Planting and Care of Fine Hardwood Seedlings

Hardwood Tree Improvement and Regeneration Center
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Diagnosing and Controlling Wildlife Damage in Hardwood Plantations

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Once trees are planted and begin growing, damage from wildlife can threaten their quality. In this publication we discuss how to identify and manage injury to hardwoods from wildlife to minimize losses.

Animal Damage

Deer are a problem for tree farmers in most of the Midwest. Excessively large deer herds devastate new tree plantings and naturally regenerating forests (Rathfon and Farlee 2002). Deer feed (browse) on new growth during the growing season and nip branches and terminal shoots during the winter (Fig. 1). Deer browsing is characterized by torn or irregular cuts on twigs. Deer browsing can kill conifers. Hardwood trees are not typically killed by deer browse, but they may be stunted and produce multiple leaders that necessitate pruning. If young trees are repeatedly browsed, they may die as a result of shade competition from weeds and other stresses.

Young trees 5 to 10 feet tall are also favored by bucks for rubbing (the process by which male deer remove "velvet" from their newly grown antlers). Rubbing damage occurs from September through November. Damage appears as long strips of torn or shredded bark, and the tree may be entirely girdled. Damaged trees may overgrow the wound, but these wounds provide openings for wood rotting organisms, and they may create permanent butt log defects. Trees damaged by deer rubbing should be coppiced to the ground during the dormant season.

Voles, also known as meadow mice, are plentiful in many landscapes and can be very destructive to young trees (O' Brien 1994). There are 23 species of voles in the United States but only the meadow vole (*Microtus pennsylvanicus*) and the pine vole (*M. pinetorum*) cause damage to trees in the Midwest. The meadow vole is found in wet meadows and grasslands, whereas the pine vole is found in forests, abandoned fields, orchards, or wherever heavy ground cover exists. Voles are active day and night, year round, and they spend time both above and below ground.

Meadow and pine voles cause damage by gnawing on the bark of seedlings and mature trees. During the spring and summer they feed on grasses and forbs and switch to bark in fall and winter. Underground, they may girdle larger lateral or tap roots. Injured trees will look weak, grow slowly, and appear pale. By the time one notices unhealthy looking trees, extensive root damage has already occurred. Vole population densities are variable, and large population fluctuations may occur every 2 to 5 years.

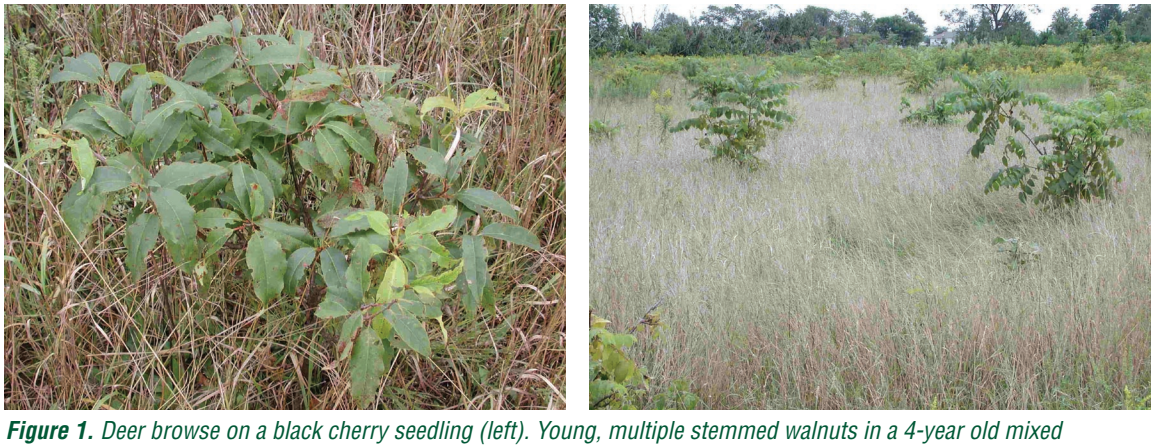

Figure 1. *Deer browse on a black cherry seedling (left). Young, multiple stemmed walnuts in a 4-year old mixed hardwood planting (right). Drought, along with chronic deer browse has killed a high proportion of the trees in this plantation and eliminated most of the red oak.*

Meadow voles build an elaborate system of surface runways within vegetation; 1½ inches wide, with many burrow openings. Pine voles do not use surface runways and push out soil at their burrow openings, leaving small conical piles of soil on the ground. These small conical piles of soil are a good indicator of the presence of pine voles.

