

The Impact of Deer Overpopulation
on
Designing Residential Landscapes
across Suburban Northern New Jersey

By: Richard R Cording
Graduate Student
Columbia University
Landscape Design Program
and
Landscape Designer
CLC Landscape Design, Inc.

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Introduction

The suburban environment across northern New Jersey has created an overabundance of the white-tailed deer (*Odocoileus virginianus*). This overabundance dramatically impacts how the residential home is landscaped. Many ornamental favorites like yew, hosta, and arborvitae are also favorites on the deer's menu. When designing a landscape, we are forced to use a limited pallet of ornamental plants classified as "deer-resistant." Or, if incorporating plants the deer prefer, the homeowner is then faced with a myriad of questionably reliable protection methods from "deer-fencing" to "deer-repellents." Frustrations are often voiced in a series of alarmed questions: "Only these *few* plants are deer-resistant?" "Even deer-resistant plants can *sometimes* be eaten?" "Deer fencing has to be *how* high?" "Deer-repellents don't *always* work?" "Ugh!"

Every homeowner desires a landscape that is both low-maintenance and provides year-round interest. When living within an area of deer overpopulation, like most of suburban northern New Jersey, achieving both of those characteristics requires taking an extra step of care – protecting the landscape from deer damage. No universal solution exists. The landscape industry has forged many novel strategies for dealing with deer. Individual homeowner's must weigh the pros and cons of the varying options and select a landscape design solution that suits their priorities and values. Five factors should be considered when assessing each approach:

1. Effectiveness
2. Landscape Impact/Aesthetic Impact
3. Maintenance Required
4. Cost
5. Risk

For example, some consider the high-degree of security afforded by deer-fencing to be worth the cost of installation. Others prefer not to surround their yard with 8-foot high deer-fencing and are willing to accept the added maintenance of applying deer-repellent frequently. Still others utilize only deer-resistant plants to create a beautiful landscape.

This essay is written to serve as a guide through the process of selecting the best option. The first step is to consider these questions:

1. How severe is the influence of deer in my neighborhood? How extreme a measure should I take to protect my landscaping from deer damage?
2. Do I mind using only "deer-resistant" plants for my landscaping? Which plants are reliably deer-resistant in my neighborhood? What are some strategies for making a deer-resistant design look attractive?
3. Are there certain plants that are not "deer-resistant" but that I love so much they must be included in my landscape? If so, then, which method of protecting these plants is best for me? Deer-fencing? Deer-repellents? Others methods?

After providing detailed information to assist answering these questions, we will revisit them in the conclusion. First, however, we must investigate the cause and impact of deer overpopulation in New Jersey.

Part I: Deer overpopulation in northern New Jersey

Throughout most of northern New Jersey's suburban communities deer exist in overpopulation. While the state has not established a target density, it acknowledges that when deer populations exceed 10 per square mile there begins a loss of biodiversity in the native ecosystem due to deer overgrazing.¹ The loss of biodiversity dramatically increases in severity as deer density increases. Generally, a density of 20 per square mile will result in minimal deer damage to the native ecosystem, as well as, to landscape plantings and for this reason it is frequently cited as the goal density of deer reduction programs.² New Jersey's deer population is estimated from 150,000 to 200,000 distributed unevenly over 4,734 square miles of deer range (total state land area is 7,417 sq mi).³ That makes the statewide average density between 32 to 42 deer per square mile. Yet because the suburban environment can support more deer than the deep woods, many communities boast densities of 60-70 deer per square mile.⁴ The suburban town of Watchung, just 35 minutes outside of New York City, reported a density of 80 per square mile in 2001.⁵ Submitted as part of the *Governor's Report on Deer Management in New Jersey* (1999), Figure 1 (next page) illustrates the average deer density throughout the state.

Both the New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Audubon Society (NJAS) advocate lessening the deer population in order to reduce the numerous negative effects the overabundance of deer has on our environment and our society. Ecologists estimate that before settlers arrived in New Jersey, the state-wide deer population was significantly less than its current level. Densities ranged from 5 to 11 deer per square mile.⁶ The population was moderated by a balanced ecosystem which included indigenous predators such as the mountain lion, gray wolf, and bobcat.⁷ Further, the unbroken old-growth forests that once stretched across the state offered less ideal habitat for the deer than the current fragmented environment does because deer thrive on the edge of clearings, not in the deep woods.⁸ All in all, the underlying source of the problem is the arrival of modern human civilization, specifically, the suburbs.*

Causes of deer overabundance:

White-tailed deer populate the suburban environment at greater densities than the undisturbed native forest for several reasons:

A. No Predators. The natural predators of the white-tailed deer no longer live in the state, except for the bobcat, which exist in such scarcity as to be listed as endangered in New Jersey.⁹

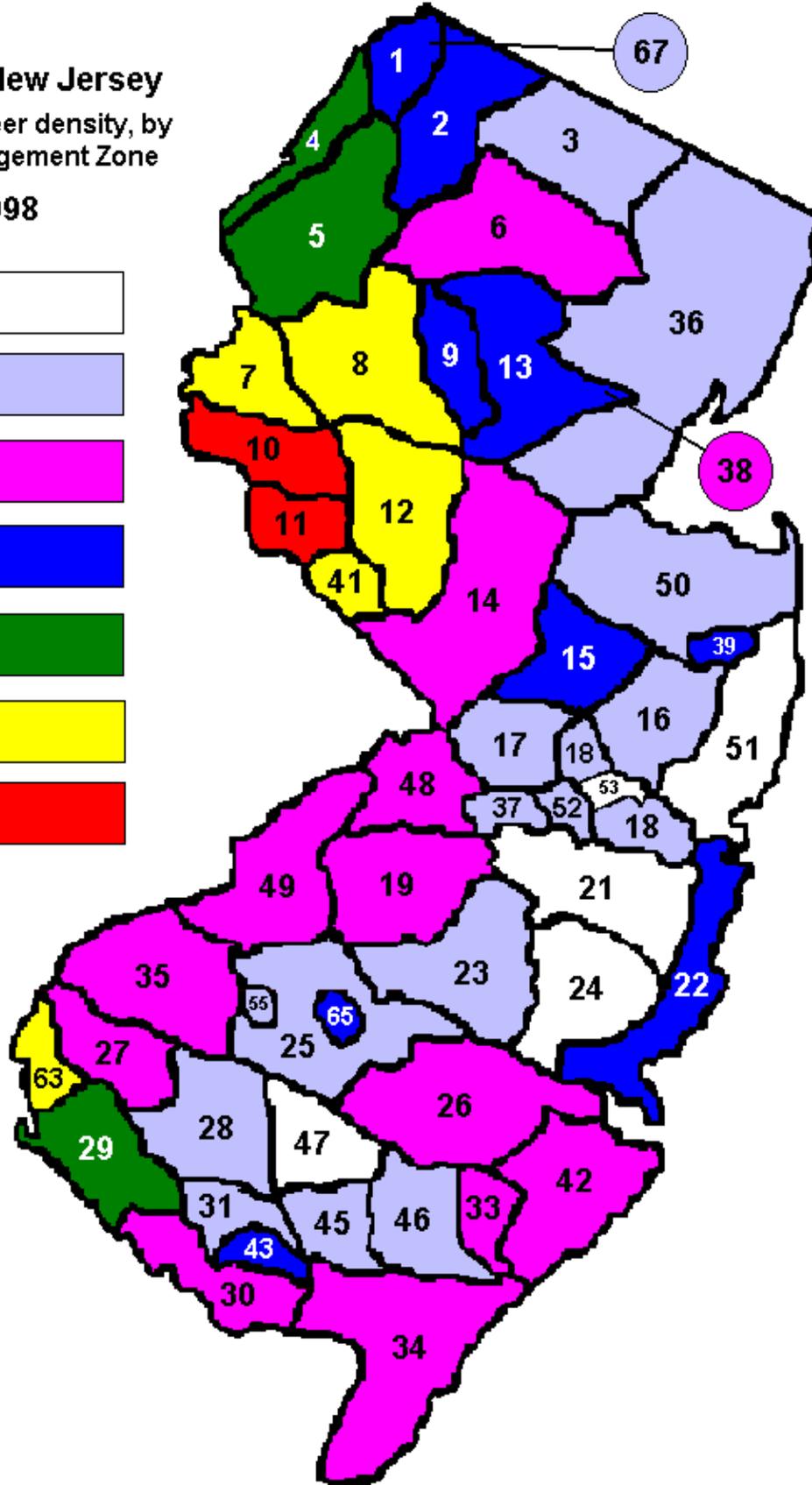
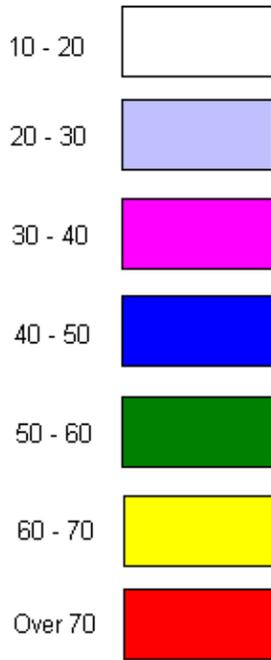
B. Habitat Expansion. Unlike the case of their predators, the suburban environment expands the optimal habitat for deer. Deer are "edge feeders." They thrive in the area between the deep woods and open fields where shrubs and small trees are within their reach.¹⁰ Suburban communities create clearings in the forest for housing developments, individual homes, public parks, powerlines, and roads, all of which are rimmed with new edge habitat.

