

Wildlife Damage Management Fact Sheet Series

White-Tailed Deer

Paul D. Curtis and Kristi L. Sullivan

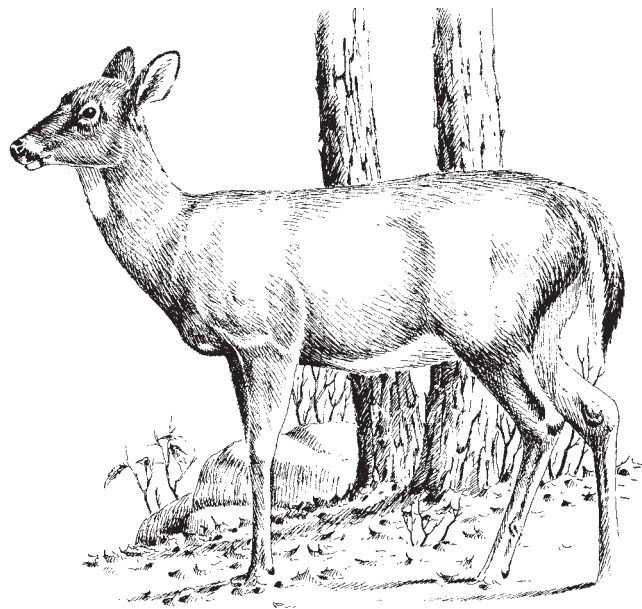
Cornell Cooperative Extension, Wildlife Damage Management Program

Over the past 30 years, especially the past decade, populations of white-tailed deer (*Odocoileus virginianus*) have increased dramatically throughout the Northeast and in many midwestern and western states. In the 1900s New York's deer population rebounded from about 20,000 to more than 1 million. Increases in deer abundance can be attributed to changes in habitat, including reversion of abandoned farm fields to forest, and shifts in human population to rural and suburban areas. Both of these trends create open and forested habitat preferred by deer. In addition, decisions by landowners to prevent hunting have made many areas off limits to hunters, allowing deer populations to increase. Although the recovery of deer populations from only about 500,000 nationwide in the early 1900s to more than 15 million today is considered a wildlife management success story, many people increasingly view the situation with mixed feelings.

General Biology

The white-tailed deer is the most widespread and abundant member of the deer family and one of the best recognized large mammals in North America. White-tailed deer are a valuable component of our wildlife heritage and are avidly sought by hunters, photographers, and nature observers. The buck, or male deer, stands 3 to 3 1/2 feet tall at the shoulder, weighs 125 to 200 pounds, and grows antlers that are shed annually. Does are smaller and lighter than males and lack antlers.

Deer are red-brown during summer and grow brown-gray winter coats each



fall. Fawns (deer that are less than one year old) typically weigh 4 to 8 pounds at birth and have red-brown hair with white spots, which they lose as they grow their first winter coat.

White-tailed deer breed from mid-September through late February, and the peak of the breeding season, or rut, occurs in November. Fawns are born in the early summer after a 200-day gestation period. In their first pregnancy, does usually give birth to a single fawn, though twins are common in later years if food is abundant.

Bucks begin to develop antlers in April, and the antlers grow until August or early September. The size of the antlers depends primarily on age and nutrition; older bucks typically have larger antlers.

Growing antlers are covered with a skin called "velvet." This skin is covered with soft hairs and contains blood vessels that supply nutrients to the growing antlers. When the antlers stop growing the velvet dries and is shed or rubbed off by the buck as he polishes his antlers on saplings, shrubs, or rocks. Bucks shed their polished antlers each winter in preparation for the growth of a new set.

Habitat and Food Habits

Deer live on the forest edge rather than in continuous areas of mature forest. They prefer mixed conifer-hardwood forests, shrublands, and old fields with active cropland nearby. This rich mixture of vegetation produces abundant food and

cover. Deer are very adaptable, however, and greater numbers are living in suburban neighborhoods, which have a combination of open lawn, succulent summer gardens, plentiful ornamental shrubs, and patches of forest cover.