Moles do not directly feed on tree roots, but belong to a group of mammals that feed primarily on grubs, earthworms, beetles, ants, and other small soil-dwelling organisms. Moles can cause problems when they tunnel near young trees. Mole tunnels create air pockets that can dry out and stress the root systems of young trees. If meadow voles are also present, mole tunnels can serve as runways for voles and aggravate a vole problem for young trees. Moles may also cause some direct damage to roots as they tunnel through them.

Moles are active day and night throughout the year. Surface tunneling occurs most frequently in the spring and fall, as well as following rains during the summer. Moles prefer loose friable soil (Loven 2000). The number of surface tunnels or mounds from deep tunnels is not a reflection of the number of moles occupying a given field. In general, one acre of land will support only two or three moles. New tree plantings surrounded by established forest may suffer from continual invasions of moles.

Rabbits are often blamed for damage caused by deer, but rabbits can also cause serious damage to young trees. Damage occurs when trees are dormant, winter through early spring. Rabbit damage appears as sharp, slanting cuts as if made by a knife. Rabbits can chew off the stems of newly planted trees, small dormant seedlings, and on some species they will scrape off and eat substantial patches of bark. Once trees resume active growth in the spring, rabbit damage is rare.

Beavers cut down small to fence-post sized trees for constructing their dams. Beavers will gnaw on almost any tree. Look for signs of beaver activity on the banks of streams near the plantation. Trees cut off by beavers have the look of a sharpened pencil. Typically, beaver damage will be limited to the perimeter of a planting near the stream they inhabit.

Birds can damage young trees by landing on and snapping off the tender, rapidly growing terminal shoot, causing the tree to fork. Redwing blackbirds are especially notorious for this behavior. Woodpeckers and sapsuckers damage mature trees in their hunt for food beneath the bark. Sapsucker damage typically appears as a series of small (about $^1/_8$ inch diameter) holes evenly spaced in rings around the circumference of a limb or the trunk. Bird peck holes decrease the value of timber and can ruin a log's value for veneer, especially if sapsuckers renew them every year. The holes may also serve as sites for the entry of disease. Sapsuckers will return and peck the same trees year after year, so leave trees with sapsucker damage to avoid pecking and damage on new trees.

Livestock. Cattle, sheep, horses, and hogs, tend to congregate beneath certain trees for shade and to rest, a behavior that causes both direct and indirect injuries to trees. The buttress roots and butt log of a tree are often injured directly when animals step on them or scratch themselves against the bark, leaving wounds that are susceptible to diseases such as butt-rots. Animals can indirectly injure trees by compacting and continuously disturbing the soil at the base of a tree, restricting the growth and function of small feeder roots. Some foresters recommend fencing out livestock for forest plantings or regeneration (Rathfon and Farlee 2002). However, there are techniques of pasture and woodland management (silvopasture) that permit the short-term maintenance of grazing animals on wooded land at specific times of the year (Klopfenstein et al. 1997). Most successful silvopasture examples have included conifer species and not hardwoods (Sharrow 1997). Allowing livestock into a hardwood plantation increases the risk of damage to the trees if the animals are not carefully monitored.

Management and Control of Animal Damage

Tree shelters are plastic tubes or squares that protect young trees. Tree shelters can be used with trees that were seeded, transplanted, naturally regenerated, or with coppiced shoots. Tree shelters can improve seedling survival, but will not make up for poor site selection (Anon. 1989). Positive features of tree shelters are accelerated tree height growth and protection from deer and voles, herbicide drift, and damage from mechanical weed control operations.

Tree shelters can be purchased in lengths from 2 to 6 feet (Fig. 2). For adequate protection from deer browse, shelters should be at least 4 feet high. Shorter shelters are effective for herbicide drift protection and rodent control. Shelters of all

Figure 2. *A 4-foot tree shelter on a 2-year-old walnut seedling.*

sizes will protect trees from rodents if inserted several inches into the soil. Shelters pushed too deeply into the ground can damage or restrict the growth of roots. Shelters create a greenhouse-like environment that nurtures young trees. Trees in shelters grow later into the fall and, as a result, some trees may not be fully dormant when cold weather arrives, resulting in winter dieback. This is a particular problem for black walnut and represents an important drawback to the use of shelters. Some shelters have a seam that can be opened in late August or early September to hasten tree dormancy or hardening off. If solid tubes are used, raise the shelter several inches above the soil or remove them entirely in the fall until the trees are fully dormant. Some landowners drill small holes in the tubes to permit airflow. None of these approaches is ideal. Raising the tubes off the ground or opening the side-seams provides a point of entry for rodents. Drilling holes is time consuming and limits the use of the shelter for spray protection.