* I define "suburbs" as the developed region between the urban and the rural. Certainly, suburban areas existing on a sliding scale from more urban (Bergen County) to some more rural (Warren County). Outside of strictly urban areas around major city centers (Paterson, Newark, Camden) and strictly rural areas (parts of the Pine Barrens) most of the Garden State is some degree of suburbs.

Figure 1.

State of New Jersey
Average deer density, by
Deer Management Zone

1998



C. Hunting Restrictions. Historically, the size of New Jersey's deer herd had been managed through sport hunting, but restrictions stemming from suburban civilization limit the influence the traditional hunter has on reducing the deer population.¹¹ In the *Governor's Report on Deer Management in New Jersey* (1999), the NJDEP wrote: "These increases [in deer population] have been caused by inadequate population control due to no or poor hunter access to land harboring deer, municipal ordinances banning hunting or firearm discharge, low density housing patterns, creation or expansion of parks not open to hunting, a decreasing hunter population, hunter unwillingness to shoot more antlerless deer, landowners protecting deer from hunters and other factors."

D. Increased Food Supply. In pre-settled New Jersey, the deer herd was subjected to naturally occurring food shortages in the summer and winter. With modern irrigation systems, the plants in suburban communities stay lush throughout the summer. With the abundance of vegetative material, along the increased edge habitat, deer have a more plentiful supply of food throughout the winter. And, some people even feed the deer.

E. White-tailed Deer are Prolific Reproducers. Although growth rate depends on quantity and quality of food, generally a herd can grow at 50% per year. An experiment conducted within the 1,146 acre Edwin S. George Reserve in southeastern Michigan showed that an isolated herd of 6 deer multiplied to 162 after six years. The experiment was repeated with an initial herd of 10 deer which grew to 212 in six years.¹² In order for a population to remain stable, studies demonstrate that 40% of female deer – the does – must be removed each year by either natural causes or human influences.¹³ Without a reduction of at least that amount, a deer herd will continue to grow.

The suburbs have created (albeit, unintentionally) an ideal breeding ground for the white-tailed deer. With the absence of natural predators and protection from being hunted, the suburbs' fragmentation of the native forest has created an abundance of edge habitat for these prolific reproducers to multiply to overwhelming populations. Before the wide sprawl of the modern-day suburbs, deer populations were effectively controlled by hunters. Beginning in the 1750's until around 1900, most of the state was deforested and turned into farmland. This earned New Jersey the nickname "The Garden State." In the process, deer were hunted to near extinction. In 1904, the state Board of Fish and Game Commissioners took action to rebuild the white-tailed deer population by gathering 100 deer from an estate in Warren County and releasing them in optimal areas of the state.¹⁴ Also, they banned hunting that year. Since these actions in 1904, the deer population has swelled. Improved hunting oversight and regulations kept the post-1904 deer herds from being over-hunted.

Throughout the first half of the 20th century, as much of the farmland was allowed to return to forest, the secondary-growth forests with abundant low-growth foliage was the ideal landscape for a resurging deer population. Then came the suburban sprawl in the 1960's, in part fueled by the post-World War II push to build interstate highways, particularly I-80 (constructed ca. 1959-1973) and I-78 (constructed ca. 1960-1970).¹⁵ As major highways crossed northern New Jersey, more and more hunting territory was taken away from the sport hunter and given to the suburban homeowner. Many of these suburban dwellers have a great love for being able to live outside of the city and in nature, although that does not directly translate to 'in harmony with' nature.

Effects of deer overabundance:

New Jersey's current overabundant deer population is considered **undesirable** for a number of reasons:

1. Loss of Biodiversity in the Natural Ecosystem. Deer are selective feeders. They prefer particular plants over others. The increased deer population consumes an increased amount of preferred plants. The toll is taken not merely on agricultural crops and landscape plantings, but on our native forests where certain plant species are being decimated. Deer's browsing range is from ground level to, on average, 4-feet above the ground. Within that height, deer overwhelm the forest's understory plants, both woody and herbaceous, and also devour new seedlings before they have a chance to grow into trees. Of the particular plants deer favor, many are being eaten to extinction within the state, to include the native Atlantic white cedar (*Chamaecyparis thyoides*). The deer negatively affect a balanced regeneration of the forest because they devour preferred seedlings, such as sugar maple, white ash, oaks, yellow poplar, hemlock, white pine, and white cedar, while allowing others to develop into maturity.¹⁶ Moreover, when the deer eliminate the forest understory shrubs, they affect the habitat of other native animals, particularly ground rousting birds such as ovenbirds, wood thrushes, veerys, worm-eating warblers, flycatchers, yellow-billed cuckoos, indigo buntings, eastern phoebes, and ruffed grouse.¹⁷ The lack of diversity in an ecosystem like the one that northern New Jersey is approaching greatly reduces its ability to bounce back from outbreaks of forest pests and diseases.¹⁸

2. Exacerbate the Issue of Invasive Species. As deer decimate certain preferred native plant populations, many exotic invasive species are given a chance to spread and colonize uncontested. Invasive species can drastically alter the composition of a natural ecosystem, its habitat and its food web. Japanese barberry (*Berberis thunbergii*), originally introduced in the United States as a landscape plant, headlines the bill of invasive plants in New Jersey whose rampant spread is aided by the deer. The National Park Service (NPS) writes: "Japanese barberry forms dense stands in natural habitats including canopy forests, open woodlands, wetlands, pastures, and meadows and alters soil pH, nitrogen levels, and biological activity in the soil. Once established, barberry displaces native plants and reduces wildlife habitat and forage. White-tailed deer apparently avoid browsing barberry, preferring to feed on native plants, giving barberry a competitive advantage. In New Jersey, Japanese barberry has been found to raise soil pH...and reduce the depth of the litter layer in forests."¹⁹

3. Decline in Overall Health of the Herd. Often deer in superabundant populations are malnourished, undersized, and sickly. No longer are there carnivorous predators to prey on the weakest of the herd, remove the sick and decrepit, and thereby improve the overall health of the herd. Moreover, where hunting is allowed, the hunters do not help the situation because they traditionally take the healthiest, largest, strongest from the herd.

4. Collisions with Automobiles. The state spent \$730,000 removing 15,000 dead deer from roadways in 2005, most a result of a collision with an automobile.²⁰ Nationally, there are an estimated 1.5 million deer-motor vehicle collisions each year, resulting in about 150 occupant deaths and more than \$1 billion in vehicle damage.²¹

5. Distribution of Lyme Disease. According to the American Lyme Disease Foundation, northern New Jersey is considered a “High Risk” zone. From 1997-2003, 15,386 new cases were reported in New Jersey, an average of over 2,000 new cases per year.²² Lyme disease is carried by black-legged ticks (*Ixodes scapularis*) which are commonly called “deer ticks” because the white-tailed deer is the principal host of the adult-stage tick. As deer roam throughout suburban communities, they spread deer ticks, each potentially carrying Lyme disease.

6. Damage to Agricultural Crops. A 1998 statewide survey conducted by Rutgers' New Jersey Agricultural Experiment Station (NJAES) Center for Wildlife Damage Control estimated that deer cause over \$10 million worth of damage to crops annually.²³

7. Damage to Residential Plantings. Many of northern New Jersey’s residential landscapes are subjected to deer damage of varying severity. As noted in the introduction, homeowners living in areas of high deer populations must weigh the value of various protection methods, each with its own degree of: (1) Effectiveness; (2) Landscape Impact/Aesthetic Impact; (3) Maintenance Required; (4) Cost; and (5) Risk.

Measures to decrease the deer population

The state manages the overall deer population primarily through regulated sport hunting. Recent measures to increase the harvest include “lengthening the hunting seasons, increasing the bag limits, increasing the number of hunting permits issued, and offering incentives for hunters to harvest more antlerless deer (does and fawns).”²⁴ Sport hunters harvest approximately 60,000 deer annually.²⁵ Many environmental organizations endorse hunting as a means to control deer populations, including the New Jersey Audubon Society and Wild New Jersey.²⁶ Some of the harvested deer are donated to food banks through the program Hunters Helping the Hungry.

But, as noted above, sport hunting is not a viable means of population control in suburban communities. To confront this issue, the NJDEP, Division of Fish & Wildlife promotes alternative methods of controlling deer populations under the Community-Based Deer Management Permit (CBDMP) program. They write, “Since the CBDMP program was instituted [in 1995], the Division of Fish and Wildlife has approved a wide variety of nontraditional and experimental methods to control deer populations in suburban communities. Programs to trap and transfer deer, trap and euthanize deer, use chemical fertility control, and shoot deer by volunteer and paid agents outside of the regular hunting season dates have been permitted.”²⁷ CBDMP programs have been instituted within Essex, Hunterdon, Mercer, Morris, Somerset, and Union counties. Some methods have proven costly and ineffective, such as trap and release/euthanize and chemical fertility control. The method which has been highly effective (along with being somewhat controversial) is for a town to hire a company of professional sharpshooters to cull the herd. The harvested deer are then donated to food banks.

Part II: Designing landscapes with strictly “deer-resistant” plants

Designing a landscape with only deer-resistant plants is an effective solution for dealing with potential deer damage. Most homeowners select this method because it adds no additional cost or maintenance. The risk is minimal. Only in times of extreme overpopulation or food scarcity would deer venture to eat these plants. Sometimes people turn away from this approach because they are leery about which plants are reliably deer-resistant and they fear the planting will be uninteresting, drab, and monotone. Contrary to those fears, there is a reliable method for selecting appropriate deer-resistant plants and many beautiful design options.

Which ornamental plants are “deer-resistant” in my neighborhood?