Deer feed primarily on grasses, forbs, crops, leaves, twigs, and buds during late spring and summer. They forage on mast (e.g., beechnuts, wild cherry seeds, and acorns) during fall and concentrate almost entirely on twigs and buds during winter and early spring.

The amount of food that a deer must consume daily depends on its gender and body weight and the season. In general, deer consume 3 percent of their body weight each day. Therefore, a buck weighing 125 to 250 pounds requires from 4,000 to 6,000 calories each day, which can be obtained from 4 to 10 pounds of grass, forbs, and twigs.

Description of Damage

Homes and Gardens

Deer frequently feed on flowers, fruits, and vegetables and the buds and twigs of fruit trees and ornamental shrubs. Damage to landscape plantings and ornamentals may occur at any time of year but is usually most severe in the late winter and early spring when other food supplies are limited. Damage to fruit trees may cause both the immediate loss of the crop and residual tree injury that leads to reduced yields in the future. Deer browsing may permanently disfigure ornamental trees.

Forests and Wildlife Habitat

Deer can also affect their own habitat and the abundance of other wildlife species. Overpopulation can profoundly influence the presence, absence, and abundance of plants and other wildlife. In many forests, over-browsing of tree seedlings creates open, park-like stands that have little or no vegetation near ground level. Instead of a diversity of woody and herbaceous plants, the ground surface may be dominated by ferns, grass, and woody shrub or tree species that are not preferred by deer. Wildflowers preferred by deer, such as various species of *Trillium* and Canada mayflower, may be reduced in abundance or eliminated completely from forests where deer densities are high.

Reduction of the understory, which gives forests a park-like appearance, removes important nesting and feeding sites for some forest songbirds. Nesting in more open forests can make bird eggs and nestlings easier for predators to detect. Some species may leave the area, whereas others will be less abundant than they once were. In addition, other wildlife, such as squirrels and chipmunks, must compete for acorns, a food preferred by deer.

Deer prefer certain plant species over others and frequently feed on economically valuable tree species. For example, they prefer oak and sugar maple seedlings, as well as acorns, over less palatable species like American beech and striped maple. Thus, less marketable species are more likely to survive to maturity, replacing more valuable trees. This change in species composition will have dramatic effects on our future forests and forest-related industries.

Economic Impacts

Annual estimates of deer damage are reported to exceed \$2 billion nationwide, including \$1 billion in car damages, more than \$100 million in agricultural crop damage, \$750 million in damage to the timber industry, and more than \$250 million in damage to metropolitan households (e.g., landscape plantings). These estimates are conservative, and it is often difficult to obtain reliable statistics for wildlife-related losses.

Identifying Damage

Deer feeding damage is readily distinguished from that caused by rabbits or rodents. Whereas rabbits or rodents leave a clean-cut surface, deer lack upper incisors and leave a ragged, broken end on browsed branches. Another indication is the height of the damage from the ground (up to 6 feet), which often rules out smaller mammals.

Laws and Regulations

Deer are classified as game animals and may be killed only during legal hunting seasons by persons holding a valid big game license. Under section 11-0521 of the New York State Conservation Law, however, the Department of

Environmental Conservation (DEC) can issue permits allowing landowners to kill deer when they become a nuisance or harm property. If sufficient damage is evident, the DEC may issue crop damage permits for the harvest of a specified number of deer outside the regular hunting season. The use of damage permits can be time-consuming, however, and often doesn't greatly reduce the damage.

