Chapter 8. Invasive Exotic Plants

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The title "Invasive Exotic Plants" may sound like the beginnings of a title for a cheap 1950s science fiction B-movie, but the ecological and economic harm that these plants cause is no work of fiction. About 1/3 of the thousands of plant species known to occur in the Northeast were introduced from some other country or region of the U.S. Most are benign and are enjoyed by many as landscape and garden plants. However, free from the diseases and organisms that keep a plant species in check in their land of origin, a select few have aggressively spread since their introduction and have become difficult to control. As a result, these invasive exotic plants have degraded our natural communities by out-competing native species for resources and have cost millions of dollars to control. Let's take a closer look at some of the invasive exotic plant species that are commonly found in early-successional habitats (both upland and wetland) and see why they tend to be invasive, what problems they cause, and how we might be able to control them.

The Invaders

Asiatic bittersweet

Also known as oriental bittersweet or round-leaved bittersweet, this species is a deciduous, woody, perennial vine with small, greenish flowers occurring in clusters along the stem. The showy yellow fruits with red seeds have made Asiatic bittersweet a popular plant for fall and winter floral arrangements. The plant is originally native to Japan, Korea, and China, but is now established in the U.S. from Maine, south to Louisiana, and west to the Great Plains.

A native bittersweet, American bittersweet, is also present in the Northeast. It is similar in appearance but its fruiting and flowering clusters occur at the ends of stems, while those of Asiatic bittersweet occur along the stem. Asiatic bittersweet can hybridize with native bittersweet and it has been suggested that the hybrids may outcompete the native species and may thus be helping to displace it.

Figure 1. Asiatic bittersweet vine in late summer (a) and late fall (b). Photos by John M. Randall, The Nature Conservancy (a) and John Lynch, The New England Wildflower Society (b).

Olive: Autumn and Russian

These nitrogen-fixing shrubs or small trees have oval- (autumn) or lance-shaped (Russian) leaves. The leaves of autumn olive are dark green above and silver below, while those of Russian olive are silvery green on both sides. Both species produce small, fragrant, light yellow flowers that produce numerous reddish to pink (autumn) and yellow (Russian) fruits that are typically smaller than a wild blueberry. The fruits will

persist into winter. The twigs of autumn olive are typically bronze colored, while those of Russian olive are typically silver. Both species are thorny. Autumn olive was introduced from China, Japan, and Korea, and is now well established from Maine, south to Florida, and west to the Great Plains. Russian olive was introduced from western Asia and Europe and now causes localized problems in many states of the eastern U.S., western plains, and the Rocky Mountains.

Figure 2. Leaves and flowers of autumn (a) and Russian (b) olive. Photos by Bill Byrne (a) and Paul Wray, Iowa State University, www.invasive.org (b).

Buckthorn: Common and glossy

These shrubs or small trees can attain 20 to 25 feet in height and ten inches in diameter. Their bark is grey to brown and is rough when mature. Common buckthorn often exhibits a spine at the tip of its branches. Leaves of both species resemble that of a dogwood, but leaf veins aren't as parallel in formation. Common buckthorn leaves are toothed, while glossy buckthorn leaves have a smooth edge. Fruits are numerous, small, black, and up to 1/4 inch in diameter. When mature, common buckthorn may resemble an abandoned apple, plum, or other domestic fruiting tree from a distance. Native to Eurasia, the buckthorns are now common throughout the northeastern and north central third of the country. A native species, alder-leaved buckthorn, does occur in the Northeast. However, it is a low shrub generally less than three feet tall.

Figure 3. Branch of common (a) and glossy (b) buckthorn. Photos by Paul Wray, Iowa State University, www.invasive.org (a) and Chris Mattrick, The New England Wildflower Society.

Bush honeysuckle: Amur, Morrow's, and Tartarian

Bush honeysuckles are deciduous shrubs with one- to two and one half-inch untoothed leaves, and flowers that range from off-white to pink or crimson and produce numerous red to orange berries. Careful identification is needed because exotic bush honeysuckles can easily be confused with the native bush honeysuckles (swamp

fly honeysuckle and American fly honeysuckle), although the native species are typically much smaller and occur exclusively in wooded areas. Exotic bush honeysuckles are native to Japan, China, Korea, Manchuria, Turkey, and southern Russia, but now occur in the U.S. from southern New England, south to Georgia, and west to the Great Plains.

