Reducing Deer Damage to Home Gardens and Landscape Plantings

**with revised repellent list*

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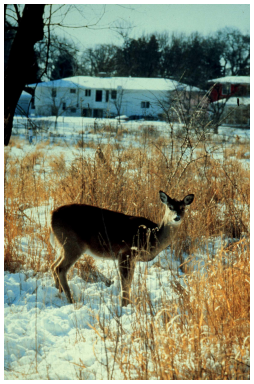

Introduction

The past 30 years has been a period of major change in the relationship of man to the whiteï tailed deer. From the animal's point of view, they have made a remarkable recovery since the early 1900's, when there were perhaps no more than 500,000 deer over their entire range in the United States. While virtually extirpated in many areas early in this century, whitetail numbers now exceed 15 million across the country. Some states including New York, Pennsylvania, New Jersey, Florida, Ohio and Illinois, have seen dramatic population increases, particularly during the past 10 years. Every state east of the Rocky Mountains has experienced a large increase in herd size.

From man's point of view we often applaud this story of wildlife population recovery. However, many homeowners increasingly view the situation with mixed feelings. The downside of increased deer numbers is that damage to ornamental plants, gardens, and commercial crops has increased greatly over the past two decades. Serious damage and economic losses have been associated with: (1) increasing deer abundance, (2) human population shifts to rural and suburban homes, (3) the natural conversion of abandoned farm land to deer habitat, (4) landowner decisions to prevent deer hunting, (5) restrictions on the use of firearms in suburban regions and (6) enforcement of leash laws. These changes have been gradual, and even with foresight, it is unlikely that any government agency or organized group could have foreseen and altered the course of events that has brought this beautiful, adaptable species into direct confrontation with man. The purpose of this bulletin is to: (1) provide some background on the current dilemma, (2) suggest state of the art actions that a homeowner or landowner may take, and (3) offer information that will allow for informed decisionï making as professional wildlife

biologists attempt to customï fit solutions to deer damage problems in urban and suburban landscapes.

Deer Feeding Habits

While deer are known to eat more than 500 different kinds of plants, they are often selective feeders that forage or browse on plants and plant parts with considerable discrimination. This is particularly true when a variety of foods are available. However, when natural, preferred foods become scarce, there are relatively few species that deer will not eat. Whether or not a particular plant species or variety will be eaten depends upon the deer's nutritional needs, previous feeding experience, plant palatability, seasonal factors, and the availability of alternate foods. Deer develop predictable travel patterns, and prior damage is often a good indicator of potential future problems. Any new plantings added to an existing landscape or garden already suffering from deer damage will likely experience extreme browsing pressure. Deer also are known to feed selectively on fertilized plantings and in managed crops and gardens.

In general, most damage occurs when winter snow cover reduces the availability of natural foods. However, in suburban settings with high deer numbers, yearï round damage may be evident. In reality, the wide range of plants and plant parts eaten, their nighttime foraging habits, and their adaptability to a manï made ecosystem (suburbia), all serve to make the whiteï tailed deer one of the most annoying and economicallyï significant problem wildlife species in all of North America.

Food Requirements

The amount of food eaten daily by a deer depends upon the sex and body weight of the animal as well as the season. A buck ranging in size from 125 lbs to 250 lbs requires 4,000 to6,000 calories, which can usually be obtained from 4 to 10 pounds of forage. A lactating doe requires 4,500 calories daily. As a general rule, deer consume about 3 percent of their body weight in forage each day. This may seem a small amount, but when taken as buds, leaves, tender shoots and flower parts, the impact on horticultural and garden plants can be devastating.

Behavior and Social Organization

Whiteï tailed deer are polygamous, with a flexible harem arrangement during the lateï autumn breeding season. At other times of the year, groups of 2ï 7 animals are usually led by an adult doe. In late winter, this group may consist of one or more adult females and their offspring from the past two breeding seasons. During spring and early summer, these groups disperse to some degree and become more secretive in behavior. This pattern of dispersal and

secretive behavior continues through the fawning period in May and June and persists until fall when deer seem to become bolder and more visible.

An important consideration as a motorist is that deer seldom travel alone, and seeing one cross the road at a distance should indicate the need for caution because other deer are likely present. In fact, the behavior of individuals in the family group is so tied to the adult doe that others often cross the road in the face of oncoming traffic in an effort to be near the adult leader. State wildlife agencies have tried to alert motorists to the presence of frequentlyï used deer crossings, but now deer near many New York State roadways present a potential hazard from dusk until after dawn.