The landscape industry created the term “deer-resistant” to categorize certain plants that are seldom, if ever, grazed upon. Plants which are *less* seldom grazed upon, are *more* deer-resistant, and vice versa. Technically, no plant is “deer-proof” because when faced with starvation, deer will eat practically anything. For that reason, no nursery or landscaper will guarantee deer-resistance. Although, deer damage to highly resistant plants usually amounts to nothing more than minor nibbling. Such was the case at one residence in Morris County where extreme overpopulation led to deer nibbling on blue spruce, andromeda, spiraea, and barberry, all considered ironclad deer-resistant plants.²⁸ While that case is a rarity, some other plants which once adorned “deer-resistant” lists as recent as 10 years ago are thoroughly devoured in particular areas of extreme (densities 50-60+) overpopulation such as white pine, fir, blue holly, burning bush, and rhododendron. To further complicate the issue of deer-resistance, certain plants which demonstrate resistance in one area of the country are sometimes reported to show no resistance in another.²⁹

For that reason, the most reliable approach to determining which plants are deer-resistant in your particular area is to cross-reference a regional list from a reputable source with a neighborhood list taken from personal observations around your home. For residents of northern New Jersey, the most reputable regional list was compiled by Rutgers University Cooperative Research & Extension (RCRE) and is posted on their website as well as included with this paper in Appendix A. The RCRE prefaces their list:

The following is a list of landscape plants rated according to their resistance to deer damage. The list was compiled with input from nursery and landscape professionals, Cooperative Extension personnel, and Master Gardeners in Northern N.J. Realizing that no plant is deer proof, plants in the *Rarely Damaged*, and *Seldom Severely Damaged* categories would be best for landscapes prone to deer damage. Plants *Occasionally Severely Damaged* and *Frequently Severely Damaged* are often preferred by deer and should only be planted with additional protection such as the use of fencing, repellents, etc. Success of any of these plants in the landscape will depend on local deer populations and weather conditions.

As noted in the preface, this list was compiled by a wide variety of sources, including many landscape professionals and gardening experts from northern New Jersey. Over 500 landscape plants are rated and the ranking system is clearly explained and easy to use. To be extra safe, cross-reference the Rutgers list with a list of plants from your neighborhood that you never see

damaged. In some areas it will be wise to stick only with plants rated “Rarely Damaged,” while in other areas you can safely incorporate plants rated “Seldom Severely Damaged,” as well. With this approach, you will tailor your list to the severity of deer damage in your area and you can be confident you will have the most accurate deer-resistant list attainable.

Although, a significant caveat is that some of these deer-resistant plants might be considered invasive species. Discussed earlier in Part I, invasive species are non-native organisms that have been introduced from a foreign ecosystem and pose an ecological threat to our native ecosystem. Invasive species can dramatically alter a natural landscape. For example within 40 years, from 1910 to 1950, the Asian fungus *Endothia parasitica* practically eliminated the once abounding American chestnut from the eastern deciduous forest.³⁰ Similarly, Dutch elm disease destroyed the American elm. Currently purple loosestrife and Japanese barberry are rapidly altering ecosystems as they spread profusely throughout the wetlands and the forest understory, respectively. Both are still commonly sold as ornamental plants.

Created in March 2004,³¹ the Invasive Species Council (ISC) of New Jersey is still in its infancy and has not established a state-sanctioned invasive species list nor have any particular plant species been legally banned from landscape use, as in Massachusetts.³² Nonetheless, invasive species pose a serious threat to a balanced ecosystem, hence the recent formation of the ISC of New Jersey. The United States Department of Agriculture, National Invasive Species Information Center website offers links to each state’s invasive species list. Since New Jersey is without an official one, that website links to the Native Plant Society of New Jersey’s invasive species list.³³ Twenty of the 63 plants on their invasive species list are *also* recommended on the Rutgers deer-resistant list either as “Rarely Damaged” or “Seldom Severely Damaged.” While these cross-referenced plants (listed in Appendix B) offer the value of being deer-resistant, their continued landscape use could worsen the imbalance in the ecosystem of New Jersey.

Suggests for using only deer-resistant plants in a landscape design

Many great landscapes can be created designing within the pallet of deer-resistant plants Here are some suggestions how:

1. The principles of good landscape design do not change. Remain true to the intent of the design by a replacing non-resistant plant with a resistant one that *has the same function*. Many landscape architects and designers create a design working within categories of plants before ever thinking in terms of a particular plant. Some such categories are: shade trees, ornamental trees, upright evergreens, evergreen shrubs, flowering shrubs, and flowering perennials, to name a few major ones. If the intent of the design is to frame the house by locating an upright evergreen on the corner of the house, you can stay true to the design concept by selecting a deer-resistant upright evergreen. Some examples of effective swaps are:

White Pine	→	Japanese Black Pine
Yew	→	Boxwood
Rhododendron	→	Andromeda
Hydrangea	→	Viburnum
Hosta	→	Catmint
Tulips	→	Daffodils
Geranium	→	Moonbeam Coreopsis
English Ivy	→	Pachysandra

2. Use a deer-resistant scheme only in the front yard planting. Design a backyard planting that will be protected from the deer by, for example, deer fencing. In this situation, a larger variety of plants can be worked into the total landscape.

3. Utilize the woods, if available, as a backdrop to hide deer fencing. By design, deer fencing is indented to avoid catching your eye. But 8-foot high netting running through an open field in your backyard will unavoidably catch the eye. So in cases where there are woods in the backyard, run the deer-fencing through the woods and the netting will essentially disappear into the background texture of the woods.

4. Select an ornamental tree, even if it is a deer favorite, whose lowest branches are above the deer's reach. An average sized white-tailed deer cannot browse above 4-feet. To be on the safe side, let's say 5-feet. Selecting trees like this keeps the entire pallet of ornamental trees available for use. You can add some variety and interest to a landscape by using a purple plum or 'Royal Burgundy' Japanese cherry. If you choose a young tree whose branches are below the deer's browsing line, install a tree guard to protect its lowest branches until they grow above the browse line.

5. Plant in masses. Admittedly, fewer total plants are available for your use when limited to deer-resistant plants. But, then again, a vast variety of plants does not necessarily mean the landscape will look good, rather often a landscape with too many different plants causes an uncoordinated patchwork look. I suggest select a few favorite plants and work them into masses that sweep along side each other or through one another. Most often this approach is done for groundcovers where, for example, a mass of myrtle sweeps around a mass of liriopse. But the same concept looks great with small and large shrubs, and especially ornamental grasses. Just a few sweeping masses will not feel like a monotonous planting scheme, but rather an artful selection of a few great plants. Planting in masses allows for the flower bloom to have more impact and also for contrasting textures to have a greater visual impact. Example: Sweep masses of dwarf fountain grass and blue oat grass amongst masses of Virginia sweetspire and 'Gold Flame' spiraea. Behind this, plant a mass of andromeda or spruce as an evergreen backdrop. If the site is shady, a mass of ferns can look great.

6. Incorporate rocks/boulders as ornamental accents. A great way to add variety and interest to a planting is to intersperse some ornamental boulders or rocks. They come in a variety of sizes and textures from granite boulders to moss rocks. Select a flat-top rock and place it at the edge of a planting bed or a patio to create a natural stone benches that also ties into the theme of interspersed rocks among the plantings.

7. Use an ornamental rock or a sculpture as the focal point. A popular design concept is to create a focal point in a landscape. This relaxes the viewer because there is a defined place for the eye to focus on first glance and thereafter wander off across the rest of the landscape. Often focal points are created with specimen plants such as a Japanese maple. Though not a deer favorite, this tree can be severely damaged by deer. Certainly no one wants their \$500 Japanese maple eaten. Use an ornamental rock or a stone sculpture in the place of this specimen plant. Often a mass planting around a sculpture aids in its role as a focal point.

8. If you choose to take a risk, take a small risk. For example, say you do not mind using a deer-resistant planting, except you especially love hydrangeas. Do not plant a large mass of hydrangeas on the edge of the woods and expect deer-repellent to protect them. Rather, install one or two hydrangea between the patio and the house where they can be appreciated from the patio in the summertime, but also where the task of applying deer-repellent will not be overly taxing. And in a worst case scenario, if the deer eat the hydrangea, the financial loss is not too great.

9. Another risk that might be worth taking is to disguise vulnerable plants with a strong scent. Deer rely heavily on their sense of smell to detect predators. Deer have been found to avoid certain highly fragrant plants because, it is presumed, the deer fear the strong scent could be masking the scent of an approaching predator.³⁴ These plants include catmint, onions, honeybush, lavender, mint, sage, society garlic, and thyme.* Massing some of these aromatic plants around some that are more vulnerable *might* keep them safe from deer damage.

10. Utilize a combination of these suggestions tailored to meet your priorities and desires.

* Catmint (*Nepeta spp.*), Onions (*Allium spp.*), Honeybush (*Melianthus major*), Lavender (*Lavandula spp.*), Mint (*Mentha spp.*), Sage (*Salvia officinalis*), Society garlic (*tulbaghia violacea*), and Thyme (*Thymus spp.*)

Part III: The effectiveness and practicality of the various “deer-proofing” methods

For some, installing a landscape with only deer-resistant plants will not be the desired course of action. In that case, each individual will have to determine the best course of action for protecting their plantings from deer damage. For the sake of creating a vocabulary to discuss and compare various “deer-proofing” methods, I have rated each in terms of five factors:

- | | |
|----------------------|---|
| 1. Effectiveness: | Its ability to prevent deer damage. |
| 2. Maintenance: | The amount of time required for upkeep. |
| 3. Cost: | Rated by comparison to other methods. |
| 4. Landscape Impact: | Visual impact on a landscape. |
| 5. Risk: | Frequency and scope of potential failure. |

The rankings are based on qualitative judgments I made from research, interviews, and professional experience. I provide supporting arguments and data where available. For the sake of comparison, I rated deer-resistant planting as well.