Figure 4. Flowers of Tartarian honeysuckle. Photo by John M. Randall, The Nature Conservancy.

Figure 5. Japanese barberry. Photo by Leslie J. Mehrhoff, University of Connecticut.

Barberry: Japanese and European

Barberry shrubs are generally two to three feet high but can grow as high as six feet. Japanese barberry has smooth-edged, oval leaves typically with a single spine behind each cluster. European barberry is similar but has leaves with toothed edges and multi-parted spines. The bright red berries of both species are small, oblong and found singly or in clusters. Native to Europe and Japan, these species are now found in this country from Maine, south to North Carolina, and west to Montana.

Figure 6. Multiflora rose bush (a) and closeup of flowers (b). Photos by James D. Oehler (a) and James H. Miller, USDA Forest Service, www.invasive.org.

Multiflora rose

Multiflora rose is a perennial shrub with a fountain-shaped drooping appearance and leaves with seven to nine toothed leaflets. Like all roses, the stems of multiflora rose bushes are adorned with stiff thorns. In late spring, small white to pinkish fragrant flowers will form in clusters. In late summer and early fall, flowers will form small, bright red, oval, and fleshy rose hips. Multiflora rose was introduced to the east coast from Japan and Korea as a rootstock for cultivated roses. It was also widely promoted by the U.S. Department of Agriculture to farmers in many parts of the country for "wildlife cover plantings". It is now present throughout the U.S. with the exception of the Rocky Mountains, the Southeastern Coastal Plains, and the Nevada and California deserts.

Tree-of-heaven

Also known as Ailanthus, tree-of-heaven is a deciduous tree with smooth gray bark that can attain heights of 27 to 54 feet. Leaves have 11 to 25 leaflets that are coarsely toothed only at the base. Leaves can be easily confused with those of black walnut and sumac. However, unlike those species, tree-of-heaven leaves will produce an offensive odor when crushed. The leaves also form a heart-shaped scar on the branch. Yellow-green flowers occur in clusters near the tips of branches in late spring, with maple-tree-like winged seeds forming thereafter. However, unlike maple, the seeds of tree-of-heaven have a single wing. This tree is native to China, but was introduced into this country as a hardy ornamental and is now found throughout the U.S.

Figure 7. Tree-of-heaven (a) and closeup of leaves with centrally located flower (b). Photos by Chuck Bargeron, The University of Georgia, www.invasive.org (a) and John M. Randall, The Nature Conservancy (b).

Sericea lespedeza

Sericea lespedeza, also known as Chinese bush clover, silky bushclover, Himalayan bushclover and hairy bushclover, is a bushy, warm-season perennial legume with a deep taproot that is native to Asia. Flowers of sericea lespedeza are creamy-white with purple throats, and when mature, plants have numerous tall, coarse stems that grow in bunches. Each leaflet of this lespedeza contains dense hairs that give the plant a grayish-green or silvery appearance. It is the only species of lespedeza that has wedge-shaped leaf bases. Sericea lespedeza was introduced in the 1940s for its value as an agriculture crop and for erosion control projects. Today, it is commonly found in grasslands and rangelands in the Midwest and eastern U.S. where it commonly dominates and displaces native vegetation.

Purple loosestrife

Purple loosestrife is a stout perennial herb with a well-developed taproot that occurs in marshes, wet meadows, and shrub swamps with little or no overhead cover. Plants range from one and one half to six feet in height. Stems are angular and can be fuzzy or hairy. Purple, white, or light pink flowers form in a spike at the top of the plant and produce small seeds in light brown capsules. Purple loosestrife will commonly take over entire wetland systems. Native to Europe and Asia, it is now found throughout the U.S., but is most problematic in the Northeast.

Figure 8. Purple loosestrife plants (a) and closeup of flowers (b). Photos by Bernd Blossey, Cornell University, www.invasive.org (a) and Norman E. Rees, USDA ARS, www.invasive.org (b).

