Chapter 22
Controlling Vertebrate Animal Damage in Southern Pines

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Abstract

Certain mammals and birds may damage or destroy southern pines, causing economic losses in intensively cultured areas such as seed orchards and nurseries. Mammal pests may eat seeds; tunnel, dislodging seedlings, or chew on roots; or girdle, debark, or sever stems or branches. Bird pests may eat seeds or excavate holes in tree trunks. The first important step is to identify the pest(s) from the damage left behind. Thereafter, various control options — from using traps and repellents to altering habitat — are available.

22.1 Introduction

Over 20 species of mammals and birds can cause economic losses to intensive pine culture in nurseries or seed orchards. Indeed, published literature on most wildlife damage problems is scanty, and the value of losses is not well documented. This chapter aims to familiarize nursery personnel (and foresters) with the species that damage southern pines, to identify the type of damage, and to summarize currently available legal controls. The number of potentially destructive animal species in such areas is higher than in stands of out-planted trees because the value of seeds and seedlings is greater per unit area.

22.2 Mammal Pests

Potential wild mammal pests include, among others, voles (*Microtus* spp.), field mice *(Peromyscus* spp.), cotton rats *(Sigmodon hispidus),* pocket gophers *(Geomys* spp.), squirrels *(Sciurus* spp.), beaver *(Castor canadensis),* rabbits *(Sylvilagus* spp.), armadillos *(Dasypus novemcinctus),* white-tailed deer *(Odocoileus virginianus),* and moles *(Scalopus aquaticus).* Potential domestic mammal pests include feral hogs, cows, horses, and perhaps others.

22.3 Bird Pests

Certain birds — for example, evening grosbeaks *(Hesperiphona vespertina)* and red-winged blackbirds *(Agelaius phoenicieus)* — eat seeds from cones. Seeds fallen to the ground or seeds sown in seedbeds may be fed on by a great number of species, especially finches. A woodpecker, the yellow-bellied sapsucker *(Syphrapicus varius),* may damage bark of live trees, and other woodpeckers may excavate holes in bark of trees infested with beetles. Large birds like hawks and crows occasionally perch on small trees and break leaders or branches. Bird damage, unlike mammal damage, often cannot be identified as to species; this is particularly true of seed losses and damage to branches and leaders.

22.4 Diagnosis of Damage

22.4.1 Terminology

Various terms describe what vertebrates do to trees or to each other. ***Predation*** refers to one animal eating another. ***Depredation*** pertains to animals destructively feeding on seeds, grains in ear, or fruits. Predation is sometimes used by foresters when they mean depredation. ***Damage*** is a general term that can apply to animals feeding on forages, seedlings, or other woody vegetation. ***Browsing*** is a specific term that applies to vertebrate animals eating leafy shoots and twigs.

22.4.2 Identification

Because vertebrates are often secretive and seldom seen, an untrained person may find it difficult to identify damage done by these animals. Therefore, it helps to know which ones occur in a given area and what "clues" they may leave behind. Good general guides include Murie [4], Burt and Grossenheider [1], and Peterson [5].

To begin identifying damage, examine it. Is it below or above ground? Damage to roots or to stems close to the ground is limited to a few species (Table 22.1). If below ground, is the damage associated with runways made by moles? Many small rodents, such as pocket gophers or pine

M. L. Duryea & P. M. Dougherty (eds), Forest Regeneration Manual, pp. 421–426.

Table 22.1. Identification of animal damage to wood vegetation in the Southeast.