Solely Deer-Resistant Planting

Effectiveness:	High
Maintenance:	Low
Cost:	Low
Landscape Impact:	Medium
Risk:	Low

As discussed in Part II, a deer-resistant landscape planting adds no additional cost or maintenance while being highly effective and low risk. The significant variable is landscape impact, which boils down to a personal decision of aesthetics. Some will feel that a planting of this sort can be beautiful and meet their desires, while others will insist on incorporating plants outside of the deer-resistant pallet. If the latter be the case, consider the following options for “deer-proofing.”

Deer-Fencing

Effectiveness:	High
Maintenance:	Low
Cost:	High (\$4,000 - \$10,000 professionally installed)
Landscape Impact:	Medium
Risk:	Low

A properly installed deer fence is the only sure way to keep deer from your yard. The maintenance involved is minimal requiring a weekly inspection for any damage to the fence. The risk involved would be if a large enough tree or branch fell on the fencing and created an avenue for deer to enter. Generally, this would be uncommon. Cost turns some people away, but depending on the size and scope of the landscape project, the cost could be factored into the budget. Installed by a professional, the fencing costs approximately \$10-\$12 per linear foot.

Enclosing a ¼-acre backyard would cost around \$4,000 and a 1-acre backyard around \$10,000. The significant variable here is landscape impact. Deer-fencing must be 8-feet high at a minimum. Many recommend 10-foot high fencing. Enclosing an entire property or even just a backyard can create a “caged” feeling. The deer-fence netting is relatively thin and designed to cause a low visual impact on a landscape.

Alternative Deer-Fence Options – Double-Row Fencing and Solid Normal Fencing

For these methods, the ratings are the same as normal deer fencing. Double-row fencing entails installing two 4-foot or 5-foot tall fences side by side with a 4 to 5-foot gap between them.³⁵ Deer do not attempt jump over both fences because they are not broad leapers. Further, deer do not attempt to land in the middle because, it is presumed, they would feel trapped. This method allows a landscape to utilize lower ornamental fencing than 8-foot high deer fencing. The cost of the fence is doubled. Another alternative deer fence works on the principle that deer need to see a safe landing site before they jump. Install a solid 6-foot high fence around a backyard. Assuming level ground, a deer’s eye level will be between 4 and 5-feet above the ground – they will not be able to see over the fence and ascertain whether it is safe for them to take a leap.

Commercial Deer Repellents

Effectiveness:	Medium
Maintenance:	High
Cost:	Low (\$25 - \$500 per application)
Landscape Impact:	Low
Risk:	Medium

The advantage of commercial deer repellents is that they have no visual impact on the landscape and are low cost (lower than fencing). Cost per application can vary significantly depending on total amount of plants requiring protection and whether you apply the repellent yourself or hire a professional service. If you apply the repellent yourself and protect just a few select plants, each application might cost around \$25. On the other end of the spectrum, if you have a large landscape planting which is sprayed regularly by a professional service, applications could run from \$100 - \$500 per application.

Depending on the deer density, repellents can be highly effective or entirely ineffective. When food is scarce, deer will force themselves to disregard the repulsive odor and take a bite. For some suburban areas of northern New Jersey, deer repellents have provided no protection.³⁶ There is a higher degree of maintenance involved because repellents have to be applied regularly, especially in the late winter when food is scarcest and in the early spring when new growth requires frequent applications. Further, deer have been known to become accustomed to a particular repellent and for that reason it is important to rotate brands. The market offers numerous liquid spray repellents to include: Bobbex, Chew Not, Deer Away, Deerbusters, Deer Ex, Deer Off, Deer Out, Deer Scram, Deer Solution, Deer Stopper, Deervik, Hinder, Liquid Fence, Not Tonight Deer, Plantskydd, Ropel, and Tree Guard. Furthermore, applying Milorganite, a fertilizer made from human waste, has been shown to repel deer.

When depending on deer-repellents there is a significant risk because if an application is missed, or if seasonal conditions limit the effectiveness (for example, excessive rain) the deer can in one night devour a fully established garden. Many gardeners report positive results using repellents and each of these repellent manufacturers boast reports near 100% effectiveness on their product labels and/or websites. This could be the result in many situations. Nevertheless, you must be aware of the risk involved, especially where deer densities run high.

Homemade Deer Repellents

Effectiveness:	Low
Maintenance:	High
Cost:	Low
Landscape Impact:	Low
Risk:	High

Homemade deer-repellent recipes generally include some combination of hot pepper juice, Tabasco sauce, eggs, and/or ammonia mixed with water and spread on and around vulnerable plants. Some people mix their repellent with Wilt Pruf to aid it sticking to the leaves. In addition to these liquid repellents, some people spread dried blood meal on the ground. Others hang strong scented soaps (for example, Irish Spring), human hair (clumps from the barber), and/or dried clumps of garlic in socks or stockings throughout their plantings. All of these applications consume a large amount of time to concoct and apply. Often they have to be alternated and aggressively reapplied after rainfall in order to provide consistent effectiveness. Some people swear by their homemade repellents but generally they only work in areas of moderate or low deer densities. There should be no expectation of any of these methods being reliable.

Ultrasonic Deterrent System – Nature Technologies’ DeerTech 880

Effectiveness:	High
Maintenance:	Low
Cost:	High (\$1,200-\$10,000 installed) (\$99+ per month maintenance fee)
Landscape Impact:	Medium
Risk:	Low

Nature Technologies Inc. was recently founded to market the DeerTech 880 ultrasonic deer deterrent system. Based in Pleasantville, NY, the company services all of northern New Jersey. DeerTech 880 is a device that gives off a high-pitched frequency, above the range of human hearing, which for a deer sounds as if they were standing next to a jet engine. Several beacons must be installed throughout a landscape in ensure total coverage. Deer avoid the beacons because they are uncomfortable being around the deafening noise where they cannot detect approaching predators. The literature available on the internet is mostly PR from the company itself that speaks very highly of system. I have no reason to doubt the alleged effectiveness. The maintenance is performed by the company which also applies some deer repellents on the property. The landscape impact entails several beacons among the plantings.

They stick out kind of like a small bird feeder on a pole would. The risk would be that when you had a power outage, the beacons would not radiate for that time period.

Motion Activated Deterrent System - ScareCrow Motion Activated Sprinkler

Effectiveness:	Medium
Maintenance:	Medium
Cost:	Low (\$75 per sprinkler)
Landscape Impact:	Medium
Risk:	Medium

The ScareCrow device attaches to the end of a garden hose and will squirt water whenever an animal (or human) triggers its battery operated motion detector. The cost is low at \$75 per device. The customer reviews on Amazon.com speak very highly of the effectiveness of the system. The manufacturer's website offers a video link of the device in action: <http://www.contech-inc.com/videos/scarecrow/crowloop_high.mov>. The drawback is that the sprinkler does make a small visible appearance in the landscape. Protecting more area will require more sprinklers which would compound the visual impact. The risk is that if the battery dies, or the device malfunctions, your plantings are sitting ducks. Although, deer are creatures of habit and they might not venture back into your yard after being scared several times. This device might find its ideal usage by protecting a small planting bed. In this case, only one device would be required and should sufficiently protect the bed from deer damage.

Unreliable Methods

While these methods listed below have been suggested at one time or another, they offer no reliable protection from deer damage.

- Guard Dog. A guard dog will only work in the particular case where the dog lives permanently outdoors and has free range to roam the property. Reports have shown that deer will learn the length of a dog chain and eventually not fear the dog.
- Scare tactics: noise-makers, loud music, bright lights. Not only have these methods proven unreliable after a few days, but they cause public disturbance issues.
- Protecting a small garden with fishing line or thin string wound around it. Some report that deer are confused about the fishing line they cannot see, and after bumping into it, retreat from the area. Some people walk along the line daily rubbing their fingers on it leaving human scent. Some hang suspended aluminum pie plates from the strings to scare the deer away when they bump into them. These strategies *might* deter deer from a small garden patch, but they cannot be considered consistent and reliable protection.
- Create a 50-foot or wider clearing between the forest edge and the home landscaping because deer tend to avoid open fields. While this might be true of herds in very rural areas where the deer still fear wild predators and hunters, the suburban deer exhibit no fear of open spaces.

- Trap and release. Despite the high-cost, high-effort, and low-survival rate of relocated deer, this option also offers no protection from other deer entering your neighborhood.

- Feed the deer. Installing a salt lick or corn feeder at the edge of a property has been shown to cause the deer to congregate there and avoid browsing on the nearby landscape plants. But, this method comes with no guarantees that one day they will not venture into the yard and eat the landscape plants. Furthermore, from an ecological standpoint, feeding the deer only exacerbates the issue of deer overpopulation in northern New Jersey.

Not Viable Methods:

- Poisoning. Aside from being illegal, this leaves rotten deer carcasses in the vicinity of your home and the poison enters the food chain.

- Mothballs. Toxic to humans and animals.

- Electric fencing. Electrical fencing is often used to protect farmland and has proven very effective in that situation. Local ordinances generally prohibit electric fences from residential areas.

- Hunting the deer. Not permitted due to safety zones around houses.

Conclusion

Guided by the information provided throughout this paper, let's revisit the questions posed in the introduction.

