

Long Term Operation & Management Plan

Invasive Plant Species Control Plan



Prepared for:

The Town of Boxford
Haynes Land Committee

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Long Term Operation and Maintenance Plan

Haynes Land Athletic Fields | Middle Street | Boxford Massachusetts

1 INITIAL INVENTORY OF MATERIAL TO BE REMOVED

- 1.1 The first task to be completed within the treatment areas will be to inventory the existing conditions of the treatment areas and assess what invasive species are scheduled to be removed from the site.
- 1.2 Invasive species of concern at the Haynes Land site include:
 - 1.2.1 Glossy Buckthorn (*Rhamnus frangula*)
 - 1.2.2 Multiflora Rose (*Rosa multiflora*)
 - 1.2.3 Asiatic Bittersweet (*Celastrus orbiculatus*)
 - 1.2.4 Burning Bush (*Euonymus alatus*)
 - 1.2.5 Japanese Barberry (*Berberis thunbergii*)
 - 1.2.6 Honeysuckle (*Lonicera* spp.)
- 1.3 Information sheets for each species attached.

2 REMOVAL OF INVASIVE PLANT MATERIAL FROM TREATMENT AREA

- 2.1 Using Whole Plant Removal techniques, the entire plant will be removed from the ground. Slow removal of standing, aboveground material will be cut and chipped on site or removed for composting.
- 2.2 Roots of wood plants are to be removed carefully, and will slow, extraction methods typically a mini-excavator with opposable "thumb" attachment.
- 2.3 Once roots are removed, hand tools are used to remove any broken roots by hand by a thorough inspection of the treated area is made to insure the maximum removal of broken roots and twig material is advanced.

3 SOIL AUGMENTATION | ENHANCEMENT

- 3.1 Inspection of the existing soil composition and condition will be made by an appropriately credentialed horticulturalist/soil scientist to assess condition of soils for plantings.
- 3.2 Representative samples of soils within each treatment area will be collected and forwarded to the state extension laboratory for primary nutrient analysis to determine the condition of the soil. Testing of soil within the treatment area can be made prior to the removal of invasive plantings.

- 3.3 Amendments to the soil condition will be made based on the recommendations of the horticulturalist/soil scientist and their interpretation of the soil testing results for each treatment area.
- 3.4 Augmentation and enhancement of the soil structure and condition will be made, as needed, prior to stabilization (see Section 5.0, below). However, should augmentation require addition time to coordinate, then the treatment areas can be immediately seeded and mulched to stabilize the disturbed soils with a cover crop or winter rye which can be plowed under and used as a green fertilizer for the treated area.

4 STABILIZATION OF TREATMENT AREA

- 4.1 The treatment area is then seeded and hay mulched immediately to stabilize the area from erosive forces.
- 4.2 The treatment areas should be seeded with a drought tolerate, native grass seed mix at approximately 4 to 5 times the normal application rate to insure a dominant native plant community within the disturbed area. A shade or sun tolerant seed mix should be used where conditions dictate. A mixture of all three (3) seed mixes can also be used in areas where conditions vary.
- 4.3 Salt hay should be hand cast over the area to establish protection over the newly seeded areas and to act as a velocity attenuation system to reduce rilling and erosive forces of rain and/or snow and ice melt.
- 4.4 Seeded areas should be watered as needed during the two year grow in period.
- 4.5 Plantings of native ground cover, shrub and canopy species can occur over the treated areas during the two year grow in period.

5 NATIVE PLANT INSTALLATIONS

- 5.1 Plantings of native material according to the planting plans are to be made soon after but not exceeding two weeks from the time of plant removal.
- 5.2 All plant material will be sourced from local nurseries and include native plant species.
- 5.3 Plantings to follow planting plans and plant lists detailed in the Order of Conditions.
- 5.4 Planted material to be irrigated as needed during the two year grow in period.
- 5.5 Appropriate deer protection including caging of small trees and shrubs, wrapping of larger tree specimens, and fencing if necessary. Deer protection measures are to be kept in well maintained and functioning condition during the two year grown in period or until it is determined by the environmental monitor and the Commission that the plant material is adequately established to survive deer impacts.

6 *LONG TERM MONITORING AND AFTERCARE*

- 6.1 Routine surveys of each of the treatment areas will occur on a monthly basis during the first six months after initial removal of the invasive species material.
- 6.2 Inspections will be focused on removal of new invasive material principally starting from seed sprouts remaining from the plant extraction process.
- 6.3 Seedlings should be handpicked and placed in plastic bags or use 5 gallon plastic buckets to contain the material. Harvested material should be either composted or burned according to local fire department rules and regulations.
- 6.4 Routine surveys and harvests of invasive species should be made on a monthly basis for the first 6 months, post removal and quarterly thereafter until such time that the environmental monitor is confident that invasive species are controlled and new invasions are limited.
- 6.5 Annual inspections should then follow for the remainder of the 5 year monitoring period following the same harvesting protocol as in the initial inspection process.