Plastic tree shelters usually last from 5 to 7 years before they become brittle and disintegrate. Shelters should remain in place until trees reach about a 2-inch caliper at ground line. Shelters can sometimes be removed and reused, but often they need to be slit open if the tree has grown large side branches. Shelters that are not removed at the proper time can injure and even kill trees that have overgrown them.

Fencing can be used to limit damage caused by large animals. Fencing out deer is appropriate when deer pressure is moderate to high, when the growing stock is valuable, and if the cost of failure exceeds the cost of the fence. Deer fences can be electrified or permanent barriers. A landowner must calculate the costs of deer protection given their financial situation, acreage, and management goals.

Temporary electric fences are relatively low in cost and easy to assemble. Electric fences require a moderately expensive charging unit that usually includes a solar cell and deep-cycle storage battery. The double or triple offset fence has proven fairly effective at keeping deer out (Fig. 3). Pierce and Wiggers (1997) provide a good description of various electric fence designs.

Electric fences are not physical barriers. Rather, they function as behavior modification devices for deer (Pierce and Wiggers 1997). A

Figure 3. *The 3-wire offset temporary electric deer fence (left). The inner double stranded fence has a lower wire 18 inches above the ground and an upper wire at 48 inches. Insulating plastic fixtures attach the wires to 5-foot fiberglass rods. The outer single wire placed 48 inches away from the inner double stranded fence, is positioned 30 inches above the ground and is the wire that is baited. Applying apple scent to a bait cap filled with cotton on the outer wire (right). Note that the bait cap is attached with a conducting metal wire and hangs upside down to prevent rain from washing off the scent. Aluminum foil covered with peanut butter is another bait option.*

Figure 4. *A 7 ½ foot plastic mesh fence provides a physical barrier to deer (left). A grafted walnut tree protected from deer browse with a 4-foot tall, 15" wide wire cage constructed from 2" × 4" welded wire (right). Around the base of this grafted tree is a 10" × 3" waxed paper tree guard.*

high voltage electric fence suitable for livestock will not affect deer because of differences in their physiology. Deer prefer to walk through or under a fence rather than jump over, so it is important that they become negatively conditioned to crossing an electric fence. The best way to condition deer to avoid an electric fence is to bait the fence with an attractant such as essence of apple or peanut butter smeared on aluminum foil (Fig. 3). When deer sniff the bait they receive an electric jolt to their nose, a tissue sensitive to shock. By this means they learn to avoid the fence. Baiting the electric fence is an important management activity indispensable to effective deer control. To increase the visibility of the fence to approaching deer, white flagging tape streamers should be attached every 60 feet or so on the top wire of the inner fence.

Keep vegetation that can ground out the electrified wires away from the fence. Vegetation under fences is typically controlled by pre- and post-emergence herbicides, although mechanical cultivation can be used. The voltage of the fence should be checked periodically to make sure that it is adequately charged, and that there are no breaks in the lines or disruption of electric current. Deer will constantly test the fence, so if the power goes out across the entire fence or even a portion, the fence will become ineffective. Fences should be powered-up immediately after installation, and they should be left on at all times, even when browse pressure is low. Otherwise, deer learn that they can cross the fence, and they will continue to do so even after it is re-electrified. If beavers are a problem, an electrified wire running 6 to 8 inches off the ground can be added.

A barrier fence can be used when deer pressure is very high, the planting is particularly valuable, other deer-control options are unavailable, maintenance of an electric fence will be difficult or impossible, or when excluding livestock is desired. Barrier fences are initially more expensive than electric fences, and they require more labor to install, but ultimately they require much less maintenance. One type of barrier fence is made from lightweight, high strength plastic mesh. These fences are nearly invisible and are thus popular for landscaping applications around homes (Fig. 4). Mesh fences are easy to attach to surrounding trees or to pressure-treated 4-inch × 4-inch posts. Because the mesh is lightweight and wind resistant, relatively few posts are needed. Alternating a 10 foot long, 1 inch wide galvanized metal conduit pipe and wooden posts every 25-feet works well. Twelve-inch stakes are used between posts to anchor the mesh to the ground. A taught high tension plastic (or metal) wire is run along the top of the mesh, and the mesh is attached to the wire with hog-ring staples. Hang white flagging on the fence at eye level to warn deer and people of the barrier.

Cages and tree guards. An alternative to a fence that spans the perimeter of a tree planting is individual tree-cages that function to fence off individual trees (Fig. 4). Cages must be a minimum of 4 feet high to adequately prevent deer browse. Fence or screen material may consist of

chicken wire or welded wire. Each cage must be staked to the ground. A four-foot square wire screen will form a circular cage 15 inches in diameter. Shorter cages may be employed against damage from rabbits, if deer are not a problem.