Common reed

Commonly known as Phragmites, common reed is a 6- to 12-foot high perennial grass that occurs in marshes, fens, shrub swamps and other types of vegetated fresh and brackish water wetland systems with little or no overhead cover. Its purplish flowers form feathery plumes of whitish or brownish seeds at the top of each stem. It reproduces by seed or more commonly via spreading root systems known as rhizomes. Common reed occurs on every continent except Antarctica. A recent study indicates that both native and invasive exotic strains occur in the U.S. The invasive strain was introduced from Europe and Asia and is now widespread.

Figure 9. A stand of common reed. Photo by John M. Randall, The Nature Conservancy.

What's the big deal?

Why are all of these species considered invasive? For one, they all produce prolific amounts of seed or fruit. For instance, a single 12-inch diameter tree-of-heaven can produce 1 million seeds in one year. An autumn olive tree can produce two to eight pounds of seed per year with 20,000-54,000 seeds per pound. Lastly, a purple loosestrife plant can produce up to 900 capsules per year with an average of 120 seeds per capsule.

Once seeds and fruits are formed, they are widely dispersed by a variety of means. Small mammals and birds carry some types of seeds in their fur or feathers to new locations, or defecate a viable seed after consuming a piece of fruit. The next time you go for a walk in an old field, pay attention to where invasive exotic plants are growing. You will commonly find them growing along fence lines and field edges or at the base of trees in the middle of fields because these are the places where birds like to perch. Wind also effectively disperses seeds of common reed, tree-of-heaven, and purple loosestrife because the seeds are either very lightweight or are contained in a winged sheath that is easily carried by the wind. Humans are great dispersers of invasive exotic plant seed as well. Most of the species listed above are still widely available from nurseries and are desired for their use as ornamentals, in erosion control projects, in floral arrangements, or planted as a source of food and cover for wildlife.

Many of these species are also effective at reproducing vegetatively. Asiatic bittersweet, tree-of-heaven, and common reed have massive root systems that will aggressively spread out and push up new plant shoots, which aids these plants in creating dense monocultures. Additionally, the branch tips of multiflora rose and the two species of barberry will take root when branches droop to the ground.

All of these species can outcompete native species for resources even in areas that seemingly have few resources to offer. Many can survive and even proliferate in soils ranging from nutrient rich to nutrient poor, from acid to alkaline, and can tolerate a wide variety of light conditions. Most of the invasive exotic shrubs and trees will be among the first plants to leaf-out and the last to lose their leaves in the fall. Some can even alter soil chemistry, making the area uninhabitable by other species. Japanese barberry appears to be such a species. Areas that I know to be dominated by Japanese barberry have few if any plants growing underneath. Research has shown that even when Japanese barberry is controlled, herbs and woody seedlings are slow to recolonize. Additionally, because of their nitrogen-fixing capabilities, autumn and Russian olive have the capacity to sharply increase soil nitrogen levels, putting many native species at a disadvantage favoring invaders.

Once these species become well established, they can have a tremendous impact on the native plants and animals in the invaded area. Dense stands of common reed and purple loosestrife will result in fewer numbers of small mammals and birds, especially waterfowl as common reed displaces more desired foraging plants. Common reed was threatening to take over a rare fen community in Massachusetts, home to more than 20 state threatened and endangered species, before The Nature Conservancy and Massachusetts Division of Fisheries & Wildlife teamed up to control the species at that site.

Other species cause problems as well. During fall migration, songbirds require a great deal of energy to complete their long treks south. Many native shrubs (especially dogwoods) produce high-quality fruits with plenty of fat to maintain songbird energy levels. In contrast, many invasive exotic plants including common buckthorn, Japanese barberry, multiflora rose, and Asiatic bittersweet, are nutrient poor and alone probably would not be able to support the energy needs of migrating songbirds.

Additionally, Asiatic bittersweet will twine and climb on top of trees and shrubs, effectively shading them out. Bush honeysuckle and both buckthorn species will inhibit forest regeneration and reduce the variety and cover of herb communities. It is not uncommon for annual herbs to be entirely suppressed by these plants. Multiflora rose will also displace native vegetation and cattle are often reluctant to enter fields dominated by this plant.