The DEC also operates the Deer Management Assistance Program (DMAP). Antlerless deer tags are available to landowners who desire increased harvests of deer to meet management goals on their property. DMAP includes agricultural lands and municipalities as well as forested areas. The program can be used to decrease crop damage, reduce urban and suburban deer populations, protect rare plants, ensure adequate forest regeneration, or improve the quality and composition of a deer herd. For agricultural areas or municipalities no minimum acreage is required to participate in the program. A minimum of 200 acres is required, however, where forests and other natural vegetation are being damaged, and the landowner must have a management plan for the property. On properties where enrollment in the program is intended to improve recreational opportunities by improving herd quality (e.g., quality deer management), a minimum of 1,000 acres is required.

Preventing Damage

Population Control

Although repellents and fencing are the primary techniques used to address site-specific deer damage problems, these methods will not decrease damage on a community-wide scale. Deer populations will increase if mortality is low and food is abundant, and they can double in size every two to three years.

Although the annual hunting season is an effective way to reduce deer populations and thus damage in rural areas, buck-only harvests cannot reduce or stabilize deer numbers. Where possible, landowners suffering damage should encourage or require hunters to harvest sufficient numbers of does (within the legal limits). Harvesting female deer is essential to reducing deer numbers and deer damage. In suburban areas where

hunting may not be practical, some other form of mortality may be required to stabilize herd growth. Reproductive inhibitors are currently experimental and difficult to apply across areas of several square miles.

Choice of Landscape Plantings

In some cases damage can be reduced by selecting plant species that deer don't prefer. When deer densities are high or natural foods are limited, especially in the winter or early spring, deer may browse on species they otherwise would not eat. When planting species that deer find desirable, be aware that they will almost certainly require protection if deer are present in the landscape. A detailed listing of woody plants and their relative resistance to deer browsing is available in the Cornell Cooperative Extension fact sheet *Resistance of Woody Ornamental Plants to Deer Damage*. This list can also be found in *Reducing Deer Damage to Home Gardens and Landscape Planting* (see References). No plants are completely deer-proof, and hungry deer will consume plants that have little nutritional value.

Scare Devices

A variety of frightening devices, including lights, whistles, loud noises, and scarecrows, have been used to prevent deer damage. Audio and visual scare devices are not recommended around the home or near urban or suburban areas, however, because of disturbance to neighbors, possible violation of noise ordinances, and lack of effectiveness. Deer habituate to scare devices after a few days of exposure.

Repellents

Repellents can help prevent deer from feeding on crops or landscaping plants and are most effective when integrated in a damage abatement program that includes one or more other techniques such as fencing and population management. Repellents are best for small orchards, gardens, and ornamental plantings around the home. Their utility is limited for row crops, forages, and other large acreages because of high costs, limitations on use, and variable results. Apply repellents at the first sign of damage to prevent deer from establishing a feeding pattern.

Repellents fall into two broad categories—those that repel by taste and those that repel with a disagreeable odor. Most deer repellents can be applied as a spray to ornamental shrubs and nonbearing fruit trees. Hinder, an ammonium soap-based repellent, and Deer-Off, a product that incorporates putrescent egg solids, are the only repellents currently approved for use on garden vegetables and fruit-bearing trees during the growing season.

The effectiveness of repellents depends on the number of deer, feeding habits, and environmental conditions. If deer are very hungry and other food supplies are limited, repellents may not work. Some damage must be tolerated with the use of repellents, even if browsing pressure is low. Young trees should be treated completely. On older trees, treat only terminal growth that is within reach of deer (up to 6 feet above ground). Growth that appears after treatment may need to be sprayed again. Repellents should be applied when precipitation is not expected for 24 hours and temperatures will remain between 40° and 80° F for that period. Research trials have shown that odor-based products usually outperform taste-based materials. No commercial repellent is 100 percent effective, and under heavy deer browsing pressure the best materials must be reapplied about every five weeks. This may limit their use in areas that have deep snow and below-freezing temperatures during winter.