Q1. How severe is the influence of deer in my neighborhood? How extreme a measure should I take to protect my landscaping from deer damage?

Have you ever seen deer in your yard? In a neighbor's yard? How often? Have you ever noticed deer damage in your yard or a neighbor's yard? Are there distinct browse lines at around 4-feet on certain plants? Are there any deer favorites like yew, hosta, arborvitae that are surviving with little or no damage? The greater the deer density, the more frequently you will see deer and deer damage in your neighborhood. Greater severity of damage is proportional to greater density of deer. The greater the density in your neighborhood, the more reliable measure of protection you should take.

Q2. Do I mind using only "deer-resistant" plants for my landscaping? Which plants are reliably deer-resistant in my neighborhood? What are some strategies for making a deer-resistant design look attractive?

If you do not mind using only deer-resistant plants for you landscaping, use Part II as a guide for selecting plants and design concepts.

Q3. Are there certain plants which are not "deer-resistant" but that I love so much they must be included in my landscape? If so, then, which method of protecting these plants is best for me? Deer-fencing? Deer-repellents? Others methods?

The answer to this question depends on the how many deer preferred plants you wish to incorporate into your landscape. If there are just a few, then you can take small-scale measures to reasonably protect the select few like deer repellents or the motion activated deterrent system. On the other hand, if you wish to include many deer-preferred plants, then more significant protection will be required such as deer-fencing or an ultrasonic deer deterrent system. Weigh the pros and cons of each method as discussed in Part III.

Personal Reflections

The information in this paper was intended to supplement good landscape design principles when planning a landscape in areas of deer overpopulation. In the process of research, I discovered the dramatic effect deer overpopulation is having on the native ecosystem of New Jersey. I recognize that the average resident is unaware of the impact of deer overpopulation. Goal levels of 10-20 deer per square mile are attainable, but only by acquiring a Community-Based Deer Management Program permit for professional harvesting. This is an approach that will meet with much public concern, but when educated of the dangerous impact of the current overpopulation, I hope, we will recognize this is the wisest course of action.

Landscape Plants Rated by Deer Resistance

Pedro Perdomo, Morris County Agricultural Agent

Peter Nitzsche, Morris County Agricultural Agent

David Drake, Ph.D., Extension Specialist in Wildlife Management

The following is a list of landscape plants rated according to their resistance to deer damage. The list was compiled with input from nursery and landscape professionals, Cooperative Extension personnel, and Master Gardeners in Northern N.J. Realizing that no plant is deer proof, plants in the *Rarely Damaged*, and *Seldom Rarely Damaged* categories would be best for landscapes prone to deer damage. Plants *Occasionally Severely Damaged* and *Frequently Severely Damaged* are often preferred by deer and should only be planted with additional protection such as the use of fencing, repellents, etc. Success of any of these plants in the landscape will depend on local deer populations and weather conditions.

Latin Name	Common Name
ANNUALS	
Rarely Damaged	
<i>Ageratum houstonianum</i>	Ageratum
<i>Antirrhinum majus</i>	Snapdragon
<i>Brugmansia sp. (Datura)</i>	Angel's Trumpet
<i>Calendula sp.</i>	Pot Marigold
<i>Catharanthus rosea</i>	Annual Vinca
<i>Centaurea cineraria</i>	Dusty Miller
<i>Cleome sp.</i>	Spider Flower
<i>Consolida ambigua</i>	Larkspur
<i>Euphorbia marginata</i>	Snow-on-the-Mountain
<i>Helichrysum</i>	Strawflower
<i>Heliotropium arborescens</i>	Heliotrope
<i>Lobularia maritima</i>	Sweet Alyssum
<i>Matricaria sp.</i>	False Camomile
<i>Myosotis sylvatica</i>	Forget-Me-Not
<i>Nicotiana sp.</i>	Flowering Tobacco
<i>Papaver sp.</i>	Poppy
<i>Pimpinalla anisum</i>	Anise
<i>Rosmarinus officinalis</i>	Rosemary
Seldom Severely Damaged	
<i>Anethum graveolens</i>	Dill
<i>Borage officinalis</i>	Borage
<i>Celosia sp.</i>	Cock's Comb
<i>Centaurea cyanus</i>	Bachelor's Buttons
<i>Cheiranthus sp.</i>	Wallflower
<i>Eschscholzia californica</i>	California Poppy
<i>Iberis umbellata</i>	Candytuft
<i>Lantana sp.</i>	Lantana
<i>Lobelia sp.</i>	Lobelia
<i>Matthiola sp.</i>	Stocks
<i>Ocimum basilicum</i>	Basil
<i>Perilla frutescens</i>	Shiso

Latin Name	Common Name
<i>Petroselinum crispum</i>	Parsley
<i>Salvia</i>	Salvia
<i>Tagetes patula</i>	French Marigold
<i>Tropaeolum majus</i>	Nasturtium
<i>Verbena x hybrida</i>	Verbena
<i>Zinnia sp.</i>	Zinnia
Occasionally Severely Damaged	
<i>Begonia semperflorens</i>	Wax Begonia
<i>Coleus sp.</i>	Coleus
<i>Cosmos sp.</i>	Cosmos
<i>Dahlia sp.</i>	Dahlia
<i>Gerbera jamesonii</i>	Gerbera Daisy
<i>Helianthus sp.</i>	Sunflower
<i>Impatiens balsamina</i>	Balsam, Touch-Me-Not
<i>Impatiens walleriana</i>	Impatiens
<i>Ipomea sp.</i>	Morning Glory
<i>Pelargonium sp.</i>	Geranium
<i>Petunia sp.</i>	Garden Petunia
<i>Viola sp.</i>	Pansy
BIENNIALS	
Rarely Damaged	
<i>Digitalis purpurea</i>	Common Foxglove
Seldom Severely Damaged	
<i>Dianthus barbatus</i>	Sweet William
<i>Lunaria annua</i>	Money Plant
<i>Myosotis alpestris</i>	Forget-Me-Not
Occasionally Severely Damaged	
<i>Campanula medium</i>	Canterbury Bells



Latin Name	Common Name
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BULBS

Rarely Damaged

<i>Allium sp.</i>	Ornamental Onion
<i>Colchicum sp.</i>	Autumn Crocus
<i>Endymion sp.</i>	Bluebell
<i>Eranthus hyemalis</i>	Winter Aconite
<i>Fritilaria imperialis</i>	Crown Imperial, Fritilia
<i>Galanthus nivalis</i>	Snowdrops
<i>Narcissus sp.</i>	Daffodil
<i>Scilla siberica</i>	Siberian Squill

Seldom Severely Damaged

<i>Camassia leichtlini</i>	Camassia
<i>Canna sp.</i>	Canna Lily
<i>Colocasia esculenta</i>	Elephant Ear
<i>Crocus sp.</i>	Crocus
<i>Gladiolus sp.</i>	Gladiolus
<i>Gloriosa superba</i>	Glory Lily
<i>Hyacinthus sp.</i>	Hyacinth
<i>Muscari sp.</i>	Grape Hyacinth
<i>Oxalis sp.</i>	Wood Sorrel
<i>Zantedeschia sp.</i>	Calla Lily

Occasionally Severely Damaged

<i>Caladium sp.</i>	Caladium
<i>Lilium sp.</i>	Garden Lily

Frequently Severely Damaged

<i>Tulip sp.</i>	Tulip
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FERNS

Rarely Damaged

<i>Athyrium goeringianum (nipponicum)</i>	Japanese Painted Fern
<i>Cyrtomium falcatum</i>	Holly Fern
<i>Dennstaedtia punctilobula</i>	Hayscented Fern
<i>Dryopteris marginalis</i>	Wood Fern
<i>Matteuccia struthiopteris</i>	Ostrich Fern
<i>Onoclea sensibilis</i>	Sensitive Fern
<i>Osmunda cinnamomea</i>	Cinnamon Fern
<i>Osmunda regalis</i>	Royal Fern
<i>Polystichum arcostichoides</i>	Christmas Fern
<i>Thelyptens noveboracensis</i>	New York Fern

GROUNDCOVERS

Rarely Damaged

<i>Aegopodium podagaria</i>	Bishop's Weed
<i>Ajuga reptans</i>	Bugleweed
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Convallaria majalis</i>	Lily of the Valley
<i>Epimedium sp.</i>	Barrenwort
<i>Galium odoratum (Asperula odorata)</i>	Sweet Woodruff
<i>Lamium sp.</i>	Spotted Deadnettle
<i>Pachysandra procumbens</i>	Allegheny Spurge
<i>Pachysandra terminalis</i>	Pachysandra

Latin Name	Common Name
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Seldom Severely Damaged

<i>Ceratostigma plumbaginoides</i>	Plumbago
<i>Gaultheria procumbens</i>	Creeping Wintergreen
<i>Liriope sp.</i>	Lilyturf
<i>Vinca major</i>	Large Periwinkle
<i>Vinca minor</i>	Periwinkle

