and commercially available “scare-eye” balloons also have been effective. Owls, rubber snakes and other objects that do not move seldom work. Visual repellents are available through your local lawn and garden and farm supply stores.

Polybutenes (e.g., Tanglefoot<sup>®</sup>, 4-The-Birds<sup>®</sup> and Roost-No-More<sup>®</sup>) can be spread around the affected area to discourage woodpeckers. Birds are not caught in the substances, but are annoyed by the sticky footing. These substances may discolor some surfaces or run in warm weather. To avoid this problem, repellents can be applied to a thin board, then fastened to the damaged area. Other methods include deadening the area behind siding boards where the damage is occurring. Removing a plank or two and stuffing insulation behind them does this. Hanging mesh netting in front of the damaged area also may discourage woodpeckers from the site. Another alternative is to cover the area with 1/4-inch hardware cloth.

If none of these repelling techniques work, the alternative is to kill the bird (usually only one bird is involved). However, woodpeckers are protected by federal law, so obtaining a permit from the US Fish and Wildlife Service is necessary. You can apply for one from US Fish and Wildlife Service, Migratory Bird and Eagle Permit Office, P. O. Box 49208, Atlanta, GA 30359. Before applying, you will need a referral from USDA Wildlife Services personnel (see Appendix B). Be aware that there is a non-refundable application fee of \$25. According to the TWRA, a Nuisance Wildlife Control Operator is able to harass or shoot a migratory bird while working under the permit obtained by the landowner or homeowner from the US Fish and Wildlife Service; however, TWRA should be notified that such action is to be taken prior to control efforts.



Yellow-bellied sapsucker looking for sap and insects.

## Canada Geese

The giant Canada goose (one of 11 subspecies of Canada geese) was once in peril with dangerously low numbers; however, wildlife management has enabled the bird to rebound to record numbers. Over the past couple of decades, the giant Canada goose (hereafter goose) has established local, non-migratory populations in many areas across the country, nesting in areas that traditionally were frequented only in winter. The result — a population explosion.

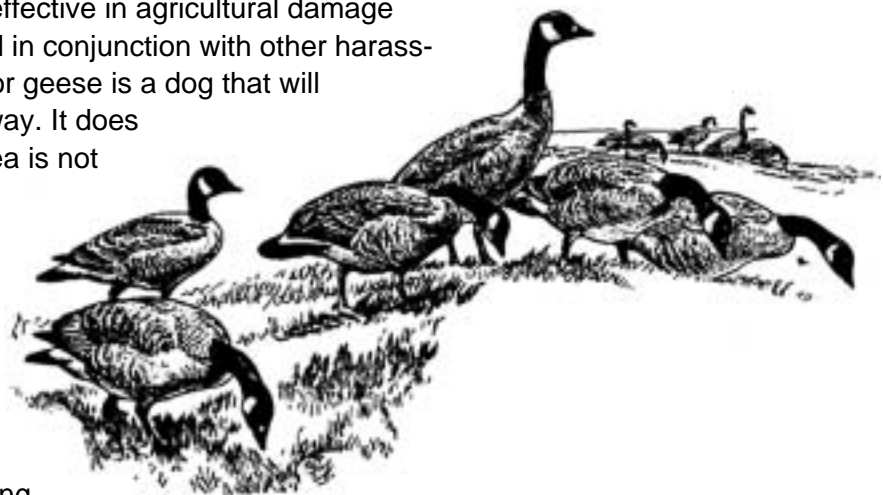
Overabundant, localized goose populations can damage and destroy agricultural crops and pose social and health problems in urban and suburban areas by nesting, feeding and defecating in residential yards, golf courses, condominium complexes and city and state parks. Overabundant goose populations also can be a threat to aircraft when found around airports. The defensive nature of nesting geese poses a threat to people passing by, and the droppings left behind feeding geese are unacceptable in many areas.

Where allowed, **hunting is the most efficient and effective method of reducing goose populations, as well as problems associated with their overabundance.** Hunting, however, is legal only in the fall and winter. During spring and summer, geese can be discouraged from an area by making the surroundings less attractive. Geese can be discouraged from nesting by keeping the area mowed. Mowing, however, may make the area more attractive as a loafing or feeding site. By eliminating fertilizer applications around the pond, the vegetation will not be as nutritious and not as attractive to grazing geese. Pond banks that are allowed to grow up with high grasses and weeds generally are not used for grazing or loafing. Unfortunately, many people find this technique unattractive as well.