Tree guards are used to limit gnawing damage at the base of trees and for protection from bark injury from mowing, hoeing, and weed-eaters, but they will not limit deer damage. Guards come in heights from 6 to 24 inches and are of several types: spiral strips of plastic that form a circular barrier around the base of trees; solid tubes of corrugated plastic with a slit for installation; or simple plastic tubes. The spiral type of slit tree guard will not girdle trees, whereas a solid tube type will and must be removed prior to girdling. Half-gallon milk cartons or other waxed paper tree protectors can be used to help protect trees from gnawing rodents such as voles and rabbits, and to protect the base of a seedling from herbicide drift in the first several years (Fig. 4). They hold up well for the first year but may begin to deteriorate by the second year.

Repellents. There are a variety of commercially available products that repel deer and deter browsing and antler rubbing (Pierce and Wiggers 1997). These compounds are sprayed onto trees or around the perimeter of the planting. Repellants are most effective when applied prior to anticipated deer browse or rubbing damage in the beginning of the dormant winter season and just before budbreak at the start of the growing season. Repellants deter feeding because of their bitter taste or foul smell, and they must be regularly reapplied to remain effective. Frequency of reapplication will depend on climatic factors such as precipitation and temperature. During the growing season, repellants may need to be applied as often as every 2 to 3 weeks. Landowners can improve the effectiveness of repellants by switching among several compounds. Commercial repellents must all be applied following label directions. The same repellents that are effective against deer often repel rabbits.

There are non-commercial deer repellants that may be more economical and just as effective as commercially available repellants. Small bars of soap (travel size) hanging from branches can suppress deer browse and antler rubbing. An inexpensive brand of tallow-based or deodorant bar soap works best. Apple growers in Indiana have found the brand Cashmere Bouquet® works well. Drill a hole through each bar (wrapper on) and use string or a twist-tie to attach it to the tree. A bar of soap will protect about a 1 square yard area; which means that every small tree in a typical hardwood tree planting will need a bar of soap.

Toxins. The most effective control measure for voles is poisoned baits containing zinc phosphide or other anticoagulants (Thurston et al. 2001). Anticoagulants are not registered in some states, but where it is legal, zinc phosphide coated bait is applied at rates of 2 to 6 pounds per acre. Registered products are commercially available, but they are restricted-use pesticides that must be applied by a licensed, certified pesticide applicator. Product labels explain conditions and details for utilizing poisoned bait. Baiting is most effective in late fall and early winter.

Two approaches to baiting may be used. One method is to construct bait stations using 1½ inch plastic pipe or a waterproof paper tube so that only voles and other field mice can enter and eat the bait. Bait can also be placed directly underground into the active runways. The second method is most appropriate for pine voles. If runways and burrows cannot be located, roofing shingles, boards or other objects can be placed on the ground in heavily damaged areas to encourage voles to build tunnels or nests under them. Bait can then be placed under the material once voles are using them. When baiting runways directly, wait until three or more days of dry weather are forecasted, as rain will reduce the bait's effectiveness.

Remember that zinc phosphide bait is poisonous to all forms of animal life and will kill nontarget mammals and birds. Avoid spilling bait on open ground, and be aware that dogs or other animals that eat poisoned voles can be harmed or killed.

Frightening. Various frightening tactics can deter the roosting of birds in the spring, but they usually only provide short-term relief. Some commercially available products include: artificial owls, terror-eyes balloons, chrome or chrome and red metallic flagging tape, and propane canons (Zon® guns).

Hunting. Hunting may be controversial, but it provides the most efficient, and in many cases, the only viable type of deer population control (Rathfon and Farlee 2002). In each state, the Department of Natural Resources (DNR) or a comparable agency regulates deer hunting by setting hunting season times, licensing hunters, and determining the number of does and bucks hunters can take. To reduce the deer population, a

maximum harvest of does must be obtained. Hunting exclusively for bucks will not significantly reduce deer pressure since one buck will breed with many does in a season. If possible, find out if adjacent landowners will allow hunting on their land. If large deer populations remain after the official hunting season, landowners can obtain off-season deer deprivation permits through their DNR Division of Fish and Wildlife to continue hunting.

Trapping (moles, beavers, rabbits). Trapping is the most reliable control method for moles, and can be used to limit rabbit and beaver damage. For moles, trap during spring and fall when their activity is at its peak. To trap moles effectively, locate their main or daily runway tunnels.