Occasionally Severely Damaged

<i>Euonymus fortunei</i>	Wintercreeper
<i>Hedera helix</i>	English Ivy

ORNAMENTAL GRASSES

Rarely Damaged

<i>Acorus sp.</i>	Japanese Sweet Flag
<i>Andropogon sp.</i>	Big Bluestem
<i>Arrhenatherum elatius</i>	Variegated Oat Grass
<i>Arundo donax</i>	Giant Reed
<i>Calamagrostis sp.</i>	Feather Reed Grass
<i>Carex sp.</i>	Japanese Sedge
<i>Chasmanthium latifolium</i>	Northern Sea Oats
<i>Cortaderia selloana</i>	Pampus Grass
<i>Eragrostus curvula</i>	Weeping Love Grass
<i>Erianthus ravennae</i>	Ravenna Grass
<i>Fargesia sp.</i>	Clump Bamboo
<i>Festuca glauca</i>	Blue Fescue
<i>Hakonechloa macra</i>	Hakonechloa
<i>Helictotrichon sempervirens</i>	Blue Oat Grass
<i>Imperata cylindrica</i>	Japanese Blood Grass
<i>Juncus Effusus</i>	Hard Rush
<i>Koeleria glauca</i>	Large Blue June Grass
<i>Leymus arenarius glaucous</i>	Lyme Grass
<i>Miscanthus floridulis</i>	Giant Japanese Silver Grass
<i>Miscanthus sinensis</i>	Japanese Silver Grass
<i>Molinia caerulea</i>	Purple Moor Grass
<i>Molinia caerulea 'Variegata'</i>	Variegated Purple Moor Grass
<i>Panicum virgatum</i>	Switch Grass
<i>Pennisetum alopecuroides</i>	Fountain Grass
<i>Pennisetum orientale</i>	Oriental Fountain Grass
<i>Phyllostachys aurea</i>	Golden Bamboo
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Sorghastrum nutans</i>	Indian Grass

Seldom Severely Damaged

<i>Bambusa sp.</i>	Bamboo
<i>Carex pendula</i>	Drooping Sedge
<i>Hystrix patula</i>	Bottlebrush Grass
<i>Ophiopogon japonicus</i>	Dwarf Mondo Grass
<i>Phalaris arundinaceae</i>	Ribbon Grass
<i>Scirpus lacustris</i>	Sedge

PERENNIALS

Rarely Damaged

<i>Aconitum sp.</i>	Monkshood
<i>Agastache sp.</i>	Anise Hyssop
<i>Allium sp.</i>	Ornamental Onion
<i>Arabis caucasica</i>	Rock-Cress

Latin Name	Common Name
<i>Arisaema triphylum</i>	Jack-in-the-pulpit
<i>Armoracia rusticana</i>	Horseradish
<i>Artemisia dracunculus</i>	Tarragon
<i>Artemisia sp.</i>	Silver Mound
<i>Asarum canadense</i>	Wild Ginger
<i>Asarum europaeum</i>	European Ginger
<i>Aubretia deltoidea</i>	Purple Rock-Cress
<i>Aurinia saxatilis</i>	Basket of Gold
<i>Baptisia australis</i>	False Indigo
<i>Bruneria macrophylla</i> (Brunnera)	Siberian Bugloss
<i>Cactaceae sp.</i>	Cactus
<i>Coreopsis verticillata</i>	Threadleaf Coreopsis
<i>Corydalis sp.</i>	Corydalis
<i>Dicentra eximia</i>	Fringed Bleeding Heart
<i>Dicentra spectabilis</i>	Bleeding Heart
<i>Echinops ritro</i>	Small Globe Thistle
<i>Euphorbia sp.</i> (except 'Chameleon')	Spurge
<i>Helleborus sp.</i>	Lenton or Christmas Rose
<i>Hesperis matronalis</i>	Dame's Rocket
<i>Hyssopus officinalis</i>	Hyssop
<i>Iris sp.</i> (may eat buds)	Iris
<i>Lavandula sp.</i>	Lavendar
<i>Ligularia dentata</i>	Bigleaf Goldenray
<i>Ligularia 'The Rocket'</i>	Rocket Ligularia
<i>Limonium latifolium</i>	Statice
<i>Linaria vulgaris</i>	Butter & Eggs
<i>Lychnis coronaria</i>	Rose Campion
<i>Majorana</i>	Marjoram
<i>Marrubium vulgare</i>	Horehound
<i>Melissa officinalis</i>	Lemon Balm
<i>Mentha sp.</i>	Mint
<i>Myosotis sp.</i>	Forget-Me-Not
<i>Nepeta sp.</i>	Catmint
<i>Oreganum sp.</i>	Oregano
<i>Paeonia sp.</i> (may eat buds)	Peony
<i>Perovskio atriplicifolia</i>	Russian Sage
<i>Phlomis sp.</i>	Greek Jerusalem Sage
<i>Podophyllum</i>	May Apple
<i>Potentilla sp.</i>	Potentilla, Cinquefoil
<i>Pulmonaria sp.</i>	Lungwort
<i>Ranunculus sp.</i>	Buttercup
<i>Rodgersia sp.</i>	Rodgers Flower
<i>Ruta sp.</i>	Rue
<i>Salvia officinalis</i>	Garden Sage
<i>Santolina chamaecyparissus</i>	Lavender-Cotton
<i>Stachys byzantina</i>	Lamb's Ear
<i>Tanacetum vulgare</i>	Common Tansy
<i>Teucrium Chamaedrys</i>	Germander
<i>Thalictrum sp.</i>	Meadow Rue
<i>Thymus sp.</i>	Thyme
<i>Yucca filimentosa</i>	Yucca

Seldom Severely Damaged

<i>Achillea filipendulina</i>	Yarrow
<i>Achillea millefolium</i>	Common Yarrow
<i>Agapanthus sp.</i>	African Lily
<i>Alchemilla sp.</i>	Ladys' Mantle

Latin Name	Common Name
<i>Anchusa sp.</i>	Bugloss
<i>Anemone x hybrida</i>	Japanese Anemone
<i>Anemonella thalictroides</i>	Rue Anemone
<i>Aquilegia sp.</i>	Columbine
<i>Armeria maritima</i>	Sea Thrift
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Asclepias tuberosa</i>	Butterfly Weed
<i>Asparagus officinalis</i>	Asparagus
<i>Aster sp.</i>	Aster
<i>Astilbe sp.</i>	Astilbe
<i>Bergenia sp.</i>	Heartleaf Bergenia
<i>Boltonia asteroides</i>	White Boltonia
<i>Cerastium</i>	Snow-in-Summer
<i>Chrysanthemum parthenium</i>	Feverfew
<i>Cimicifuga sp.</i>	Snakeroot, Bugbane
<i>Coreopsis lanceolata</i>	Lance Coreopsis
<i>Croscosmia sp.</i>	Crococsmia
<i>Cyclamen sp.</i>	Cyclamen
<i>Delphinium sp.</i>	Delphinium
<i>Dianthus sp.</i>	Carnation, Pinks
<i>Dictamus alba</i>	Gas Plant
<i>Digitalis grandiflora</i>	Yellow Foxglove
<i>Echinacea purpurea</i>	Purple Coneflower
<i>Erythronium</i>	Trout Lily
<i>Eupatorium coelestinurn</i>	Mist Flower
<i>Eupatorium rugosum</i>	White Snakeroot
<i>Geranium macrorrhizum</i>	Hardy Geranium
<i>Gypsophila sp.</i>	Baby's Breath
<i>Helenium autumnale</i>	Sneezeweed
<i>Heuchera sp.</i>	Coralbell
<i>Hypericum calycinum</i>	St. John's Wort
<i>Iberis sempervirens</i>	Candytuft
<i>Kirengeshoma palmata</i>	Yellow Wax-Bells
<i>Kniphofia tritoma</i>	Red-Hot Poker
<i>Liatris sp.</i>	Blazing Star
<i>Lobelia sp.</i>	Cardinal Flower
<i>Lupinus sp.</i>	Lupine
<i>Lychnis chalconica</i>	Maltese Cross
<i>Macleaya cordata</i>	Plume Poppy
<i>Mertensia virginica</i>	Virginia Bluebells
<i>Monarda didyma</i>	Beebalm
<i>Papaver orientale</i>	Oriental Poppy
<i>Patrinia scabiosifolia</i>	Patrinia
<i>Physostegia sp.</i>	Obedient Plant
<i>Polemonium caeruleum</i>	Jacob's Ladder
<i>Primula sp.</i>	Primrose
<i>Rheum rhabarbarum</i>	Rhubarb
<i>Rudbeckia sp.</i>	Black-Eyed Susan
<i>Salvia nemorosa</i>	Meadow Sage
<i>Saponaria sp.</i>	Soapwort
<i>Satureja montana</i>	Savory
<i>Scabiosa caucasica</i>	Pincushin Flower
<i>Sempervivum sp.</i>	Hens and Chickens
<i>Solidago sp.</i>	Goldenrod
<i>Stokesia laevis</i>	Stokes' Aster
<i>Symplocarpos foetidus</i>	Skunk Cabbage
<i>Tiarella cordifolia</i>	Foam Flower
<i>Tradescantia sp.</i>	Spiderwort
<i>Tricyrtis hirta</i>	Toad Lily

Latin Name	Common Name
<i>Trillium sp.</i>	Trillium
<i>Verbascum sp.</i>	Mullein
<i>Veronica sp.</i>	Speedwell
<i>Viola sp.</i>	Violets