Geese like easy access into and out of a pond. Geese typically nest at the water's edge in clumps of tall grass and other vegetation. A single clutch of 4-8 eggs is produced annually. By erecting a poultry fence approximately 3 feet tall around the perimeter of the pond, geese can be discouraged from nesting and establishing territories around the pond. These fences also can be used to keep geese with goslings (young geese) out of yards and gardens. Adult geese usually will not cross a fence and leave their young behind. An alternative to fencing is establishing a dense hedge of low-growing shrubbery. A hedge serves the same purpose as fencing, yet is more aesthetically pleasing and may last longer than fencing.

Visual repellents, such as flags, mylar tape, balloons and scarecrows, all have been used with limited success in scaring geese away from an area. As with other wildlife species, geese usually learn that these materials are not harmful and they soon return. Visual repellents have been most effective in agricultural damage situations, including gardens, and are best used in conjunction with other harassment methods. The most successful repellent for geese is a dog that will actively patrol the area and chase the geese away. It does not take many chases for geese to learn the area is not safe and few will return. It is most important to realize that geese (and all other pesky critters) should be repelled before habituation to an area occurs. If this is accomplished, problems down the road will be lessened substantially.

Large congregations of geese often form at ponds and lakes in mid-summer (late June-early July). It is at this time that adult geese molt and temporarily lose their ability to fly. During



this period, geese are susceptible to herding and capture with walk-in funnel traps. Federal law prohibits individuals from possessing, transporting or handling migratory birds without a permit from the U. S. Fish and Wildlife Service. In addition, it is illegal to manipulate eggs or destroy nests of migratory birds. Although the majority of these “problem” goose populations are resident populations, they still are considered migratory species. It is unlawful for geese to be trapped (at any time) or killed outside of the designated hunting season by private individuals. Therefore, in areas with large congregations of geese, personnel from USDA Wildlife Services (see Appendix B) may be contacted to trap and remove problem geese. Finally, geese, as well as all other waterfowl species, should **never** be fed. Not only does this serve to attract them, but also increases the rate of disease and the birds’ dependency on humans.

## Great Blue Herons

Aquaculture facilities and small backyard ponds created for wildlife attract great blue herons — a large, gray-blue bird with a long neck that is S-shaped when flying and a long, pointed beak. These ornate birds stand approximately 3 feet tall and have a wing span up to 6 feet. Once highly sought after for plumes found on the birds’ head, neck and back, these herons were driven to near extinction. Now, through protection, great blue herons are numerous once again, even to the point that they cause serious problems at many aquaculture facilities and may limit frog populations in some areas.

Great blue herons eat fish (as well as frogs and tadpoles, insects and small birds) and can have a significant economic impact on aquaculture. In addition, homeowners often are upset when they find great blue herons feeding at the small pond they created for wildlife, not unlike the sentiment felt when a Cooper’s hawk preys upon bluebirds nesting or cardinals feeding in the backyard. It is important to realize that predation is a natural phenomenon and is quite necessary for healthy wildlife populations. However, these feeding forays can become excessive, especially when predators (i.e., great blue herons) find that obtaining food at these sites is exceptionally easy and habits are formed.

Total exclusion using netting has been found quite effective for combating great blue heron predation at aquaculture facilities; however, this is not aesthetically pleasing when placed over a small backyard pond. Perimeter fencing placed around a pond in water 2-3 feet deep with mesh netting reaching to the pond bottom can help prevent herons from feeding upon fish in the pond.

Scare tactics that employ sound (e.g., propane exploders and firearms) can be effective, but those that scare by sight (e.g., lights and balloons) are not effective over time. Perhaps the most efficient, effective and aesthetically pleasing deterrent to great blue herons is a dog. Several aquaculture facilities now “employ” border collies to chase away great blue herons. A dog can be quite effective on a relatively small area; however, effectiveness on larger areas is questionable. It is illegal to shoot great blue herons without a permit from the US Fish and Wildlife Service and there are no registered toxicants or repellents for use on great blue herons. The address for permit application is U. S. Fish and Wildlife Service, Migratory Bird and Eagle Permit Office, P. O. Box 49208, Atlanta, GA 30359. There is a \$25 non-refundable application fee. Initially, you will need a referral from USDA Wildlife Services personnel (see Appendix B) before applying for a permit.