Deer like squirrels, raccoons, rabbits and even the coyote, are quite adaptable and seem to thrive in suburbia with its mix of woodlots, old fields, landscaped plants and gardens. Many have lost their fear of people and boldly browse on tulips, broccoli, hedgerows and ornamental shrubs. Deer quickly learn which areas have dogs and children and adjust their feeding schedule accordingly. Deer are capable of learning, and it is this particular characteristic of their behavior that is useful for applying some of the damage prevention techniques suggested later.

The antlerï rubbing behavior of males during fall is particularly damaging to small saplings or ornamental trees that are selected. Deer will rub both conifers and hardwoods, and "rub lines" tend to follow field edges along primary travel lanes. Trees and shrubs with stem diameters of about 6 inches or less are at risk from September through November. Special precautions should be taken to protect valuable, rare, or otherwise unique woody shrubs and trees. A buck marking his territory and rubbing the remaining velvet from his antlers chooses a sapling or shrub based upon its size, shape and location rather than its nutritive value or palatability.

Population Regulation

Biologists with state wildlife management agencies have a comprehensive knowledge base for understanding natality, mortality and population growth for whiteï tailed deer. Age and sex ratios at harvest, coupled with knowledge of carrying capacity of the habitat and estimates of overwintering populations, allow most states to reliably predict fall populations on at least a regional basis and often for areas as small as a township or deer management unit. Hunting has traditionally been used to keep local subpopulations in balance with their habitat. In many parts of the whitetail's range man is the only significant predator. Combining hunting take with estimates of deerï automobile collisions and natural losses, establishes the mortality rate for the herd. In many eastern states the breeding potential of the herd curretly xceds the mortality rate, resulting in increased deer numbers. Also, for a variety of reasons, we no longer hunt some herds and deer populations in those areas are expanding rapidly. At present practical methods for reducing deer numbers other than through hunter harvest are limited. Agency biologists, university researchers, and other interested parties are pushing hard for alternative management procedures that may prove useful in reducing populations in certain nonï

huntied parks and other protected areas. Foremost among the new options is an effort to regulate birth rates through immunoï contraceptive procedures. While this may be a partial solution in some areas, we are likely 8 to 10 years away from having fieldï applicable contraception for freeï ranging deer. Currently, the only relief for suburban homeowners will come from: (1) applying stateï ofï theï art damage abatement techniques, (2) learning to tolerate a certain level of deer damage, and finally selectively culling the herd.

The Prognosis

In the short term, the prevailing conditions are largely irreversible. Damage problems in suburban areas, particularly those having good quality deer habitat, are likely to intensify in the future. It is rather easy to predict that the elimination of hunting due to firearms restrictions, safety concerns, and changed landowner values will only intensify the conflicts between man and deer in many areas. In the longer view, citizens in each affected region will have to face the challenge that they are now stakeholders in this issue and can no longer sit back and ask their state wildlife agency, local town, or county authorities to solve this problem without additional financial support for research and management. State wildlife agencies manage their deer herd to satisfy several interest groups. Landowners enjoy seeing some deer on their property in spite of the damage potential they bring. This observation coupled with the aesthetics and broad economic value of deer, argues that management of the herd through hunting, combined with a reasonable approach to damage abatement is a reasonable goal to attain. Several state agencies have developed and successfully used publicï involvement procedures to manage a variety of wildlife populations including the whiteï tailed deer. However, the problem we now face in suburbia goes beyond the techniques, expertise, and authorized funding of most state agencies, and new approaches must now be considered.

In the interim, landowners must work with wildlife management agencies to find acceptable longï term solutions. While new techniques are being developed, stateï ofï theï art recommendations should be employed to limit deer damage around the home and in the garden.

Reducing Deer Damage to Ornamental and Garden Plots

Fencing

Where deer are abundant or crops are especially valuable, fencing can be an effective means of reducing deer damage. While a variety of fence types may successfully deter deer, consideration should be given to the following:

1. **Fencing as an absolute barrier** can be achieved in one of two ways. The preferred approach is the construction of at least an 8ï footï high wovenï wire fence that completely encloses plants requiring protection. If deer must be kept

out entirely, this is the only reliable method. Fences reaching 5, 6 or even 7 feet are useful deterrents, but do not always provide complete exclusion. The eight foot fence is expected to last 20ï 30 years and costs $6 to $8 per foot to install. Details of construction, cost, materials needed, and design information can be found in publications listed in the tables at the end of this document.