Occasionally Severely Damaged

<i>Alcea sp.</i>	Hollyhock
<i>Aruncus sp.</i>	Goat's Beard
<i>Begonia grandis</i>	Hardy Begonia
<i>Bellis perennis</i>	English Daisy
<i>Campanula glomerata</i>	Bellflower
<i>Centaurea montana</i>	Mountain Bluet
<i>Chelone sp.</i>	Pink Turtlehead
<i>Chrysanthemum</i>	Fall Mums
<i>Chrysanthemum superbum</i>	Shasta Daisy
<i>Erigeron sp.</i>	Fleabane
<i>Euphorbia dulcis</i> 'Chameleon'	Spurge
<i>Filipendula sp.</i>	Meadowsweet
<i>Gaillardia sp.</i>	Blanket Flower
<i>Geranium clarkei</i>	Hardy Geranium
<i>Geranium sanguineum</i>	Hardy Geranium
<i>Geranium x cantabrigiense</i>	Hardy Geranium
<i>Geum sp.</i>	Geum, Avens
<i>Hemerocallis sp.</i>	Daylily
<i>Hibiscus moscheutos</i>	Rose Mallow
<i>Leucanthemum maximum</i>	Shasta Daisy
<i>Lysimachia clethroides</i>	Gooseneck Loosestrife
<i>Lythrum sp.</i>	Purple Loosestrife
<i>Oenothera sp.</i>	Sundrops
<i>Penstemon sp.</i>	Penstemon
<i>Phlox sp.</i>	Phlox
<i>Platycodon grandiflorus</i>	Balloon Flower
<i>Polygonatum sp.</i>	Solomon's Seal
<i>Sedum spectabile</i>	Showy Sedum
<i>Sidalcia malviflora</i>	Checkermallow
<i>Symphytum officinale</i>	Comfrey
<i>Trollius sp.</i>	Globeflower

Frequently Severely Damaged

<i>Eryngium sp.</i>	Sea-Holly
<i>Fragraria sp.</i>	Strawberry
<i>Geranium endressii</i>	Hardy Geranium
<i>Hosta sp.</i>	Hosta
<i>Pardancanda x norrisii</i>	Candy Lily

SHRUBS

Rarely Damaged

<i>Aralia spinosa</i>	Devil's Walking Stick
<i>Berberis sp.</i>	Barberry
<i>Buddleia sp.</i>	Butterfly Bush
<i>Buxus sempervirens</i>	Common Boxwood
<i>Calliuna sp.</i>	Heather
<i>Caryopteris clandonensis</i>	Blue Mist Shrub
<i>Cephalotaxus harringtonia</i>	Japanese Plum Yew
<i>Cytisus sp.</i>	Broom
<i>Daphne sp.</i>	Daphne
<i>Elaeagnus angustifolia</i>	Russian Olive

Latin Name	Common Name
<i>Erica sp.</i>	Heath
<i>Ilex x 'John T. Morris'</i>	John T. Morris Holly
<i>Ilex x 'Lydia Morris'</i>	Lydia Morris Holly
<i>Juniperus horizontalis</i> 'Prince of Wales'	Prince of Wales Juniper
<i>Juniperus scopulorum</i> 'Moonglow'	Moonglow Juniper
<i>Leucothoe fontanesiana</i>	Drooping Leucothoe
<i>Mahonia aquifolium</i>	Oregon Grape Holly
<i>Mahonia bealei</i>	Leatherleaf Mahonia
<i>Microbiota decussata</i>	Russian Cypress
<i>Myrica pensylvanica</i>	Bayberry
<i>Pieris floribunda</i>	Mountain Pieris
<i>Pieris japonica</i>	Japanese Pieris, Andromeda
<i>Potentilla fruticosa</i>	Bush Cinquefoil
<i>Rhus aromatica</i>	Fragrant Sumac
<i>Sambucus racemosa</i>	Red Elderberry
<i>Sarcococca hookeriana</i>	Sweet Box
<i>Skimmia japonica</i>	Japanese Skimmia
<i>Viburnum dentatum</i>	Arrowwood Viburnum

Seldom Severely Damaged

<i>Abelia sp.</i>	Glossy Abelia
<i>Abies balsamea</i>	Dwarf Balsam Fir
<i>Andromeda polifolia</i>	Bog Rosemary
<i>Aronia arbutifolia</i>	Red Chokeberry
<i>Aucuba japonica</i>	Goldust Plant
<i>Callicarpa sp.</i>	Beautyberry
<i>Calycanthus floridus</i>	Common Sweetshrub
<i>Calycanthus occidentalis</i>	California Sweetshrub
<i>Chaenomeles japonica</i>	Japanese Flowering Quince
<i>Clerodendrum fargesii</i>	Harlequin Glorybower
<i>Clethra sp.</i>	Sweet Pepperbush
<i>Cornus alba</i>	Red Twigged Dogwood
<i>Cornus sericea</i>	Red Osier Dogwood
<i>Corylus sp.</i>	Hazelnut
<i>Cotinus coggygria</i>	Smokebush
<i>Cotoneaster apiculatus</i>	Cranberry Cotoneaster
<i>Cotoneaster congestus</i>	Pyrenees Cotoneaster
<i>Cotoneaster dammeri</i>	Bearberry Cotoneaster
<i>Cotoneaster horizontalis</i>	Rockspray Cotoneaster
<i>Cotoneaster salicifolius</i>	Willowleaf Cotoneaster
<i>Deutzia sp.</i>	Deutzia
<i>Elaeagnus umbellatus</i>	Autumn Olive
<i>Enkianthus campanulatus</i>	Redvein Enkianthus
<i>Forsythia x intermedia</i>	Forsythia
<i>Fothergilla sp.</i>	Fothergillia
<i>Halesia carolina</i>	Carolina Silverbell
<i>Hamamelis virginiana</i>	Common Witchhazel
<i>Hibiscus syriacus</i>	Rose of Sharon
<i>Hippophae rhamnoides</i>	Sea Buckthorn
<i>Hypericum prolificum</i>	St. John's Wort
<i>Ilex aquifolium</i>	English Holly
<i>Ilex cornuta</i>	Chinese Holly
<i>Ilex glabra</i>	Inkberry
<i>Ilex verticillata</i>	Winterberry Holly
<i>Itea virginica</i>	Virginia Sweetspire
<i>Juniperus chinensis</i> 'Armstrongii'	Armstrong Juniper

Latin Name	Common Name
<i>Juniperus chinensis</i> cv. *	Chinese Juniper
<i>Juniperus chinensis</i> 'Pfitzerana'	Pfitzer Juniper
<i>Juniperus horizontalis</i> cv. *	Creeping Juniper
<i>Juniperus horizontalis</i> 'Youngstown'	Youngstown Andorra Juniper
<i>Juniperus procumbens</i> 'Nana'	Japanese Garden Juniper
<i>Juniperus sabin</i> cv.	Savin/Tam Juniper
<i>Juniperus scopulorum</i> cv. *	Mountain Juniper
<i>Juniperus squamata</i> 'Blue Star'	Blue Star Juniper
<i>Juniperus squamata</i> cv. *	Singleseed Juniper
<i>Kerria japonica</i>	Japanese Kerria
<i>Kolkwitzia amabilis</i>	Beautybush
<i>Lagerstroemia indica</i>	Crape Myrtle
<i>Leucothoe axillaris</i>	Coast Leucothoe
<i>Ligustrum</i> sp.	Privet
<i>Lindera benzoin</i>	Spicebush
<i>Magnolia x soulangiana</i>	Saucer Magnolia
<i>Osmanthus heterophyllus</i>	Holly Osmanthus
<i>Philadelphus coronarius</i>	Sweet Mock Orange
<i>Pinus mugo</i>	Mugo Pine
<i>Prunus laurocerasus</i>	Cherry Laurel
<i>Pyracantha coccinea</i>	Firethorn
<i>Rhamnus</i> sp.	Buckthorn
<i>Ribes</i> sp.	Currant
<i>Rubus</i> sp.	Brambles
<i>Sambucus canadensis</i>	Blueberry Elder, Sweet Elder
<i>Spiraea japonica</i>	Japanese Spirea
<i>Spiraea prunifolia</i>	Bridalwreath Spirea
<i>Spiraea x bumalda</i>	Anthony Waterer Spirea
<i>Symphoricarpos albus</i>	Snowberry
<i>Symphoricarpos x chenaultii</i>	Coralberry
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Syringa vulgaris</i>	Common Lilac
<i>Viburnum carlesii</i>	Koreanspice Viburnum
<i>Viburnum opulus</i>	Cranberry Bush
<i>Viburnum plicatum tomentosum</i>	Doublefile Viburnum
<i>Viburnum prunifolium</i>	Blackhaw Viburnum
<i>Viburnum rhytidophyllum</i>	Leatherleaf Viburnum
<i>Viburnum x juddii</i>	Judd Viburnum
<i>Weigela florida</i>	Weigela

Occasionally Severely Damaged

<i>Cornus racemosa</i>	Panicled Dogwood
<i>Cornus sanguinea</i>	Bloodtwig Dogwood
<i>Corylopsis glabrescens</i>	Fragrant Winterhazel
<i>Euonymus alata</i>	Winged Euonymus
<i>Euonymus japonica</i>	Japanese Euonymus
<i>Hydrangea arborescens</i>	Smooth Hydrangea
<i>Hydrangea macrophylla</i>	Bigleaf Hydrangea
<i>Hydrangea paniculata</i>	Panicle Hydrangea
<i>Hydrangea quercifolia</i>	Oakleaf Hydrangea
<i>Ilex crenata</i>	Japanese Holly
<i>Ilex x meserveae</i>	Blue Holly
<i>Juniperus conferta</i>	Shore Juniper
<i>Kalmia latifolia</i>	Mountain Laurel
<i>Nandina</i> sp.	Heavenly Bamboo