What to do

Now that you have learned a little about these plants and the damage that they can cause, it's time to take a walk around your property to see if you have any of them growing on your land. If you do, determine the extent of the invasion on your property and on adjacent properties (remember invasive exotic plants can easily spread across boundaries). Then, consider the following questions:

- Is the species currently having or likely to have a negative impact on the resources that you want to promote?
- Is it feasible to control the species?
- If it appears feasible to control the species, how should it be done?

Regardless of any other actions that are taken, landowners/managers should be diligent in identifying and preventing new invasions. A few new seedlings may be easily pulled by hand, but if allowed to proliferate they may form a dense stand that is difficult and costly to control. When managing a property with invasive exotics on or near it, use techniques that won't worsen the invasion. Many invasive exotic plant species will thrive in areas where other vegetation has been damaged or destroyed and soils have been disturbed or exposed. For instance, reclaiming an old field with a bulldozer can create a perfect bed for seeds of invasive exotic plants that are picked up and inadvertently spread by the machine. The numerous root segments that are left behind in the soil also will likely resprout, producing many more shrubs than were present at the start. When planning a timber harvest it is better to address an invasive exotic plant problem in a stand prior to harvest. Many invasive exotics will respond favorably to the added sunlight that a timber harvest provides, taking advantage of it more quickly than more desirable native species can. Like the bulldozer scenario, harvesting equipment can also expose soil and effectively disperse seed. It is often necessary to delay management plans for an area until invasive exotic plant control efforts are well underway. Otherwise you may be contending with them for years, to the detriment of other management goals and objectives.

If you determine that the invasive exotic plant is not and will not adversely affect the resources that you want to promote, continue to monitor the plant annually (it could take a number of years for impacts to be realized). If the plant is having or going to have a negative impact, then determine if it is feasible to control the plant given the extent of the invasion, available control techniques, and associated costs.

There are a number of techniques to control invasive exotic plants, which can be grouped into two general categories: manual and chemical. Manual techniques include pulling, cutting/mowing, and other techniques that physically damage plants. Manual techniques can minimize damage to desirable plants and animals in many situations, but they are generally labor and time intensive compared to chemical techniques, and therefore can be much more costly. Manual techniques can also cause a great deal of site and soil disturbance, creating seedbeds for further invasions. As such, manual techniques are generally limited to use against small infestations, which can be easily monitored and controlled. When using manual methods, it is especially important to thoroughly clean and inspect all equipment when finished. This will lessen the probability of spreading the invasive plant elsewhere. Let's take a closer look at some of the more commonly used manual control methods for the types of invasive exotic plants addressed in this chapter.

Manual control techniques

Weed pulling

Pulling by hand or using a pulling tool such as the Root Talon® or Weed Wrench® is an effective means of controlling shrub/tree seedlings and saplings (Table 1). Pulling is not as effective on plants with taproots (e.g., sericea lespedeza) or mature root systems, since root segments that are left in the ground will often resprout. When using this technique, try to minimize soil disturbance by pulling out weeds slowly and carefully, and replace soil in disturbed areas where possible. Trampled and disturbed areas can provide optimal germination sites for many weeds. For more information on the Root Talon® and Weed Wrench® contact:

- Root Talon®: Lampe Design, LLC, 262 South Griggs Street, St. Paul, MN 55105, (612) 699-4963.
- Weed Wrench®: New Tribe, P.O. Box 638, Grants Pass, OR 97528, (541) 476-9492, www.canonbal.org/weed.html.

Figure 10. A Weed wrench can be an effective means of controlling shrub/tree seedlings and saplings. Illustration reproduced with permission from Brooklyn Botanic Garden.

Mowing, cutting, and weed-eating

Mowing and cutting can reduce seed production and restrict growth for many species, but won't totally control an invading plant (Table 1). To be most effective, mowing should be done two to six times per season over numerous years. For some species, like Asiatic bittersweet, vigorous resprouting will occur after cutting, and may ultimately result in increasing the abundance of the invader. Mowing and cutting are often used in conjunction with herbicide applications. For example, vegetation that is too tall to safely treat with herbicides is cut or mowed, after which herbicides are applied to resprouts.