Location and description of damage	Most likely animal pest
Chewing below ground	
Taproot chewed through. Chew marks about 0.16 cm (1/16 in.) wide.	Pocket gopher
Taproot or other roots chewed through, or bark chewed off. Toothmarks very fine, about 1 mm (0. 04 in.) or less.	Pine vole (Orchard mouse)
Stem girdling or debarking near the ground [within 1.2 m (4 ft)]	
Bark chewing up to 0.3 m (1 ft. above ground. Toothmarks 0.16 cm (1/16 in.) wide.	Cotton rat
Bark chewed within 0.6 m (2 ft) of ground. In snow country, damage may be higher. Toothmarks 0.16–0.32 cm (1/16–1/8 in.) wide.	Rabbit
Bark or stem chewed within 5 cm (2 in.) of ground. Toothmarks very fine, about 1 mm (0.04 in.) or less.	Pine vole (Orchard mouse)
Bark removed up to 0.9 m (3 ft) above ground. Lengthwise rub marks (antlers).	Buck deer (fall and winter only)
Bark removed up to 0.9 m (3 ft) above ground. Crosswise, parallel toothmarks 0.3–0.6 cm (1/8–1/4 in.) wide.	Beaver
Irregular strips removed at base of saplings as a result of trampling. No toothmarks.	Cattle
Branch girdling or debarking (usually 10 cm (4 in.) or more above ground)	
Irregular plates of bark removed, often measuring several inches on a side. Large toothmarks, few and scattered. Bark may be stripped from base due to inner bark feeding. Claw marks result from climbing.	Bear
Bark removed from trunks or branches, often at considerable heights.	Squirrel
Bark removed 0.6–2.4 m (2–8 ft) above ground. Large, irregular toothmarks combined with stripping.	Horse
Bark removed from twigs in patches, or stems may be girdled. Chewing so fine that no toothmarks show.	European hornet (insect); often mistaken for vertebrate animal damage
Branch or stem severing	
Shoots, saplings, or small trees cut off at base within 0.6 m (2 ft) of ground. Saplings cut off at an angle – larger trunks cut so as as to leave a stump tapering to a point in the middle. Toothmarks 0.3–0.6 cm (1/8–1/4 in.) wide.	Beaver
Twigs or branches found at water's edge with bark chewed off.	Beaver
Twigs chewed off at sharp angle within 38 cm (15 in.) of ground. Toothmarks 1/16–1/8 in. wide.	Rabbit
Twigs broken or pulled off within 1.8 m (6 ft) of the ground; may be very close to the ground. Twigs do now show cut edges.	Deer, cattle, horses
Twigs cut from high up in trees and found lying on the ground. Toothmarks 0.16–0.32 cm (1/16–1/8 in.) wide.	Squirrel
Leafy twigs of hickory or pecan cut neatly from high up in trees and lying on the ground. Cut ends show twig has been encircled by a 0.16 cm (1/16 in.)-deep cut and the central part of the wood has broken off.	Hickory twig girdler (insect); often mistaken for vertebrate animal damage
Holes in tree trunks	
Small holes 0.6–1.3 cm (1/4–1/2 in.) in diameter in bark of live trees and arranged in horizontal lines (feeding injury).	Yellow-bellied sapsucker (woodpecker)
Small holes as above in live or dead trees but randomly scattered (feeding injury).	Small woodpeckers (various species)
Round holes about 5 cm (2 in.) diameter in large, live pines (nesting cavity). Pecked area around hole oozes pitch.	Red-cockaded woodpecker
Round holes 3.8–7.6 cm (1 1/2–3 in.) in diameter in dead or live trees (nesting cavity).	Woodpeckers (various species)
Vertical oval or rectangular holes 5 × 10 cm (2 × 4 in.) or larger. Long, irregular 2.5–15 cm (1–6 in.) chips at base of tree.	Pileated woodpecker
Holes as above but chewed at edges by some other animal (nesting cavity enlarged by squirrels).	Woodpecker

voles, travel in mole runways and can severely damage roots. If above ground, how far above? Certain small mammals, notably cotton rats and rabbits, often damage small stems within 60 cm of the ground. Deer or domestic livestock may browse from ground level to about 2 m up. Beavers may chew bark to almost a meter up, squirrels at any height.

Visit the area where damage occurs at various hours to see and identify wildlife. Night is a good time to look for mammals; early morning is prime time to observe birds feeding. Rake the earth smooth in selected areas so it will preserve tracks. Set mouse or rat traps to catch small mammals; peanut butter or moistened, rolled oats make good bait. Freeze unfamiliar small mammals and get assistance in identifying them from a wildlife biologist; be aware that some apparent "vertebrate damage" is actually due to insect pests. Get legal permission from state and federal wildlife agencies before collecting protected birds.

22.5 Control Options

After identifying the pest, consider management options. The first is to do nothing. Is the damage serious? Is the animal a federally protected species? Are control permits required? Sometimes the extent of damage does not justify control. For example, sapsuckers may deface valuable trees but may cause no real threat to their existence or to seed or timber production. Often, however, damage by a single animal exceeds the acceptable economic threshold. For

Table 22.2. Options for controlling damage to the southern pines by vertebrate pests.