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An alternative barrier that may be useful in certain circumstances consists of a smaller weldedï wire fence which includes a top so that the plants to be protected are completely enclosed. This procedure may be more economical for protecting bedding plants or specialty crops such as asparagus, broccoli or perennial flowers. This approach can also be combined with other fencing deterrents to save a particular plant or highï value crop. This smaller, complete exclosure can be costï effective for very small garden plots or isolated plantings.

Anyone who has made a significant financial commitment to the production of bedding plants, cut flowers, Christmas tree seedlings, or speciality crops of fruit or vegetables should seriously consider a wovenï wire fence that is at least eight feet in height. While the initial cost is higher than that for other types of fencing, the commercial investment may only be ensured with absolute protection. Such a barrier may be practical for plots ranging from 25' x 25', up to 50 or more acres if absolute protection is warranted. A finerï mesh wire (i.e., one inchï hexagonal chicken wire or 1x2ï inch weldedï wire) can be added to the bottom to prevent other pests such as rabbits and woodchucks from entering the protected area. If raccoons are a problem, the addition of a single strand of electrified wire located 4 inches above ground around the outside perimeter of the fence will deter all except the most persistent animals.

The placement of an absolute barrier need not be an eyesore if attention is given to details of construction, including proper setting of corner posts, a wide gate frame for easy access, and addition of screening plants to landscape the fence. Small homeï gardenï sized plots may be made more accessible to tillers and small tractors by permanent construction of three sides of the fence, leaving the fourth side to be covered by a portable, removable section. Such a portable fence can be built in framed sections small enough to remove by hand if needed.

The alternative barrier for small planting beds may be a much lower fence depending upon the crop needing protection. Plants started in seedbeds may be protected with a oneï or twoï foot high covered fence. A practical fence of this type can be constructed by installing two parallel fences far enough apart so that one can work comfortably in between, but close enough so that a wire top and ends can be fitted into place after planting.

2. **Non–electric fences** may be sufficient to keep deer out of an area if their density is not particularly high (≤10 mi2) and a variety of natural foods are available. Several sizes of welded or mesh wire can be combined with additional single wires. For vegetable or flower gardeners who do not wish to lose plants to deer or other wildlife pests, we recommend a 1/2ï inch weldedï wire fence three feet high, with the bottom edge buried 6 inches buried beneath

the soil. This will deter rodents, rabbits, and woodchucks from entering the area. With an additional 3 wires spaced 1 1/2 feet apart above the welded wire, this design is a suitable exclosure but not an absolute barrier for deer.

3. Electric fences. Several types of electric fencing provide a less expensive, yet effective alternative to the complete barrier described earlier. The polytape liveï stock electrical fencing coated with peanut butter can be effective for home gardens and small nurseries or truck crops up to 40 ac. This simple, temporary fence works best under light deer pressure during summer and fall. The polyï tape fence apparently attracts deer with its bright color and peanut butter odor. Deer make noseï toï fence contact when they approach, receiving a substantial shock and quickly learn to avoid such fenced areas. Polytape fences are portable, have a life expectancy of more than 15 years, and can be installed for $0.10 to $0.25 per foot. A variation of this fence substitutes a suitable repellent such as HinderTM or Big Game RepellentTM for peanut butter, and in recent studies is shown to be even more effective at repelling deer. Certainly the combination of electronic shock with either attractants or malodorous repellents is more effective than electric fences alone.

The vertical, highï tensile electric fence is a proven deterrent to deer and is effective in 6ï or 7ï wire combination. Because deer choose to crawl under or step through a fence rather than jump over it, the spacing of the wire is critical. The bottom wire should be 10 inches above the ground with additional wires at 10ï to 12ï inch spacing to be effective.

This is a permanent fence with a 20 to 30 year lifespan. Materials include highï tensile, smooth steel wire (200,000 PSI, 12 1/2 gauge) with accessories to maintain up to 250 lbs. wire tension. A highï quality fence energizer that delivers a minimum of 5,000 volts at a maximum pulse is essential. Installation and material costs range from $0.50 to $1.50 per foot. Costs are reduced by increasing the area to be fenced. Identify any electric fence with warning signs placed at 100 foot intervals, with at least one sign on each fence border. For tips on construction consult a fencing contractor or references in this booklet.