The deer repellents listed in Table 1 are grouped by active ingredient and include a brief description of use, application rates, and costs. Product labels provide all necessary information on use and must be followed to meet legal requirements and achieve maximum success. The active ingredients are shown in parentheses after the trade names. Cost estimates are provided for comparative purposes. "Home remedies" such as tankage, soap, bobcat urine, and human hair may act as repellents. However, because both state and federal regulatory agencies prohibit the commercial use of products not registered by the Environmental Protection Agency (EPA), we do not recommend them.

Fencing

If deer densities are high, tolerance of damage is minimal, or particularly valu-

able plants need to be protected, fencing alone or fencing plus repellents may be the best option. Many different fence designs are available; the one you select may be based on cost-effectiveness, aesthetic considerations, or ease of construction.

ROPE FENCING

A cotton rope fence used with a repellent is particularly useful for preventing deer browsing in flower beds or small vegetable gardens; this combination of a visual barrier and odor repellent can reduce browsing considerably during the growing season when alternative foods are available. The fence can be constructed by installing 3- to 4-foot posts around the perimeter of the beds. Attach cotton cord or rope at a height of about 30 inches. Spray an odor-based repellent directly onto the cotton rope or on strips of cotton cloth tied to the rope at 3- to 4-foot intervals.

SNOW FENCING

Snow fences can be used during the winter and early spring to protect small groups of trees or shrubs. Although not an absolute barrier, a snow fence may effectively deter deer from entering small areas (a circle 20 yards in diameter).

PLASTIC BIRD NETTING AND WIRE CAGES

Plastic netting and wire cages can be used to prevent deer browsing of individual plants or small plantings. Both alternatives are inexpensive and can be aesthetically pleasing. Plastic netting can be wrapped around individual shrubs during the winter and early spring. The netting is usually invisible from a distance. Although deer may browse any portion of the plants that extend beyond the netting, damage is greatly reduced. Plastic netting can also be wrapped around clumps of flowers in early spring when other food supplies are most limited and deer are most likely to cause damage.

OFF LIMITS CROP PROTECTION SYSTEM

The Off Limits Crop Protection System is an invisible fence design that combines wire, a power unit, and receiver collars with highly active, properly trained dogs that are able to withstand harsh winter conditions. The system was field-tested in apple orchards in central New York, using

Table 1. Repellents

Repellent	Formulation	Plants for Which Registered	How to Apply	Length of Effectiveness	Cost	Remarks
Deer Away/Big Game Repellent (37% commercial putrescent egg solid)	Primarily odor-based	Fruit trees before flowering; ornamental and Christmas trees	Spray on all susceptible plant parts.	Minimum of five weeks with heavy feeding pressure	1-gallon liquid kit: about \$26	Used extensively in western conifer plantations. Has been reported to be greater than 85 percent effective in some field studies.
Deer-Off Repellent Spray (3.1% egg solids, 0.0006% capsaicin, and 0.0006% garlic)	Combination odor and taste-based product; available as spray	Flowers, grass, bulbs, ornamental shrubs, edible crops, plants, seedlings, trees	Apply to all leaves, stems, and branches at onset of deer damage.	About five weeks with heavy feeding pressure	1-pint kit: about \$28; makes about 1 gallon of spray	
Hinder (ammonium soaps of higher fatty acids, 13.8%)	Odor-based	Home gardens, ornamentals, annual and perennial flowers, fruit trees until one week before harvest	Apply directly.	About four weeks; varies owing to weather and application technique; reapplication may be necessary after heavy rains.	1 gal. liquid: about \$40	One of the few repellents registered for use on edible crops. Can be painted full strength on the bark of trees to prevent rabbits from chewing the bark. Compatible with most pesticides.
Miller's Hot Sauce Animal Repellent (2.5% capsaicin)	Taste-based	Ornamentals, fruit and nut trees, bushes, vines, and hay bales stored in the field; can also protect vegetable crops if sprayed before development of edible parts	Backpack or hand-pump spray on all susceptible plant parts.	—	Hot Sauce and Vapor Gard: about \$80 and \$30 per gallon, respectively	Weatherability can be improved by adding an antitranspirant such as Nu-Film-17 or Vapor Gard. The 10x and 100x concentrations approved for ornamentals have effectively prevented both deer and elk damage to trees. Do not apply to fruit-bearing plants after fruit set.
Nott's Chew-Not (20% thiram)	Fungicide that acts as taste-based repellent; liquid formulation	Dormant trees and shrubs	Spray or paint on individual trees.	—	2 gal. 42% percent thiram: about \$50	Add adhesives such as Latex 202-A or Vapor Gard to mixture to increase its resistance to weathering. Thiram-based repellents also protect trees against rabbit and vole damage.
Tree Guard (0.20% dentonium benzoate)	Taste-based; ready-to-use spray	Shrubs, ornamental plants, conifers, and nonbearing deciduous trees; not intended for use on food or feed crops	Spray on all susceptible plant parts.	About two weeks with heavy feeding pressure	about \$40	This material may not protect yews from deer damage during winter.