Animal	N*	SO*	Tree age class	Damage characteristics	Control options	Remarks
MAMMALS						
Armadillo (*Dasypus novemcinctus*)	X		Seedlings only	Holes dug in earth.	Shooting. Trapping. Soil insecticides.	
Insectivores						
Mole (*Scalopus aquaticus*)	X		Seedlings	Tunneling in seedling beds.	Trapping. (Control soil insects with insecticides, possibly.)	Insect control often gives slow and uncertain results. Some insecticides may not kill earthworms, which moles also feed on.
Rodents						
Pine vole (orchard mouse) (*Microtus pinetorum*)	X	X	All; usually seedlings and saplings	Roots chewed. Bark removed from large and small roots. Roots severed. Small stems chewed, within 7 cm of ground. Toothmarks about 1 mm wide.	Poison baits. Weed control around trunks in harborage areas.	Pine vole populations are local and sporadic. Potentially serious pest. Controls practical and economic. Surveillance desirable.
Deer mouse, whitefooted mouse, and others (*Peromyscus* spp.)	X		Seeds	Seeds chewed or consumed.	Poison baits. Seed treatments. Removing harborage areas.	*Peromyscus* species occur throughout the United States.
Cotton rat (*Sigmodon hispidus*)	X		Seeds	Seeds chewed or consumed.	Poison baits. Seed treatments. Removing harborage areas.	Status of problem unknown.
		X	Seedlings, saplings	Bark girdled, usually within 30 cm of ground.	Poison baits. Weed control.	Sporadic but serious problem when populations are high and food is scarce.
Pocket gopher (*Geomys* spp.)	X	X	Seedlings, saplings potentially larger tress as well	Roots chewed. Large roots severed. Toothmarks 2 mm wide.	Poison baits. Traps.	Usually confined to sandy soils. Sandy mounds easily identified.
Squirrel Gray squirrel (*Sciurus carolinensis*)		X	Saplings and up	Bark chewed on trunks and branches well above ground.	Traps. Shooting. Tree guards. Custom-designed fences.	Rated the most important vertebrate pest by seed orchardists. Squirrel populations are cyclic.
Fox squirrel (*Sciurus niger*)		X		Cones removed.	Poison baits (not labeled for squirrels but could be very effective).	Squirrels will travel long distances during population highs and concentrate at food sources. Could remove nearly all cones from large acreage.
Beaver (*Castor canadensis*)		X	Saplings and up	Bark chewed. Large and small trees felled.	Trapping with live, leghold, or body-grip traps.	Likely near water. Control practical and effective.
Lagomorphs						
Rabbit (*Sylvilagus floridanus*)	X	X	Seedlings, saplings	Bark chewed up to 46 cm (18 in.). Seedlings up to 2 cm in diameter severed.	Repellents. Trapping. Eliminating brush or other harborage. Fencing with small-mesh chicken wire 85 cm high.	Populations local. Sporadic population highs likely. Do not harvest fox and bobcat in problem areas. Repellents often unsatisfactory.
Ungulates						
Deer (*Odocoileus virginianus*)	X	X	Seedlings, saplings	Foliage and buds browsed. Bark rubbed from saplings (lengthwise rubbing) Bark of large tress gouged with antlers (rare). Seedlings trampled in seedbeds.	Repellents a temporary solution. Shooting and sport hunting. Electric fencing. Plastic tubing will protect outplanted seedlings (Vexar® is a common brand).	Potentially serious problem.
Pig (*Sus scrofa*)	X	X	All	Ground disturbed. Saplings uprooted. Barks removed from roots and stems. Lateral roots dug out and debarked.	Trapping with live or leghold traps. Shooting.	Seldom reported but potentially serious pest. Feral populations exist in many parts of the South.

* N = nursery problem; SO = seed-orchard problem.

Table 22.2 (continued)

Animal	N*	SO*	Tree age class	Damage characteristics	Control options	Remarks
Cow	X	X	Seedlings, saplings	Stems trampled. Bark gouged close to ground. Foliage and buds browsed. Branches broken.	Notifying owner.	Rare problem.
Horse	X	X	Seedlings, saplings	Stems trampled. Foliage and buds browsed. Bark stripped and chewed.	Notifying owner.	Rare problem.
BIRDS						
Seedeaters	X		Sown seeds	Seeds eaten.	Seed treatments. Scaring. Netting. Avitrol® will disperse flocks (only labeled for	Potentially serious problem. Widespread. Many species involved: blackbirds, house sparrows, and pigeons.
		X	Seeds from cones	Seeds eaten.	Scaring.	Red-winged blackbirds, grosbeaks, some others will pick seeds from open cones. Not a problem when closed cones are harvested. (Not reported to be a serious problem.)
Yellow-bellied sapsucker (*Sphyrapicus varius*)		X	Large trees	Horizontal rows of closely spaced holes penetrating to inner bark.	Shooting.	Injuries not usually serious in themselves but may attract insect pests.
Other woodpeckers		X	Large trees	Round or irregular holes in bark.		No records of important damage.
Miscellaneous large birds		X	Leaders of saplings	Broken leader.		Leaders damaged by perching. Associated with borer damage to leader.