Rosa multiflora -- Multiflora rose

NH Prohibited Invasive Species List



Description: Multiflora rose is a thorny, perennial shrub with arching stems (canes), and leaves divided into five to eleven sharply toothed leaflets. The base of each leaf stalk bears a pair of fringed bracts. Beginning in May or June, clusters of showy, fragrant, white to pink flowers appear, each about an inch across. Small bright red fruits, or rose hips, develop during the summer, becoming leathery, and remain on the plant through the winter.



Habitat: Multiflora rose has a wide tolerance for various soil, moisture, and light conditions. It occurs in dense woods, prairies, along stream banks and roadsides and in open fields and pastures.

Distribution: Multiflora rose occurs throughout the U.S., with the exception of the Rocky Mountains, the southeastern Coastal Plain and the deserts of California and Nevada. It was introduced to the East Coast from Japan in 1866 as rootstock for ornamental roses. Beginning in the 1930s, the U.S. Soil Conservation Service promoted it for use in erosion control and as "living fences" to confine livestock. State conservation departments soon discovered value in multiflora rose as wildlife cover for pheasant, bobwhite quail, and cottontail rabbit and as food for songbirds and encouraged its use by distributing rooted cuttings to landowners free of charge. More recently, multiflora rose has been planted in highway median strips to serve as crash barriers and to reduce automobile headlight glare. Its tenacious and unstoppable growth habit was eventually recognized as a problem on pastures and unplowed lands, where it disrupted cattle grazing. Multiflora rose reproduces by seed and by forming new plants that root from the tips of arching canes that contact the ground. Fruits are readily sought after by birds which are the primary dispersers of its seed. It has been estimated that an average multiflora rose plant may produce a million seeds per year, which may remain viable in the soil for up to twenty years.

Similar Species: Multiflora rose can be distinguished from native roses by the presence of a feathery or comb-like margin on the narrow stipules (a green, leaf like structure found at the base of each leaf stalk). Native rose species all have stipules at the base of the leaf stalk, but their stipules do not have feathery margins. Multiflora rose can also be distinguished from most native roses by the fact that its styles are fused together into a column.

Threats: Multiflora rose is extremely prolific and can form impenetrable thickets that exclude native plant species. This exotic rose readily invades open woodlands, forest edges, successional fields, savannas and prairies that have been subjected to land disturbance.

Control: Frequent, repeated cutting or mowing at the rate of three to six times per growing season, for two to four years, has been shown to be effective in achieving high mortality of multiflora rose. In high

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quality natural communities, cutting of individual plants is preferred to site mowing to minimize habitat disturbance. Glyphosate herbicide can successfully reduce the size of particularly large patches of multiflora rose, especially if applied in the spring. One application can control the patch pretty well initially and provide a great deal of control one year later. Careful monitoring and touch-up treatments may be necessary, especially because of the long-lived stores of seed in the soil. Application of systemic herbicides (e.g., glyphosate) to freshly cut stumps or to regrowth may be the most effective methods, especially if conducted late in the growing season. Plant growth regulators have been used to control the spread of multiflora rose by preventing fruit set. There is also a plant-feeding wasp (*M. aculeatus*) that has been used in some places in the United States as a means of biological control. The specifics of this method of treatment are complex, but it is successful because the wasp larvae develop inside the seed of the multiflora rose and then mature around June or July, at which time they then consume the entire plant seed. As with any means of biological control, careful research is necessary before this method can be assumed to be biologically safe.

Alternatives: *Rosa setigera* (Climbing Prairie Rose).

LINKS: http://www.chicagobotanic.org/research/conservation/invasive/rosa_multiflora.html
<http://www.newfs.org/conserve/docs/invall2.pdf>
<http://www.invasive.org>
<http://www.lastgreatplaces.org/berkshire/issues/art6403.html>



Lonicera japonica -- Japanese honeysuckle

NH Prohibited Invasive Species List



Description: Japanese honeysuckle is a perennial vine reaching from 15 to 30 feet that climbs by twisting its stems around vertical structures, including limbs and trunks of shrubs and small trees. Leaves are opposite, simple, evergreen, semi-evergreen to deciduous, ovate to oblong-ovate, sometimes lobed, have short stalks, and occur in pairs along the stem, 1.25 to 3.25 inches long, one half as wide, acute to short-acuminate, rounded to subcordate at base, entire, dark green to lustrous dark green, pubescent on both sides when young, later glabrate above; petiole—0.25 inches long. In colder northern climates, the leaves may fall off after exposure to prolonged winter temperatures. Flowers are tubular, with five fused petals, white to pink, turning yellow with age, very fragrant, and occur in pairs along the stem at leaf junctures. Japanese honeysuckle blooms from late April through July and sometimes into October. Stems and leaves are sometimes covered with fine, soft hairs. Small black fruits are produced in autumn, each containing 2-3 oval to oblong, dark brown seeds about 0.25 inches across. Buds: are small, solitary, covered with 2 pubescent scales, superposed and sessile. Stem: Reddish brown to light brown, covered with soft pubescence, twining; pith the stem is excavated and generally hollow.