two dogs per 12 to 15 acres of orchard. The system is not a complete barrier, so some level of browsing must be tolerated. An invisible fence may also be effective for protecting small orchards, gardens, and ornamentals around the home. The system will work best if the dog (or dogs) is kept outdoors at all times. In addition, the breed of dog selected must be highly active and willing to chase deer.

TEMPORARY ELECTRIC FENCING

Temporary electric fences protect flower and vegetable gardens during the growing season. They are easy to construct, do not require rigid corners, and use readily available, inexpensive materials. Install fences at the first sign of damage to prevent deer from establishing feeding habits. Use only UL-approved fence chargers and never connect fences directly to household current. Temporary electric fences require regular inspection and maintenance.

Electric fences can be more effective if used along with an attractant or repellent (Figure 1). To use peanut butter as an attractant, attach 3-x-4-inch foil strips to the wire at 3-foot intervals, using 1-x-2-inch strips of cloth adhesive tape. Apply a 1:1 mixture of peanut butter and vegetable oil to the foil strips, fold the foil over the wire, and secure with adhesive tape. Deer are attracted by the peanut butter, which encourages them to make nose-to-fence contact. After being shocked, they learn to avoid fenced areas. Repellent, sprayed on cloth strips and tied to electric fencing, can also increase the effectiveness of electric fencing and has been found to be even more effective than peanut butter. The addition of an offensive odor reinforces the physical shock of the fence.

PERMANENT HIGH-TENSILE ELECTRIC FENCING

High-tensile fencing can provide year-round protection from deer damage. Many designs are available to fit specific needs. A seven-wire design with the first strand 8 inches above the ground is recommended (Figure 2). All require strict adherence to construction guidelines concerning rigid corner assemblies and fence configurations. Frequent inspection and maintenance are necessary. High-tensile fences have a 20- to 30-year life expectancy.

PERMANENT WOVEN-WIRE FENCING

Permanent woven-wire fences are the best deer barrier. They are used for year-round protection of high-value crops subject to intense deer feeding pressure. These fences are expensive, difficult to construct, but easy to maintain. Woven-wire fences are used most often to protect orchards or nurseries where the high crop value, perennial damage, acreage, and 20-year life span of the fence justify the initial cost. Woven-wire fences can be used around the home to protect large gardens or as cages around individual trees or groups of trees. Woven-wire fencing costs \$6 to \$8 per linear foot. Barrier fences should be at least 8 feet high, and their height can be increased to 10 feet using larger poles and two strands of smooth wire.

GATES AND CATTLE GUARDS

Whenever fencing is used, it is important to incorporate functional gates or cattle guards to prevent deer from entering fenced areas via roadways. Gates should be closed following each entry and exit. To avoid the inconvenience of opening and closing gates, cattle guards may be installed at gate entrances. In a study conducted in Ohio, researchers found that cattle guards reduced deer crossings by at least 95 percent. Fencing should be extended along each side of the cattle guard to prevent deer from crossing along the sides.