## Other Bird Species and Associated Problems

During the spring and summer months (especially early spring), cardinals, mockingbirds and a few other species are frequently reported flying into windows. Large picture windows and sliding glass doors are attacked most often. You may think the birds would learn once they hit the window, but they don't. They repeatedly fly back into it.

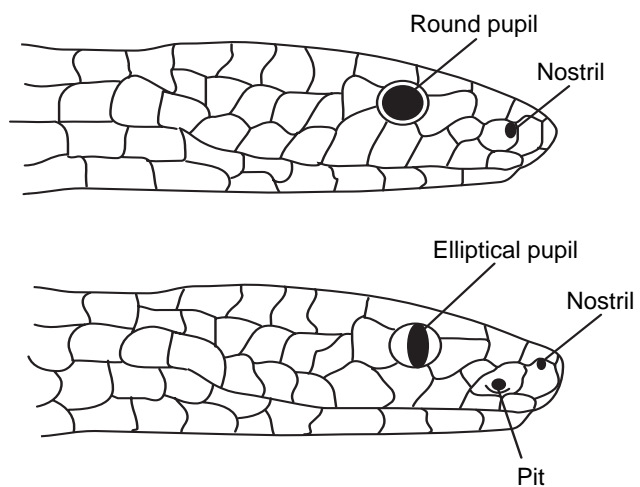
Most species of wildlife establish territories they defend for breeding, roosting, nesting or feeding. When the defending bird sees its reflection in the bright, shiny glass, it fiercely attacks, apparently thinking an intruder is invading his territory. Homeowners usually are concerned that the bird will kill itself, or become perturbed at the droppings and occasional blood spots on the window. Birds fighting their reflections usually do not hit the window hard enough to kill themselves. However, birds occasionally mistake a large window for an opening in the building and hit with enough force to kill themselves. Birds frequently fly into windows on buildings in wooded areas because the reflection in these windows has the illusion of additional trees.

Three control measures have been tried with varying degrees of success. One is to stick several strips of masking tape about 2 inches apart in the middle of the window. This seems to break up the reflection. In some cases, placing a lighted lamp in the window can eliminate the reflection. Finally, try taping a large black silhouette of a hawk to the window. If your window is attacked, don't despair, because in most cases the problem lasts only a short time – during the height of the breeding season. As a last resort, killing the bird under a depredation permit may be the only solution.

## REPTILES

### Snakes

A common complaint regarding wildlife around the house is the presence of snakes. Many people are afraid of snakes and believe that all snakes are poisonous, vile creatures. The reason is obvious — they just don't know enough about them. In actuality, snakes are quite beneficial as they help control rodent populations. Only four species of poisonous snakes are found in Tennessee: copperhead (highland moccasin), cottonmouth (water moccasin), timber rattlesnake and pygmy rattlesnake. All of these are pit vipers and can be differentiated from non-poisonous snakes by three primary methods. All pit vipers have pits (heat sensors used for detecting warm-blooded prey in low-light conditions) located between the eye and the nostril. Pit vipers also have elliptical pupils (similar to cats) and **undivided** scales on the underside of the tail including the scale covering the anus (anal plate). (NOTE: The scales on the underside of the **very tip** of the tail of pit vipers may be divided). Non-poisonous snakes in Tennessee do not have pits or elliptical pupils (they are round), and all scales on the underside of the tail are divided in two. You **cannot** determine if a snake is poisonous by the shape of its head.



If snakes are found frequently around your house, it is probably because there is an abundance of rodents in the area. All snakes are predators and, depending upon the species of snake, eat many different kinds of food — from rodents to insects, birds and eggs, worms, fish and frogs. Snakes typically are found in areas that provide shelter for rodents such as woodpiles, brush and rockpiles, overgrown fields, and old sheds and barns (especially those where feed is stored). The best way to reduce snake populations around your house is to remove or clean up those areas that are attractive to rodents. Vegetation should be mowed closely and all brush and rockpiles near a house or other buildings should be removed to make the area less attractive to rodents and snakes.