* N = nursery problem; SO = seed-orchard problem.

example, one beaver feeding in young pines along a creek or building a dam that could flood a large area may justify preemptive control with rifle or body-grip trap.

Wildlife management involves regulating the abundance of a certain species through two main approaches: (1) habitat management, which manipulates the animal's environment, and (2) population management, which removes or protects animals. Both approaches often are necessary. For example, to control pine voles in a seed orchard or nursery, it is desirable to (1) minimize their habitat area by removing any mulch or vegetation near tree trunks and mowing grass closely, and (2) reduce their population in remaining areas of thatch or brush by broadcasting zinc phosphide bait pellets. In production stands, vole control is impractical.

Habitat management, where it works, may have longer lasting effects than population management. For instance, small rodents can reproduce or reinvade explosively in an ideal environment.

The following text and Table 22.2 describe damage-control options available to seed-orchard, nursery, and forest managers for specific vertebrate pests. Currently, the single best source for further information about wildlife-damage control is Timm [6].

22.5.1 Mammals

22.5.1.1 Armadillos

Armadillos may dig and burrow in soft earth in their search for insects and worms and, in the process, dislodge seedlings. Use a soil insecticide to remove insects and worms, or use cage traps to remove the armadillos. Rotten bananas and slightly spoiled hamburger make good baits. Shooting with a 22 rifle or shotgun loaded with size 2 shot or larger is also effective.

22.5.1.2 Moles

Insectivorous moles may heave or dislodge seedlings by tunneling in seedling beds. Moreover, their burrows may harbor small rodents that feed on roots, stems, or seeds. But moles can be beneficial, too, by feeding on insects that may

damage seedlings, including beetle larvae and mole crickets. Overall, they are not a problem in most forestry situations.

Moles reproduce very slowly in comparison with rodents. They typically have one litter of young per year and only a few young at a time. For this reason, mole traps are often effective. Both choker and harpoon types work well. To locate a good trap site, tread down runways in several places. Mark those spots. Repeat the process for a few days to locate places where burrows are reopened daily; set traps at such places.

Soil insecticides will reduce a mole's food supply and, eventually, the mole population, although the short-term result may be more tunneling because moles will have to burrow further to meet their food requirements. However, since these insecticides also kill beneficial organisms such as earthworms and some other soil invertebrates, removing the moles, rather than their food supply, is the better approach.

22.5.1.3 Small rodents

Small rodents cause a variety of occasional and sporadic problems ranging from eating seeds to chewing stems and roots. Cotton rats, mice, and voles may eat seeds or damage seedlings. Cotton rats and pine voles may damage saplings as well.

To control small rodents, population and habitat should be managed in combination. Periodically trap rodents in snap traps. Eliminate weeds near seedbeds as well as mulch in problem areas; mow seed orchards closely. In outplanted areas, controlling weeds and planting less vulnerable large-diameter seedlings can eliminate cotton rat damage.

Hawks and owls that prey upon small rodents can help significantly to manage rodent populations. Because predatory birds need a high vantage point from which to watch for prey, leave some tall trees or snags in areas to be planted to facilitate use by avian predators. Avoid shooting or trapping mammalian predators (such as foxes, bobcats, and coyotes) in areas where rodent control is a high priority.

Dry baits in the form of 2% zinc phosphide pellets are labeled for controlling pine voles and certain other mice. These may be handplaced near burrows or in runways, or broadcast on grassy or weedy areas. Do not broadcast this bait on bare ground because rodents are less likely to find it and it may poison birds. Repeat treatments are necessary, however, because rainy and damp conditions cause pellets to quickly deteriorate. For a review of vole control with baits, read Byers *et al.* [2].

22.5.1.4 Pocket gophers

Pocket gophers may girdle or completely clip small trees and damage roots of a wide variety of tree species. These rodents are usually confined to soils with a sandy or sandy loam A horizon. They make conspicuous mounds of soil — hence their local southern name of "sandy mounder," which has been corrupted to "salamander" in many areas.

Pocket gophers are major problems where pastures and fields are converted to pines. They may be controlled by strychnine or zinc phosphide baits handplaced in burrows. If gophers are present in pastures intended for reforestation, gopher control is recommended before planting begins. Locate burrows by digging down at the mound to intersect the main tunnel. Place baits deep in the burrows; special probes for placing bait are commercially available. Then plug the tunnels with earth where they intersect the excavation.