A modification of the vertical fence is the slanted 7ï wire electric fence which has proven effective for larger acreages. This fence is constructed in much the same way as the vertical fence but slants outward to present the deer with a more effective twoï dimensional barrier. With all electric fences vegetation must be carefully controlled beneath the fence to avoid loss of power. The slanted fence requires more extensive vegetation control, and can be maintained with herbicide sprays or gasï powered weed trimmers.

Another design consists of a 3ï wire combination of electrical fencing, deer repellent, and visual cue. This fence is economical, easy to build, and quite effective if maintained in good working order. Standard 7ï or 8ï foot wooden or steel posts, with electrical wires placed 18, 36 or 54 inches above ground, can be supplemented with 5ï or 6ï inch strips of cotton cloth stapled to the wires at 10ï foot intervals. The cloth strips are then saturated with odorï based repellents (i.e., HinderTM or Big Game RepellentTM) and the wires are energized with at least 5,000 volts. Solarï powered charging units are available that will hold a charge for 24 hours even on cloudy days. The

addition of another electrical wire 4 inches above ground will exclude most woodchucks and raccoons, but not rabbits and mice.

With electrical fencing of any design it is important to remember that:

1. A quality energizer that delivers a minimum of 5,000 volts is a must.

2. Highï tensile fences require strict adherence to construction guidelines (i.e., corner assembly, wire configurations and maintenance).

3. Cost of construction decreases with increasing size of the plot to be fenced.

Repellents

Several deer repellents are available to the home gardener, and function either as taste or odor repellents. Most commerciallyï available repellents can be applied as a spray to ornamental shrubs and nonï bearing fruit trees. Generally, repellents are only partially effective. There is nothing on the market that provides absolute protection. Repellents are most effective when applied on a regular 4ï week schedule, before serious damage has begun. They work best on plants that are low on the deer's preference list, and especially when alternate natural foods are available. Recent studies indicate satisfactory protection of perennial flower beds and some vegetable gardens by alternating the use of more than one repellent. For example, thiram applied as a spray coupled with BGR™ or Hinder™ on a cotton rope around the perimeter of the flower bed has provided good protection in a number of recent trials. Other useful combinations are still to be discovered as we seek even better ways to protect garden plantings.

Deer Away®/Big Game Repellent® (37 % commercial putrescent egg solid*)*

This material is primarily an odor-based repellent, and has been used extensively in western conifer plantations. It is reported to be > 85 % effective in field studies, and is registered for use on fruit trees prior to flowering, and ornamental and Christmas trees. Apply it to all susceptible new growth and leaders. Applications weather well and are effective for a minimum of 5 weeks with heavy feeding pressure by deer. A one-gallon liquid kit costs about $26 and covers 15 to 18, 4-foot ornamental shrubs or 100-150 seedlings.

Deer-Off Repellent Spray (3.1 % egg solids, 0.0006 % capsaicin, and 0.0006 % garlic)

Deer-Off is a combination odor and taste-based product registered for use on flowers, grass, bulbs, ornamental shrubs, edible crops, plants, seedlings and trees. Deer-off is available as a spray and should be applied to all leaves, stems and branches at the beginning of each season. Treatment must be repeated after heavy rains or as new growth emerges, and if the effects of the previous treatment appear to be wearing off. A one-pint kit of deer-off costs about $28.00, makes about 1 gallon of spray, and treats up to 200 ornamental shrubs

4 feet in height, or approximately 2,000 square feet of plants depending on surface conditions and size of plantings.

Hinder® (ammonium soaps of higher fatty acids, 13.8%*)*

This odor-based product is one of the few repellents registered for use on edible crops. Hinder can be applied directly to home gardens, ornamentals, annual and perennial flowers, and fruit trees until 1 week before harvest. Its effectiveness is usually limited to 2 to 4 weeks but varies because of weather and application technique. Reapplication may be necessary after heavy rains. Apply at temperatures above 40°F. One gallon of liquid costs about $40, and when mixed with 100 gallons of water will cover one acre. Hinder can also be painted full strength on the bark of trees to prevent rabbits from chewing the bark. Hinder is compatible for use with most pesticides.