Shooting or severing the head of a snake is the action taken by many people when a snake has been encountered. Few people realize snakes are protected wildlife species and indiscriminate killing is illegal. This should not preclude you from killing a poisonous snake that poses a genuine threat; however, it is recommended that the animal be captured and removed if possible. Since snakes are protected wildlife species, you should consult an officer with the Tennessee Wildlife Resources Agency before killing these animals, when possible.

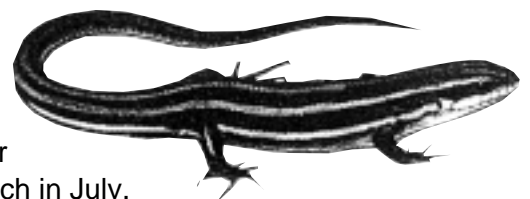
Methods of removing snakes include glue boards and traps. Glue boards work well and are quite cost effective. Glue boards should be placed against walls for best results, as this is where snakes normally travel. Vegetable oil is used to dissolve the glue and release the snake unharmed once the snake has been relocated. Another trap used for snakes is the funnel trap, which is made of wire mesh with drift fences radiating out to direct the snake into the trap. Snake repellants have not been found effective on a consistent basis. As with other pesky critters, exclusion is the most important step in avoiding future problems with snakes. All openings into buildings 1/4-inch or larger should be sealed by some means, such as mortar, steel wool, sheet metal or hardware cloth.

Although costly, a properly constructed snake-proof fence made of heavy galvanized hardware cloth can keep snakes from entering a given area. The fence should be approximately 36 inches tall with the lower edge buried 4-6 inches. The fence should be slanted outward from the bottom to the top at a 30-degree angle. Supporting stakes should be placed inside the fence and gates should be fashioned to swing inward because of the slope of the fence. Any opening under the fence should be filled firmly. Vegetation should be mowed closely or killed with herbicide to prevent snakes from using these plants to climb over the fence.

## Lizards

People are frequently concerned with lizards around their house and want to know how to control them. There are 10 kinds of lizards in Tennessee, and all are harmless; none are venomous. Two of the most common lizards are the fence lizard (*Sceloporus undulatus*) and the 5-lined skink (*Eumeces fasciatus*). The fence lizard is scaly gray with a rough appearance and the 5-lined skink has 5 light stripes on a dark background. Juvenile 5-lined skinks have a blue tail that turns to brownish-gray in adults. The older males may lose their stripes and have a coppery-red colored head.

The above lizards obtain sexual maturity in their second spring and females lay 6-10 eggs in a relatively moist, protective spot, such as under a rotting log, sawdust pile or rock. Eggs normally are laid in June and hatch in July. Lizards feed on invertebrates (e.g., insects, spiders, millipedes and snails) and are preyed upon by foxes, skunks, raccoons, hawks, owls, snakes and other lizards.



Five-lined skink

Despite the fact that all lizards in Tennessee are harmless, some people still want to remove them. It should be understood that lizards are protected in Tennessee and indiscriminate killing is illegal. Also, permission from your county wildlife officer and a permit are necessary to keep one in captivity.

Glue boards are effective for trapping lizards. As with snakes, glue boards should be placed against walls for best results. Vegetable oil poured over lizards stuck to the glue boards will allow them to be released unharmed.

## **General Trapping Tips**

Following are some tips that can help you in trapping those pesky critters around your house.

Traps should not be treated, because the odor of paint or wood preservatives may act as a repellent to some animals. The odor of an animal previously captured sometimes will attract other animals to the trap. Some animals may be repelled by the scent of other animals. Urine from either wild or domestic mammals placed on a new trap may make it more attractive. Placing a new trap outside for several weeks will enable it to “weather.” Avoid using petroleum-based grease or oil. If lubrication is needed, rub animal fat over the working parts.

Place traps near cover along a trail used by the animal. Live traps should be placed as level as possible so that it works properly and will not roll over when the

animal tries to enter. Some animals may try to reach the bait from outside the trap, so be sure to center the bait in the trap, behind the trigger mechanism. Tall grass and other obstructions in front of the trap door should be removed so the animal has a clear entrance.

Make every effort to minimize chances of capturing or killing non-target individuals or species. Traps should be checked regularly (at least once per day) so captured animals will not harm themselves. Make a point to see that no animal suffers unnecessarily in your trap.