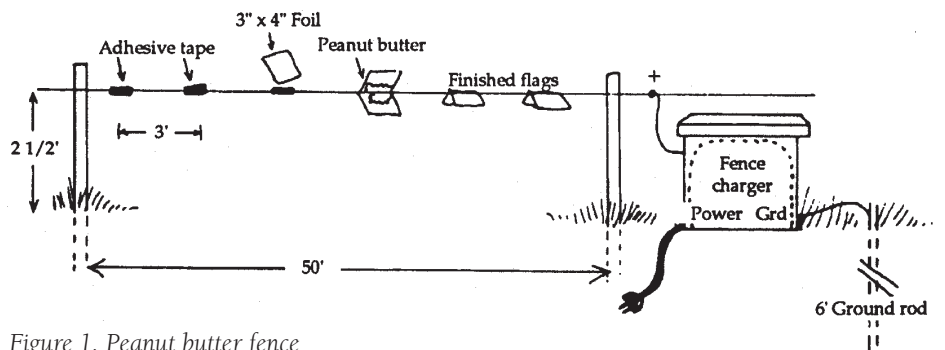


Figure 1. Peanut butter fence

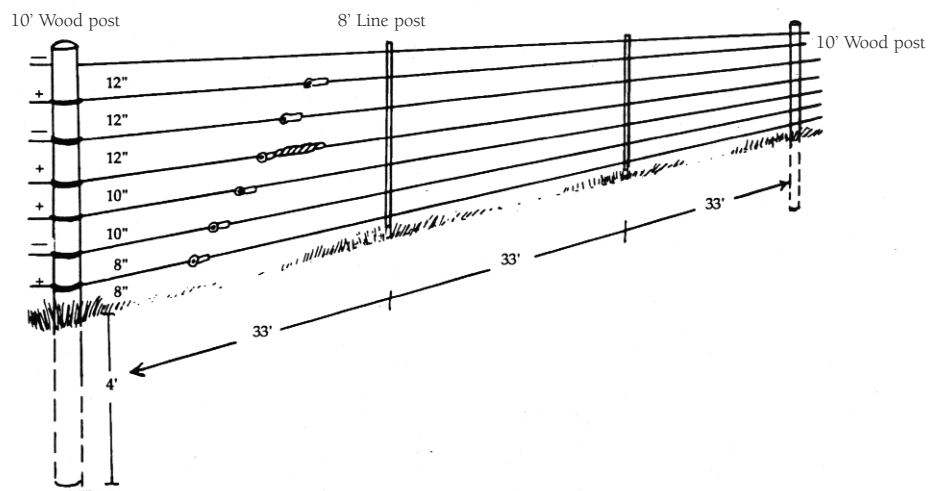


Figure 2. Seven-wire vertical deer fence

Human Health and Safety

High populations of deer may result in numerous deer-vehicle collisions and pose a serious threat to motorists. It is estimated that each year in the United States 29,000 people are injured and more than 200 lose their lives in deer-vehicle collisions. More than 50,000 deer-vehicle collisions are estimated to occur in New York each year. Because many incidents go unreported, the actual number of collisions is difficult to ascertain. Defensive driving is the only way to reduce the risk of having a deer-vehicle accident.

Research in the United States has indicated that deer whistles and other ultrasonic devices are ineffective. About two-thirds of deer-vehicle accidents occur during October, November, and December, especially in the early morning and at dusk. If it appears that you will collide with a deer, do not swerve to avoid the animal. More human injuries occur when drivers swerve to avoid deer and instead collide with roadside obstacles or vehicles in the opposing lane than if they hit the animal.

Deer have been implicated in the distribution and transmission of Lyme disease. According to the Centers for Disease Control, there were more than 16,000 cases of Lyme disease nationwide in 1998, up from approximately 2,000 cases in 1987. New York State had 3,325 cases of Lyme disease in 1997, the highest number of reported cases in the United States, followed by Connecticut, Pennsylvania, and New Jersey. Lyme disease has reached epidemic proportions on Long Island and in portions of the lower Hudson Valley.