Miller's Hot Sauce® Animal Repellent (2.5 % capsaicin)

This taste-based repellent is registered for use on ornamentals, fruit and nut trees, bushes, vines and hay bales stored in the field. Apply it with a backpack or trigger sprayer to all susceptible plant parts, such as leaders and young leaves. Do not apply to fruit-bearing plants after fruit set. Vegetable crops also can be protected if sprayed prior to the development of edible parts. Weatherability can be improved by adding an anti-transpirant such as Nu-Film-17® or Vapor Gard®. Hot Sauce and Vapor Gard® cost about $80 and $30 per gallon respectively. Eight ounces of Hot Sauce and 2 quarts of anti-transpirant mixed with 100 gallons of water will cover 1 acre. The 10x and 100x concentrations approved for ornamentals have effectively prevented both deer and elk damage to trees.

Nott's Chew-Not (20 % thiram)

Thiram, a fungicide that acts as a taste-based repellent, is registered for use on dormant trees and shrubs. A liquid formulation is sprayed or painted on individual trees. Although thiram itself does not weather well, adhesives such as Latex 202-A® or Vapor Gard® can be added to the mixture to increase its resistance to weathering. Thiram-based repellents also protect trees against rabbit and vole damage. Two gallons of 42 percent thiram cost about $50 and when mixed with 100 gallons of water will cover 1 acre.

Tree Guard (0.20 % dentonium benzoate)

Tree Guard is a taste-based repellent registered for use on shrubs, ornamental plants, conifers and non-bearing deciduous trees. Tree Guard is available as a ready-to-use spray and costs about $40. One gallon will treat 16 to 20 global arborvitae 20-24" high. This product is not intended for use on food or feed crops. A recent Cornell University study indicated that this material was not effective for protecting Japanese yews from deer damage during winter.

Other Measures

The usse of dogs as a frightening device is another alternative that merits attention. A dog of sufficient size and temperament may be kept on a leash near the garden and allowed to stay outdoors overnight. A number of deer damage problems have been alleviated with a system such as this. An alternative that has shown great promise in recent experiments is the use of a dog contained by a buried electrical ("invisible") fence. Such an invisible fence has great utility in keeping the dog at home, while simultaneously repelling deer from the property. More research is needed before we can recommend what breed of dog is most effective, and determine how much area one dog can protect.

Noiseï making devices (i.e., exploders, sirens, whistles, etc.) are not recommended for the home garden because of the disturbance to neighbors and lack of effectiveness. Deer readily acclimate to the noise and are little disturbed after a few days of exposure.

Choice of Landscape Plantings

Homeowners are often faced with the dual problem of preventing deer from damaging a vegetable garden and/or a few fruit trees, while also protecting ornamental shrubs, flowers, and trees. In the first instance, the choice of garden plants is dictated by the owners desire for specific products, so little compromise is possible. With ornamental plants, however, the homeowner has some additional latitude in choice of species and variety, and may avert future problems and expenses by selecting landscape materials from a list of plants considered less desirable to deer. Publications describing the mostï and leastï preferred food plants for deer are available. Such lists may vary somewhat across broad geographic regions, but are generally reliable (Appendix A). This information can be useful both for selecting plants that are unlikely to be damaged by deer, and identifying those ornamentals that almost certainly will require protection from deer, even in areas where populations are low and feeding patterns are selective.

Appendix A

Resistance of woody and herbaceous plants to deer damage

This list is included only as a guideline and was developed from a variety of sources which may not all be equally reliable. Note that no plant is completely "deer-proof", particularly when deer densities are high.