22.5.1.5 Squirrels

Fox squirrels *(Sciurus niger)* and gray squirrels *(Sciurus carolinensis)* feed on cones, and both species, especially fox squirrels, occasionally remove bark from large trees. Sometimes fox squirrels may remove plates of bark up to 10 x 30 cm near the tops of large (25-m) pines. Squirrels are highly mobile and may cover a larger home range that other rodents or rabbits. Moreover, individuals from crowded populations short on food may travel for miles. Hence, removing a few animals may not stop the problem. Tree guards made from bands of metal 85 cm wide and wrapped to form a cylinder at head height on trunks will protect individual trees. Shooting may reduce populations in some cases. Box choker-type traps wired to tree trunks can be very effective; use two or three traps per acre. Bait with nut meats or crusts of bread spread with peanut butter.

22.5.1.6 Rabbits

A rabbit which has clipped seedlings usually lives close to the area where clipping damage is observed. For small areas, persistent shooting aided by a spotlight after dark will reduce rabbit populations. Wooden box traps left permanently in place will catch new arrivals; such traps are effective with or without bait.

For larger areas, broader measures are needed. A 1-in.-mesh wire fence 85 cm high will keep rabbits out of a nursery. Site- preparation treatments that avoid debris piles but leave a few snags and isolated trees per hectare for birds of prey can be effective in preventing high rabbit populations from developing. Habitat management that reduces hiding cover and abundance of forage plants is probably the best approach on large tracts.

22.5.1.7 Deer

Deer trample seedbeds, browse seedlings, and rub their antlers on saplings. A single electric wire 85 cm high baited with a 50-50 slurry of peanut butter and vegetable oil and marked with flagging will keep most deer out [3]. Apply the peanut butter slurry with a paint roller. The most practical approach is population management through legal hunting or under authority of state game agencies by special permit. Plant large vigorous seedlings to increase their chances of surviving browsing. Where deer populations are high, delaying planting until spring foods have emerged may be a good strategy, although this may require using container seedlings.

Various repellents are labeled for use with deer and are of two types: (1) area repellents, which are sprayed on vegetation near the crop or applied to rags hung on posts or branches to give off an unpleasant smell to deer, and (2) taste repellents, which are sprayed on the plant parts to be protected and which taste unpleasant to deer. Thiram® and rotten-egg solids are common ingredients in taste repellents. Repellents should be applied before deer discover seedlings. However, regardless of type, repellents provide partial and temporary protection at best.

22.5.1.8 Domestic grazing animals

Cattle, the most common domestic pest, trample and browse seedlings, and compact the soil where they tend to congregate. Domestic livestock may be fenced out much more easily than deer, but usually the problem is with the owner of the livestock.

Keep cattle out of newly regenerated areas for at least the first 1 or 2 years. Then permit grazing under a system in which the number of cattle and length of grazing on a site can be regulated. Locate feeding stations outside of planted areas if possible. Keeping cattle off bedded sites is a must because cattle will walk along bed tops during the wet months. On the other hand, subsoiled trenches on upland sites tend to protect seedlings because cattle prefer not to walk in those trenches.

Escaped domestic or feral hogs, which occasionally are a problem in newly planted stands and which can severely damage orchards, nurseries, and progeny test plots, may be removed with special box traps or gated enclosures. Where legal, no. 4 leghold traps will catch feral hogs; however, this size trap is illegal for upland use in some states. Do not use these large traps on lands that are not under strict control. Stake the traps securely or fasten them to heavy drags. Set traps in known trailways or bait hogs to trap locations with corn, table scraps, or other food.

22.5.2 Birds

In nurseries, bird species may eat sown seed or pluck the tops off seedlings after they have emerged but while the endosperm is still attached. This is a serious problem because genetically improved seeds are expensive.

Make sure the sowing technique covers the seed. Sowing seeds treated with Thiram® is also effective. Other seed treatments (e.g., methiocarb) are labeled for protecting planted corn from bird damage, but there has been no research on their efficacy on pine seeds. In addition, sowing with stratified seed under conditions favorable for rapid germination will minimize the vulnerable time of seed.

Various scaring devices, such as regular or "cracker" shells, acetylene or gas exploders, or fireworks, may provide short-term protection of seedbeds from flocks of seed-eating birds. However, these devices need regular attention. They should be relocated periodically and combined with human activity to be most effective. Otherwise, birds will soon learn to ignore the sound.

Netting, while often scorned as too costly or impractical, is a viable solution to some bird-damage problems. In some states (California, in particular), vast areas of small fruits are protected with removable netting which is reused annually.

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