Girdling

Girdling can be an effective means of controlling individual trees (Table 1). This technique involves cutting away a strip of bark at least two inches wide around the circumference of the trunk (some fast growing species can actually "heal" over a girdle that is narrower) with an axe, knife, or saw. The cut must be deep enough to remove the cambium, or inner bark, which is the lifeline of the tree. Girdling typically requires less labor than cutting and removing the tree, is inexpensive, kills only the targeted plant, and provides valuable wildlife habitat in the form of snags. Because it will resprout vigorously, girdling should not be used to control tree-of-heaven unless accompanied by a spray application of 100% triclopyr herbicide to the cut (see herbiciding section of chapter 10).

Tilling

Tilling is often used to control weeds in agricultural situations, but may also have a place in old-field habitats where the soils have already been disturbed. Tilling is effective against annuals and shallow-rooted perennials, but root fragments of species with dense root systems (e.g., Asiatic bittersweet, tree-of-heaven) can often resprout following tillage. If attempted, tilling should be at a depth of 6 to 24 inches, and completed before seeds develop and shed onto the soil. It is best to use this technique during dry periods or in well-drained soils so root segments won't survive and grow. This technique has not been used widely, so any successes or failures should be widely shared with other land managers.

Flooding

If the water level of a wetland or riverine system can be manipulated, flooding can be used to control some of the plant species listed above (Table 1). Common buckthorn seedlings in particular have been successfully killed with flooding. Additionally, common reed patches are often reduced when tidal flows are restored in salt marsh areas. Check with local and state wetland authorities before implementing this technique to see if any wetland regulations apply.

Biocontrol techniques

Biocontrol agents have also been successful at controlling the spread and reducing the deleterious effects of many unwanted plants. Biocontrol pertains to the use of organisms to feed upon, parasitize, or otherwise interfere with a targeted pest species. Although often viewed as an environmentally friendly approach to controlling invasive exotic plants and other unwanted pests, some biocontrol agents have been documented as causing irreparable harm to non-target organisms. For instance, a weevil introduced in the 1960s to control non-native thistles has been documented attacking and significantly reducing the reproduction of native thistles. On the other hand, the benefits of using biocontrol include the potential for attacking specific plants (if adequately researched and documented prior to introduction) and the ability to act over huge areas with little or no cost.

With regards to the invasive exotic plants addressed in this chapter, biocontrol agents have been tested and proven successful at reducing above ground biomass of purple loosestrife. Since the early 1990s, four species of *Galerucella* beetles have been introduced to attack purple loosestrife in the U.S. and Canada. Introductions of these beetles in Ontario led to a 200-fold reduction in above ground biomass of purple loosestrife. However, it is not yet clear whether or not the beetles also reduce the root biomass of established loosestrife stands. As with any management technique, the pros and cons of using biocontrol methods to control invasive exotic plants must be carefully researched and weighed prior to implementation.

Figure 11. Golden loosestrife beetles (Galerucella pusilla) and other Galerucella species can reduce above ground biomass of purple loosestrife. However, it is not yet clear whether or not the beetles also reduce the root biomass of established loosestrife stands. Photo by Agriculture and Agri-Food Canada Archives, Agriculture and Agri-Food Canada, www.invasive.org.

Chemical control techniques

All of these tools and techniques have their place in the invasive exotic plant control tool belt. However, when dealing with large invasions, manual techniques become less practical and except for purple loosestrife, biocontrol techniques currently are not an option. In these cases chemical techniques typically are used. Chemical techniques involve the use of herbicides either alone or in combination with manual techniques (e.g., cutting a stem and then dabbing herbicide on the cut surface). Even though the use of herbicides can be efficient and cost effective (if hiring someone to do the work), a land owner/manager should be confident that herbiciding will do more good than harm and not endanger the health of the applicators or others in the area. For more information on using herbicides to control invasive exotics and other plants, refer to the herbiciding section of chapter 10 in this management guide. There you will find guidance on what you should consider prior to using herbicides, which herbicides may be the best to use given your situation, the techniques used to apply them, and associated costs.