Look for tunnels that:

- Run straight for a good distance
- Appear to connect two mounds or two different tunnels
- Follow fencerows, roadways, and existing wooded land

Use three to five traps per acre for quick results. Traps can be purchased from nursery retail stores or local exterminator companies. Follow the instructions that come with the trap to set the trigger. Moles (except the star-nosed mole) are not protected, and may be trapped year round without a permit.

Rabbits may be hunted, but the best way to control their numbers is with live trapping (see Other Resources for a Web site with information on how to build and use a simple, effective, and inexpensive rabbit trap). Baiting the traps is not necessary. Set them out, and on the first cold, rainy day the rabbits will resort to them as they search for shelter. The rabbits can then be released a safe distance from your trees.

If you are losing trees to beavers and are not planning to fence the plantation or use tree cages, you may want to reduce the local beaver population by trapping. Contact your State's Department of Natural Resources or a similar agency for information and regulations regarding beaver trapping. If you are unable to trap beavers yourself, your local DNR may help you find private citizens or groups that can trap them. Beavers may be trapped without a permit in most Midwestern states, but be careful to avoid trapping river otters.

Cultural Methods of Animal Control

Deer. Browse damage can be mitigated somewhat by mowing a path through the plantation along the route that deer are likely to travel. Paths of this type may encourage the deer to pass through without stopping to eat. Permitting briars to grow along the edges and throughout plantations may also discourage deer. In young plantations, tall, late-summer weeds can help hide trees from the deer. If a new planting is adjacent to a mature planting or natural forest, clear the underbrush in a 60-foot wide strip around the young trees to limit cover for the deer.

Voles. An effective way to prevent voles from damaging tree trunks is to eliminate weeds, leaf litter, and mulch from around the base of trees, especially in the winter. Using mulch as a weed control strategy can unwittingly create a vole problem. Small piles of pea gravel placed around the base of trees may prevent voles from girdling the lower trunk during the winter.

Birds, rabbits, and other rodents. Placing bird perches in and around young plantations can help control several sources of damage. Roosting birds will enjoy these perches instead of the tender, young terminal shoots of the trees. Perches also provide a good spot for raptors (hawks and owls) to survey the area and control small mammals.

Insects and Diseases

Insects and diseases. The type and extent of damage to hardwood trees by insects and diseases is species dependent. Some species, such as walnut, have very few problems and most of these are cosmetic. Other species, such as ash, butternut, and elm, may be seriously endangered by disease or pests. All hardwoods are susceptible to the invasion of new and exotic pests and diseases. Pests and disease are not usually so prevalent that they are the limiting factor in the productivity of a plantation, even for single-species plantations. It is inevitable that some pest problems will occur when many trees are planted near each other. Several excellent publications and Web sites are available on insect and disease pests of hardwood trees, and these can be consulted when damage occurs (see Other Resources, below). If you have a question or a serious insect or disease problem, seek advice from DNR and Extension personnel in your area.

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Other Resources

Web sites for additional information:

Animal Damage

Deer

http://muextension.missouri.edu/explore/miscpubs/mp0685.htm

Moles

http://www.entm.purdue.edu/Entomology/ext/targets/ADM/ADMPDF/ADM-10.pdf

Voles

http://www.agnr.umd.edu/users/hgic/diagn/wild/voles2.html

http://pubs.cas.psu.edu/freepubs/pdfs/uh094.pdf

Rabbit (trap)

http://www.conservation.state.mo.us/documents/nathis/woodwork/ww10.pdf

Birds

http://www.na.fs.fed.us/spfo/pubs/howtos/ht_sap/sap.htm

Insects

http://www.na.fs.fed.us/spfo/pubs/fidleast.htm

http://www.fl-dof.com/Pubs/Insects_and_Diseases/index.htm

http://www.forestryimages.org/collections/projectimages.cfm?id=3

http://www.forestpests.org/

http://www.na.fs.fed.us/spfo/pubsfth%5Fpub%5Fpages/fidlpage.htm

http://www.na.fs.fed.us/spfo/pubs/howtos/ht_walnut/cover.htm

Emerald Ash Borer:

http://www.na.fs.fed.us/spfo/pubs/pest_al/eab/eab.htm

Diseases

http://www.na.fs.fed.us/spfo/pubs/howtos/ht_bwal/bwal-ls.htm

http://www.na.fs.fed.us/spfo/pubs/howtos/ht_walnut/cover.htm

http://www.forestpests.org/southern/Diseases/nectria.htm

http://www.caes.state.ct.us/PlantPestHandbookFiles/pphIntroductory/pphsrch.htm

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