Remove live-trapped animals with caution. Know beforehand where and how you will release or dispose of trapped animals. Live-trapped animals should either be killed or released far enough away so they will not return. Do not release animals in an area where they will become someone else’s problem. The law requires you get the landowner’s permission before releasing an animal on someone else’s property.

To catch a certain kind of animal, trap size, trap placement and kind of bait are important. There are many kinds of commercial baits and scents available, but many baits are available in your home. Baits that may be used successfully in trapping common pests around the house are listed in Appendix A.

### **Appendix A. Baits and Trap Sizes for Various Animals.**

<b>Species</b>	<b>Bait</b>	<b>Live Trap Size (inches)</b>	<b>Other</b>
Opossum	Vegetables, apple slices, sardines, scrap meat, canned dog food, chicken entrails, fish, table scraps	11 x 11 x 36	
Rabbit	Vegetables, cabbage, carrots, lettuce, bread, apple slices	7 x 7 x 30	Enclosed box trap does not have to be baited, lead the rabbit over the trip by placing several small pieces of bait in front of the trap and at 3" or 4" intervals on into the trap.
Raccoon	Fish (fresh or canned), fresh corn, scrap meat, canned dog food, sardines, chicken, whole fresh egg over sardines, bacon, table scraps	13 x 13 x 42	Fish oil or commercial raccoon lure are attractive to coons.
Skunk	Chicken heads or entrails, fish (fresh or canned) scrap meat, canned dog or cat food, sardines, dead mice, whole fresh egg over sardines, bacon, table scraps, peanut butter and honey	7 x 7 x 30	Skunks usually do not spray if trap is covered with a burlap bag to darken it before transporting.
Squirrel	Nuts, peanut butter, whole peanuts, rolled oats, bread, shelled corn, pumpkin or sunflower seed, dried prunes	7 x 7 x 30	Set traps along paths frequently used by squirrels - tree bases, feeding stations, rooftops, etc.
Weasel	Fresh fish, liver, chicken entrails, meat scraps	5 x 5 x 18	Place trap in crannies, brush piles, log piles, or any small covered area. Adjust pan to "hair trigger."
Groundhog	Lettuce, peas or beans, corn, cabbage, carrots, apples, and other fruits	11 x 11 x 36	
Coyote	Weiners, canned dog food	30 x 30 x 70	Commercial coyote scents work well.
House cat	Fish, meat, cat food, table scraps	11 x 11 x 36	
Fox	Chicken necks and entrails, meat or flesh from almost anything that walks, flies or swims	12 x 12 x 55	Commercially available fox urine is effective, and just a small amount on the end of a stick is enough.
Chipmunk	Nuts, peanut butter, bread, shelled corn, unroasted peanuts, rolled oats, apple cubes, sunflower seeds	5 x 5 x 18	Set traps near trails or dens.
Mouse	Cheese, bread, oatmeal, peanut butter, nuts, gumdrops, raisins, scorched bacon (most human foods are readily accepted)	3 x 3 x 10	
Mink	Chicken entrails, fresh fish, liver	7 x 7 x 30	Cubby sets are effective. Place brush or other material over the trap so animal has sensation of going into a hole to get bait.
Muskrat	Apple slices, other fruits, carrots, cabbage, lettuce	7 x 7 x 24	
Rat	Bloody meat scraps, peanut butter, cheese, gumdrops, (most human foods are readily accepted)	5 x 5 x 18	Place traps along walks, behind objects, along sills, head boards and rafters.
Dog	Weiners, canned dog food, bacon, smoked ham scraps, table scraps	30 x 30 x 70	
Bobcat	Chicken necks and entrails	12 x 12 x 55	Commercial bobcat scents work well.

## Appendix B

For further assistance, who do you call?

### USDA Wildlife Services:

- Migratory birds
- Non-game species
- Pigeons
- House (English) sparrows
- Winter blackbird roosts (from Thanksgiving through March 15)
- Wildlife problems associated with commercial and industrial sites
- Wildlife problems around airports

Brett Dunlap, State Director  
USDA, APHIS, Wildlife Services  
441 Donelson Pike, Suite 340  
Nashville, TN 37214  
Phone: (615) 736-5506

Keith M. Blanton  
USDA, APHIS, Wildlife Services  
4708 Western Ave., Suite A  
Knoxville, TN 37921  
Phone: (865) 588-0299