Deer serve as one of several potential hosts for the black-legged tick (*Ixodes scapularis*), which transmits the bacterial spirochete *Borrelia burgdorferi* that causes Lyme disease. Larval and nymphal ticks commonly feed on whitefooted mice and other mammals and birds. Adult ticks prefer deer as their host, although they may also occur on medium-sized mammals such as raccoons and opossum. Tick abundance has been found to be positively correlated with deer density.

Individuals who are active outdoors, particularly hunters who handle and transport deer, should examine themselves and their clothing frequently for deer ticks. If

you are bitten by a tick, consult your doctor. In order to transmit Lyme disease, ticks must be attached to a person for at least 24 hours, so frequent inspection and removal of ticks is the best prevention.

References

Publications

- Craven, S., and S. Hygnstrom. 1994. "Deer." In *Prevention and Control of Wildlife Damage*. S. Hygnstrom, R. Timm, and G. Larson, eds. Lincoln: University of Nebraska Cooperative Extension.
- Curtis, P. D., and M. E. Richmond. 1994. *Reducing Deer Damage to Home Gardens and Landscape Planting*. Ithaca, N.Y.: Cornell Cooperative Extension and Department of Natural Resources.
- DeNicola, A. J., K. C. VerCauteren, P. D. Curtis, and S. E. Hygnstrom. 2000. *Managing White-Tailed Deer in Suburban Environments: A Technical Guide*. Ithaca, N.Y.: Cornell Cooperative Extension.
- Fargione, M. J., P. D. Curtis, and M. E. Richmond. 1991. *Resistance of Woody Ornamental Plants to Deer Damage*. Home-Grounds-Garden Fact Sheet 800.00. Ithaca, N.Y.: Cornell Cooperative Extension, College of Agriculture and Life Sciences.
- Henderson, F. R., and C. Lee. 1992. *Controlling Deer Damage*. Manhattan: Kansas State University Cooperative Extension Service.

Videos

- Suburban Deer Management: Voices, Views, Visions*. 1993. 28 min. Ithaca, N.Y.: Cornell Cooperative Extension.
- Whitetails at the Crossroads*. 1996. 30 min. Ithaca, N.Y.: Cornell Cooperative Extension.

©2001 Cornell University

Cornell Cooperative Extension *Helping You Put Knowledge to Work*

This publication is issued to further Cooperative Extension work mandated by acts of Congress of May 8 and June 30, 1914. It was produced with the cooperation of the U.S. Department of Agriculture; Cornell Cooperative Extension; and College of Agriculture and Life Sciences, College of Human Ecology, and College of Veterinary Medicine at Cornell University. Cornell Cooperative Extension provides equal program and employment opportunities. D. Merrill Ewert, Director.

Alternative formats of this publication are available on request to persons with disabilities who cannot use the printed format. For information call or write the Office of the Director, Cornell Cooperative Extension, 365 Roberts Hall, Ithaca, NY 14853 (607-255-2237).

This information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned or criticism of unnamed products is implied.

Additional copies of this publication may be purchased from Cornell University, Media and Technology Services Resource Center, 7 Cornell Business & Technology Park, Ithaca, NY 14850. Phone: 607-255-2080. Fax: 607-255-9946. E-mail: resctr@cornell.edu.

A free catalog of Cornell Cooperative Extension publications and audiovisuals is available from the same address, or from any Cornell Cooperative Extension office. The catalog also can be accessed at www.cce.cornell.edu/publications/catalog.html.

Deer illustration by John Sidelinger

Figures 1 and 2 from Hygnstrom, S., et al. 1994

Produced by Media and Technology Services at Cornell University
www.mediasrv.cornell.edu
Printed on recycled paper
147WCFS1 200/300 3/01 2M CR MTS00028d