Latin Name	Common Name
<i>Prunus x cistena</i>	Purple Leaf Sand Cherry
<i>Rhododendron carolinianum</i>	Carolina Rhododendron
<i>Rhododendron catawbiense</i>	Catawba Rhododendron
<i>Rhododendron maximum</i>	Rosebay Rhododendron
<i>Rhododendron</i> sp. *	Deciduous Azaleas
<i>Rosa multiflora</i>	Multiflora Rose
<i>Rosa rugosa</i>	Rugosa Rose
<i>Rosa x hybrid</i>	Hybrid Tea Rose
<i>Syringa villosa</i>	Late Lilac
<i>Syringa x chinensis</i>	Chinese Lilac
<i>Syringa x persica</i>	Persian Lilac
<i>Vaccinium corymbosum</i>	Highbush Blueberry

Frequently Severely Damaged

<i>Euonymus fortunei</i>	Wintercreeper
<i>Rhododendron penclymenoides</i>	Pinxterbloom Azalea
<i>Rhododendron</i> sp. *	Evergreen Azaleas
<i>Rhododendron</i> sp. *	Rhododendrons
<i>Taxus</i> sp.	Yews

TREES

Rarely Damaged

<i>Aesculus parviflora</i>	Bottlebrush Buckeye
<i>Albizia julibrissin</i>	Mimosa
<i>Asimina triloba</i>	Pawpaw
<i>Betula nigra</i>	River Birch
<i>Betula papyrifera</i>	Paper Birch
<i>Cercidiphyllum japonicum</i>	Katsura Tree
<i>Ilex opaca</i>	American Holly
<i>Picea glauca</i> 'Conica'	Dwarf Alberta Spruce
<i>Pinus resinosa</i>	Red Pine
<i>Pinus rigida</i>	Pitch Pine
<i>Pinus thunbergiana</i>	Japanese Black Pine

Seldom Severely Damaged

<i>Acer griseum</i>	Paperbark Maple
<i>Acer palmatum</i>	Japanese Maple
<i>Acer pensylvanicum</i>	Striped Maple
<i>Acer rubrum</i>	Red Maple
<i>Acer saccharum</i>	Sugar Maple
<i>Aesculus x carnea</i>	Ruby Horsechestnut
<i>Amelanchier arborea</i>	Downy Serviceberry
<i>Amelanchier canadensis</i>	Shadbush
<i>Amelanchier laevis</i>	Allegheny Serviceberry
<i>Betula albo-sinensis</i>	Chinese Paper Birch
<i>Betula jacquemontii</i>	Himalayan Birch
<i>Betula lutea</i>	Yellow Birch
<i>Betula pendula</i>	European White Birch
<i>Chaenomeles speciosa</i>	Common Flowering Quince
<i>Chamaecyparis pisifera</i>	Japanese Falsecypress
<i>Chionanthus retusus</i>	Chinese Fringe Tree
<i>Cornus kousa</i>	Kousa Dogwood
<i>Crataegus laevigata</i>	English Hawthorn
<i>Cryptomeria japonica</i>	Japanese Cedar
<i>Fagus sylvatica</i>	European Beech
<i>Fraxinus pennsylvanica</i>	Green Ash

*Check other rating categories to find additional species or cultivars of this genus.

Latin Name	Common Name
<i>Fraxinus excelsior</i>	European Ash
<i>Gleditsia triacanthos</i>	Honey Locust
<i>Ilex x aquipernyi</i>	Dragon Lady, San Jose Holly
<i>Juniperus virginiana</i>	Eastern Red Cedar
<i>Koelreuteria paniculata</i>	Goldenrain Tree
<i>Liriodendron tulipifera</i>	Tulip Tree
<i>Metasequoia glyptostroboides</i>	Dawn Redwood
<i>Oxydendrum arboreum</i>	Sourwood
<i>Picea abies</i>	Norway Spruce
<i>Picea glauca</i>	White Spruce
<i>Picea omorika</i>	Serbian Spruce
<i>Picea pungens</i>	Colorado Blue Spruce
<i>Pinus densiflora</i>	Japanese Red Pine
<i>Pinus nigra</i>	Austrian Pine
<i>Pinus strobus</i>	Eastern White Pine
<i>Pinus sylvestris</i>	Scotch Pine
<i>Prunus serrulata</i>	Japanese Flowering Cherry
<i>Pseudotsuga menziesii</i>	Douglas Fir
<i>Salix matsudana tortuosa</i>	Corkscrew Willow
<i>Sassafras albidum</i>	Common Sassafras

Occasionally Severely Damaged

<i>Abies balsamea</i>	Balsam Fir
<i>Abies concolor</i>	White Fir
<i>Abies fraseri</i>	Fraser Fir
<i>Acer platanoides</i>	Norway Maple
<i>Acer saccharinum</i>	Silver Maple
<i>Aesculus hippocastanum</i>	Common Horsechestnut
<i>Cedrus atlantica</i>	Atlas Cedar
<i>Cercis canadensis</i>	Eastern Redbud
<i>Chamaecyparis obtusa</i>	Hinoki Cypress
<i>Chamaecyparis thyoides</i>	Atlantic White Cedar
<i>Chionanthus virginicus</i>	White Fringe Tree
<i>Cornus alternifolia</i>	Alternate-Leaved Dogwood
<i>Cornus florida</i>	Flowering Dogwood
<i>Cornus mas</i>	Cornelian Cherry
<i>Cupressocyparis leyandii</i>	Leyland Cypress
<i>Ilex pernyi</i>	Pernyi Holly
<i>Ilex x 'Nellie R. Stevens'</i>	Nellie Stevens Holly
<i>Larix decidua</i>	European Larch
<i>Liquidambar styraciflua</i>	Sweetgum

Latin Name	Common Name
<i>Malus sp.</i>	Apples
<i>Prunus avium</i>	Sweet Cherry
<i>Pyrus calleryana</i>	Callery Pear
<i>Pyrus communis</i>	Common Pear
<i>Quercus alba</i>	White Oak
<i>Quercus prinus</i>	Chestnut Oak
<i>Quercus rubra</i>	Northern Red Oak
<i>Rhus typhina</i>	Staghorn Sumac
<i>Robinia pseudoacacia</i>	Black Locust
<i>Salix sp.*</i>	Willows
<i>Taxodium distichum</i>	Bald Cypress
<i>Thuja plicata</i>	Western Arborvitae
<i>Tilia americana</i>	Basswood
<i>Tilia cordata</i> 'Greenspire'	Greenspire Littleleaf Linden
<i>Tsuga canadensis</i>	Eastern Hemlock
<i>Tsuga caroliniana</i>	Carolina Hemlock

Frequently Severely Damaged

<i>Prunus sp.</i>	Plums
<i>Prunus sp.*</i>	Cherries
<i>Sorbus aucuparia</i>	European Mountain Ash
<i>Thuja occidentalis</i>	American Arborvitae

VINES

Seldom Severely Damaged

<i>Celastrus scandens</i>	American Bittersweet
<i>Jasminum nudiflorum</i>	Winter Jasmine
<i>Wisteria floribunda</i>	Wisteria

Occasionally Severely Damaged

<i>Campsis radicans</i>	Trumpet Creeper
<i>Clematis sp.</i>	Clematis
<i>Hedera helix</i>	English Ivy
<i>Hydrangea anomala petiolaris</i>	Climbing Hydrangea
<i>Lonicera x heckrottii</i>	Goldflame Honeysuckle
<i>Parthenocissus quinquefolia</i>	Virginia Creeper

Frequently Severely Damaged

<i>Euonymus fortunei</i>	Wintercreeper
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*Check other rating categories to find additional species or cultivars of this genus.

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RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY
NEW BRUNSWICK**

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Appendix B

Plants found on both invasive species and deer-resistant lists

Created in March 2004,³⁷ the Invasive Species Council (ISC) of New Jersey is still in its infancy and has not established a state-authorized invasive species list nor have any particular plant species been legally banned from landscape use, as in Massachusetts.³⁸ Nonetheless, invasive species pose a serious threat to a balanced ecosystem, hence the recent instituting of the ISC of New Jersey. The United States Department of Agriculture, National Invasive Species Information Center website offers links to various states' invasive species lists. Since New Jersey is without an official one, that website links to the Native Plant Society of New Jersey's invasive species list.³⁹ The following plants are cited on their invasive species list *and also* recommended for ornamental use on the Rutgers deer-resistant plant list. While these cross-referenced plants offer the value of being deer-resistant, their continued landscape use could worsen the imbalance in the ecosystem of New Jersey.

Botanical Name	Common Name	Deer-Resistant Rating
Achillea millefolium	Yarrow	Seldom Severely Damaged
Ajuga reptans	Common Bugleweed	Rarely Damaged
Albizia julibrissin	Mimosa	Rarely Damaged
Allium vineale	Field Garlic	Rarely Damaged
Arundinaria, Bambusa	Any Hardy Bamboo	Seldom Severely Damaged
Berberis thunbergii	Japanese Barberry	Rarely Damaged
Elaeagnus angustifolia	Russian Olive	Rarely Damaged
Dianthus armeria	Depford Pink	Seldom Severely Damaged
Hesperis matronalis	Dane's Rocket	Rarely Damaged
Lamium purpureum	Purple Dead Nettle	Rarely Damaged
Linaria vulgaris	Butter-and-Eggs	Rarely Damaged
Matricaria matricariodes	Pineapple Weed	Rarely Damaged
Mentha spicata	Spearmint	Rarely Damaged
Ranunculus acris	Common Buttercup	Rarely Damaged
R. bulbosus	Bulbous Buttercup	Rarely Damaged
R. ficaria	Lesser Celandine	Rarely Damaged
R. repens	Creeping Buttercup	Rarely Damaged
Verbascum thapsus	Common Mullein	Seldom Severely Damaged
V. blattaria	Moth Mullein	Seldom Severely Damaged
Wisteria floribunda	Wisteria	Seldom Severely Damaged

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