David B. Lingo  
USDA, APHIS, Wildlife Services  
36 Brentshire Square, Suite A-2  
Jackson, TN 38305  
Phone: (731) 668-3388

### Tennessee Wildlife Resources Agency (TWRA):

- Game species
- Furbearers
- Exotic species (e.g., lions, parrots, hyenas, Bigfoot)
- Summer blackbird roosts (from March 15 through Thanksgiving)

Ed Warr, Wildlife Services Coordinator  
Tennessee Wildlife Resources Agency  
Ellington Agricultural Center  
P. O. Box 40747  
Nashville, TN 37204  
Phone: (615) 781-6612

TWRA Region I-Jackson  
225 Martin Luther King Blvd.  
State Office Bldg., Box 55  
Jackson, TN 38301  
(731) 423-5725  
Toll Free: 1-800-372-3928

TWRA Region II-Nashville  
Ellington Agricultural Center  
P. O. Box 40747  
Nashville, TN 37204  
(615) 781-6622  
Toll Free: 1-800-624-7406

TWRA Region III-Crossville  
464 Industrial Blvd.  
Crossville, TN 38555  
(931) 484-9571  
Toll Free: 1-800-262-6704

TWRA Region IV-Morristown  
3030 Wildlife Way  
Morristown, TN 37814  
(423) 587-7037  
Toll Free: 1-800-332-0900

TWRA Central Office-Nashville  
Wildlife Division  
Ellington Agricultural Center  
P. O. Box 40747  
Nashville, TN 37204  
(615) 781-6610

## Appendix C

### MATERIALS AND SUPPLIES

#### Metal Wires or Projectors

Nixalite of America  
1025 16<sup>th</sup> Avenue  
Box 727  
East Moline, IL 61244-0727  
(800) 624-1189

Cat Claw, Inc.  
Box 3778  
Johnstown, PA 15904  
(800) 832-2473

#### Polybutenes (sticky or tacky repellents) and Foot Irritants

B & G Chemicals and Equipment Co., Inc.  
10539 Maybank  
Dallas, TX 75354-0428  
(800) 345-9387

Birdbusters  
1083 Thomas Jefferson St. NW  
Washington, DC 20007  
(800) 662-4737

Bird-X, Inc.  
730 W. Lake Street  
Chicago, IL 60661  
(800) 662-5021

J. T. Eaton & Co., Inc.  
1393 E. Highland Rd.  
Twinsburg, OH 44087  
(800) 321-3421

J. C. Ehrlich Chemical Co.  
500 Springs Ridge Dr.  
Reading, PA 19612  
(800) 488-9495

Hot Foot America, LP  
#406 1980 Washington St.  
San Francisco, CA 94109  
(800) 533-8421

The Tanglefoot Co.  
314 Straight Ave., SW  
Grand Rapids, MI 49504-6485  
(616) 459-4139

#### Taste Repellents

Miller Chemical and Fertilizer Corp. (Hot Sauce®)  
Box 333 Radio Rd.  
Hanover, PA 17331  
(800) 233-2040

Burlington Scientific Corp. (Ro-pel®)  
222 Sherwood Ave.  
Farmingdale, NY 11735  
(516) 694-9000

#### Skunk Odorizers

R.C.F. Development, Inc. (Super CD-2®, Skunk-Off®)  
2509 Browncroft Blvd.  
Rochester, N.Y. 14625

J. Norris Corp. (Dazie Disk®)  
25 West Merrick Rd.  
Dept. BR-92  
Freeport, N.Y. 11520

Nisus Corp. (Shazam® Odor Control)  
215 Dunavant Dr.  
Rockford, TN 37853  
(888) 274-2026

#### Netting

Miller Net and Twine  
Box 18787  
Memphis, TN 38181-0787

Nylon Net Co.  
615 East Bodley Avenue  
Box 592  
Memphis, TN 38101

Home Depot

Lowes

## **Rodenticides (Zinc Phosphide and Anticoagulants)**

ArChem Corp.  
1514 11<sup>th</sup> St.  
Box 767  
Portsmouth, OH 45662  
(800) 635-1125

B & G Chemicals and Equipment Co., Inc.  
10539 Maybank  
Dallas, TX 75354-0428  
(800) 345-9387

Bell Laboratories, Inc.  
3669 Kinsman Blvd.  
Medicine, WI 53704  
(608) 241-0202