After reading all of the manual and chemical control information provided here, you may determine that it is not feasible to control the species at present. The reasons for this are probably one or a combination of the following:

- Controlling the plant is cost-prohibitive. If this is the case, you may still have some options. One option is to look into cost-share programs such as the Wildlife Habitat Incentives Program or the

Forest Land Enhancement Program (see chapter 12). In some states, these programs will provide financial assistance to landowners to control invasive exotic plants. A second option may be to enroll your neighbors into the project. They are likely having the same problems with invasive exotic plants, but may not know it. The cost per acre may decrease substantially if additional acres are added to the scope of the project. At the very least, keep abreast of new developments on the invasive exotic plant control front. New techniques may be developed that are more cost effective.

- There is concern about using herbicides. The decision whether to use herbicides should not be taken lightly by any land owner/manager. The use of the wrong chemical in the wrong situation can indeed have negative impacts. Unfortunately, invasive exotic plants can and do have tremendous negative impacts on our natural resources as well. The key is deciding whether the benefits of controlling the invasive plants outweigh the potential negative impacts of herbicide or other treatment methods (or combination of methods) under consideration. The only way to determine this is to become educated on all aspects of the issue. Hopefully this chapter and the herbiciding section of chapter 10 will help in this regard.

Many invasive, exotic plant species not discussed in this chapter can be found in our fields, forests, and wetlands. Those described here are some of the more commonly observed species in the early-successional habitats of our region. Many states maintain invasive exotic plant lists. To find out what other plants are considered invasive in your area, contact your state's Natural Heritage Program (http://www.natureserve.org/visitLocal/usa.jsp).

Suggested reading

Invasive and Exotic Species of North America (images and links to other publications) http://www.invasive.org/

Invasive Plant Atlas of New England (information on invasive exotic plant distributions in New England, life history information, and images) http://invasives.eeb.uconn.edu/ipane/

Native Plant Conservation Initiative, Exotic Plant Working Group (invasive exotic plant fact sheets) http://www.nps.gov/plants/alien

The Nature Conservancy, Weed Control Methods Handbook (detailed information on controlling invasive exotic plants) http://tncweeds.ucdavis.edu/handbook.html

Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants http://www.dnr.state.wi.us/org/land/er/invasive/manual_toc.htm

Biography

Jim Oehler has a B.S. in Wildlife Management from the University of Wisconsin – Stevens Point, and an M.S. in Wildlife Ecology from the University of New Hampshire. Prior to joining the New Hampshire Fish & Game Department in January 2003, Jim spent five years with the Massachusetts Division of Fisheries & Wildlife reclaiming and maintaining early-successional habitats and controlling the invasive exotic plants commonly found in those habitats.

Table 1. Invasive exotic plants commonly found in early-successional habitats and the manual techniques known to be effective against them.

Plant Name	Pulling[a]	Cutting/Mowing	Girdling	Flooding[b]
Asiatic bittersweet	Yes	--	--	Yes
Barberry	Yes	Mow 3-6x/yr for 3-5 yrs	--	Yes
Buckthorn	Yes	Mow 3-6x/yr for 3-5 yrs	Yes	Yes
Bush honeysuckle	Yes	Mow 3-6x/yr for 3-5 yrs	--	--
Common reed	Yes	--	--	Restore tidal flow or flood in 3 feet of water for a prolonged period.
Multiflora rose	Yes	Mow 3-6x/yr for 3-5 yrs	--	Yes
Olive	Yes	--	--	Yes
Serecia lespedeza	No	Mow 1-2x/yr for at least 3 yrs	--	--
Purple loosestrife	Yes	--	--	--
Tree-of-heaven	Yes	--	--	Yes

[a] Mostly those plants with undeveloped root systems (e.g., seedlings and saplings). Pulling is either by hand or with a Weed Wrench or similar tool. Care must be taken to remove all of the roots as fragments commonly resprout.
[b] Check with local and state authorities to determine if any wetland regulations apply prior to implementing this technique.