Woody Ornamental Plants Rarely Damaged by Deer

American holly

Common boxwood

Colorado blue spruce

Herbaceous Plants Rarely Damaged by Deer

Annuals and biennials

Ageratum

Blanket flower

Blue salvia

Cleome

Dahlia

Dusty miller

Edging lobelia

Forget-me-not

Four O'clock

Foxglove

Heliotrope

Marigold

Morning glory

Parsley

Polka-dot plant

Poppy

Snapdragon

Sweet alyssum

Sweet basil

Thorn apple

Verbena

Wax begonia

Zonal geranium

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Perennials

American bittersweet

Amsonia

Anemones

Angelica

Astilbe

Avens

Baby's breath

Balloon flower

Barrenwort

Basket of gold

Bishop's weed

Bittersweet

Beebalm

Bergenia

Bishop's weed

Bleeding heart

Boltonia

Bugbane

Bugleweed

Buttercup

Butterfly bush

Candytuft

Catmint

Christmas fern

Cinnamon fern

Cinquefoil

Clematis

Columbine

Coreopsis

Crown imperial

Daffodil

Dead nettle

Evening primrose

False indigo

Feverfew

Forget-me-not

Garlic chives

Gas plant

Globe thistle

Goatsbeard

Goldenrod

Hay-scented fern

Heath

Heather

Hellebore

Hungarian speedwell

Interrupted fern

Jack-in-the-pulpit

Jacob's ladder

Japanese pachysandra

Joe-pye weed

Knapweed

Kirengeshoma

Labrador violet

Lamb's ear

Lavender

Lily-of-the-valley

Lupine

Lungwort

Mint

Mullein

New York fern

Oregano

Ornamental onion

Ostrich fern

Oriental poppy

Painted daisy

Partridgeberry

Pennyroyal

Perennial blue flax

Plumbago

Primrose

Purple coneflower

Queen-of-the-prairie

Rhubarb

Ribbon grass

Rosemary

Royal fern

Sage

Scilla

Sensitive fern

Shasta daisy

Soapwort

Spike gayfeather

Statice

Sundrops

Sweet Cicely

Sweet William

Sweet Woodruff

Tansy

Tiger lily

Toadflax

Turtlehead

Tussock bellflower

Wisteria

Wormwood

Yarrow

Yucca

Woody Ornamental Plants Seldom Severely Damaged by Deer

American bittersweet

Austrian pine

Beautybush

Chinese holly

Chinese junipers

Common lilac

Common sassafras

Corkscrew willow

English hawthorn

European beech

European white birch

Forsythia

Honey locust

Inkberry

Japanese flowering cherry

Japanese wisteria

Kousa dogwood

Mountain laurel

Mugo pine

Norway spruce

Pitch pine

Red osier dogwood

Red pine

Redvein enkianthus

Scots pine

White spruce

Woody Ornamental Plants Occasionally Severely Damaged by Deer

Allegheny serviceberry

Anthony water spirea

Basswood

Border forsythia

Bradford callery pear

Bridalwreath spirea

Bush cinquefoil

Carolina hemlock

Carolina rhododendron

Chestnut oak

China girl/boy holly

Climbing hydrangea

Common horsechestnut

Common pear

Common witchhazel

Cranberry cotoneaster

Dawn redwood

Deciduous azaleas

Doublefile viburnum

Douglas fir

Downy serviceberry

Eastern hemlock

Eastern red cedar

Eastern white pine

European larch

Firethorn

Greenspire littleleaf linden

Japanese cedar

Japanese flowering quince

Japanese holly

Japanese tree lilac

Judd viburnum

Koreanspice viburnum

Late lilac

Leatherleaf viburnum

Northern red oak

Oldfashion weigelia

Panicled dogwood

Panicled hydrangea

Paperbark maple

Persian lilac

Privet

Red maple

Rockspray cotoneaster

Rosebay rhododendron

Rose of Sharon

Rugosa rose

Saucer magnolia

Silver maple

Smokebush

Smooth hydrangea

Staghorn sumac

Sugar maple

Sweet cherry

Sweet mock orange

Trumpet creeper

Virginia creeper

White fir

White oak

Willows

Herbaceous Plants Occasionally Damaged by Deer

Annuals and biennials

Pansy

Sunflower

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Perennials

Coneflower

Cranesbill geranium

English ivy

Iris

Meadow rue

Peony

Sedum

Wood hyacinth

Woody Ornamental Plants Frequently Severely Damaged by Deer

American arborvitae

Atlantic white cedar

Apples

Atlantic white cedar

Balsam fir

Catawba rhododendron

Cherries

Clematis

Cornelian dogwood

English ivy

English yew

English/Japanese hybrid yew

European mountain ash

Evergreen azaleas

Frazer fir

Hybrid tea rose

Japanese yew

Norway maple

Pinxterbloom azalea

Plums

Rhododendrons

Wintercreeper

Herbaceous Plants Frequently Damaged by Deer

Annuals and biennials

Hollyhocks

Impatiens

Mexican sunflower

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Perennials

Cardinal flower

Crocus

Daylily

Hosta

Rose

Tulips

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