HOCCO Inc.  
Box 7190  
Madison, WI 53707  
(608) 221-6200

J. T. Eaton & Co., Inc.  
1393 E. Highland Rd.  
Twinsburg, OH 44087  
(800) 321-3421

Monterey Chemicals Co.  
5150 N. 6<sup>th</sup> St.  
Box 5317  
Fresno, CA 93755  
(209) 225-4770

Motomco, Ltd.  
3699 Kingman Blvd.  
Madison, WI 53704  
(813) 447-3417

RCO, Inc. (Mole Patrol®)  
P. O. Box 446  
Junction City, OR 97448  
(800) 214-2248

The Huge Co.  
7625 Page Blvd.  
St. Louis, MO 63133  
(800) 873-4843

York Distributors  
120 Express St.  
Plainview, NY 11803  
(800) 645-6007

## **Mole Traps**

Nash Mole Trap Co. (Choker-loop type)  
5716 E. S Ave.  
Vicksburg, MI 49097-9990  
(616) 323-2980

Woodstream Corp. (Harpoon and Pincher type)  
69 N. Locust  
Lititz, PA 17543-0327  
(717) 626-2125

B & G Chemicals and Equipment Co., Inc.  
(Harpoon type)  
10539 Maybank  
Dallas, TX 75354-0428  
(800) 345-9387

P-W Mfg. Co. (Pincher type)  
610 High St.  
Henryetta, OK 74737  
(918) 652-4981

## **Traps and General Trapping Supplies**

Burnham Brothers  
Box 1148  
Menard, TX 76859  
(800) 451-4572

Duke Co.  
508 Brame Ave.  
Box 555  
West Point, MS 39773  
(601) 494-6767

Forestry Suppliers, Inc.  
P. O. Box 8397  
Jackson, MS 39284-8397  
(800) 647-5368

M & M Fur Co.  
Box 15  
Bridgewater, SD 57319-0015  
(605) 729-2535

R-P Outdoors  
P. O. Box 1170  
Mansfield, LA 71052  
(800) 762-2706

Tomahawk Live Trap Co.  
P. O. Box 323  
Tomahawk, WI 54487  
(800) 27A-TRAP

Woodstream Corp.  
69 N. Locust  
Lititz, PA 17543-0327  
(717) 626-2125

The University of Tennessee Agricultural Extension Service does not necessarily endorse any of the above-mentioned companies or commercial products.

Some of the information and illustrations in this publication were adapted from *Prevention and Control of Wildlife Damage* (1994), edited by S. E. Hygnstrom, R. M. Timm and G. E. Larson.

# ***a U.T. Extension Reminder...***

## **Methods for Reducing Deer Damage**

### **Herd Management**

Harvesting an adequate number of deer during the legal hunting season is the most efficient method of controlling damage. Since there are virtually no wild predators remaining in Tennessee (e.g., wolves, mtn. lions), people must fill the void to prevent overpopulation (which already has occurred in many areas). Concentrate on harvesting does. Herd reduction is not possible without harvesting an adequate number of female deer.

### **Fencing**

Fencing is most practical when the area of protection is 50 acres or less. A cost-benefit analysis will weigh the value of the crop against the cost of fence construction and maintenance. Several types of fencing are available; however, exclusion fences ( $\geq 8$  feet high) are the most effective (and expensive). Electric fences are effective, especially when some type of attractant (e.g., peanut butter) is placed on aluminum foil tabs and attached to the fencing (e.g., polytape) so that the deer's nose or mouth is shocked, thereby helping to ensure avoidance of the area. Further, a high-tensile 6-wire electric fence that presents a physical and psychological barrier to the deer is effective.

### **Repellents**

Repellents are best used to reduce deer damage to relatively small areas (e.g., vegetable garden, small orchard) and are not recommended to eliminate damage by deer. Two types of repellents are available: contact (which repels by taste) and area (which repels by odor). Success of repellents is determined to a large extent by the availability of alternate food sources and how hungry the deer are. Success oftentimes is limited and re application of repellents is necessary over time, especially after rainfall. Habituation is a common problem as deer learn that there is no harm associated with the repellents.

A combination of these methods may be required to be effective and successfully eliminate deer damage. For further information, contact your county Extension agent and request "Managing Deer Damage in Tennessee" (PB 1509), or contact the appropriate TWRA regional office.

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