Habitat: A ubiquitous invader, Japanese honeysuckle thrives in a wide variety of habitats including fields, forests, wetlands, barrens, and all types of disturbed lands.

Distribution: *Lonicera Japonica* originated in Japan and Korea. Japanese honeysuckle occurs across the southern U.S. from California to New England and the Great Lakes region. Escaped populations also occur in Hawaii. Growth and spread of Japanese honeysuckle is through vegetative (plant growth) and sexual (seed) means. It produces long vegetative runners that develop roots where stem and leaf junctions (nodes) come in contact with moist soil. Underground rhizomes help to establish and spread the plant locally. Long distance dispersal is by birds and other wildlife that readily consume the fruits and defecate the seeds at various distances from the parent plant. Additional contributors: garden centers, nurseries, and Internet sales.

Similar Species: See *Lonicera bella* for similar species.

Threats: In North America, Japanese honeysuckle has few natural enemies which allows it to spread widely and out-compete native plant species. Its evergreen to semi-evergreen nature gives it an added advantage over native species in many areas. Shrubs and young trees can be killed by girdling when vines twist tightly around stems and trunks, cutting off the flow of water through the plant. Dense growths of honeysuckle covering vegetation can gradually kill plants by blocking sunlight from reaching their leaves. Vigorous root competition also helps Japanese honeysuckle spread and displace neighboring native vegetation.

Control: Manual and mechanical: For small patches, repeated pulling of entire vines and root systems may be effective. Hand pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. Monitor frequently and remove any new plants. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. An effective method for removal of patches of honeysuckle covering the ground is to lift up and hold a portion of the vine mass with a rake and have a chain saw operator cut the stems low to the ground. Mowing large patches of honeysuckle may be useful if repeated regularly but is most effective when combined with

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herbicide application (see below). Mow at twice a year, first in mid-July and again in mid-September. Plants can also be grubbed out using a pulaski or similar digging tool, taking care to remove all roots and runners. Burning removes above ground vegetation but does not kill the underground rhizomes, which will continue to sprout. In certain situations, tethered goats have been used to remove honeysuckle growth, but must be monitored to prevent their escape to the wild where they would become an added ecological threat. **Chemical:** In moderate cold climates, Japanese honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when most native species are dormant. However, for effective control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. Several systemic herbicides (e.g., glyphosate and triclopyr) move through the plant to the roots when applied to the leaves or stems and have been used effectively on Japanese honeysuckle. Following label guidelines, apply a 2.5% rate of glyphosate (e.g., Rodeo for wetlands; Roundup for uplands) mixed with water and an appropriate surfactant, to foliage from spring through fall. Alternatively, apply a 2% concentration of triclopyr (e.g., Garlon 3A) plus water to foliage, thoroughly wetting the leaves but not to the point of drip-off. A coarse, low-pressure spray should be used. Repeat applications may be needed. Treatment in the fall, when many non-target plants are going dormant, is best. Also, a 25% glyphosate or triclopyr solution mixed with water can be applied to cut stem surfaces any time of year as long as the ground is not frozen. **Biological control:** No biological control agents are currently available for Japanese honeysuckle.

Alternatives: Vines that make good substitutes for Japanese honeysuckle include but are not limited to false jasmine (*Gelsemium sempervirens*), trumpet honeysuckle (*Lonicera sempervirens*), trumpet creeper (*Campsis radicans*), crossvine (*Bignonia capreolata*), native wisteria (*Wisteria frutescens*), jackman clematis (*Clematis jackmanii*).

LINKS: <http://www.nps.gov/plants/alien/fact/loja1.htm>
<http://www.nobleplants.com/classnotes/spring/springprofiles/vines/lonicerajap.htm>
<http://tncweeds.ucdavis.edu/photos/lonja03.jpg>
<http://www.giardinaggio.it/giardino/rampicanti/Lonicera/Lonicera%20japonica.jpg>
<http://lachlan.bluehaze.com.au/.../june2001/03jun2001/>
http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=LOJA&photoID=loja_008_ahp.tif
http://www.chicagobotanic.org/research/conservation/invasive/Lonicera_japonica.html



Euonymus alatus -- Burning Bush Ban to go into effect in New Hampshire 1/1/2007

Description: Winged burning bush, also known as winged euonymus and burning bush euonymus is a deciduous shrub that grows to 15 to 20 feet tall and equally as wide. It is a member of the Staff-tree family (Celastraceae) with elliptic to obovate leaves, which are opposite or sub-opposite, 1 to 3 inches long and ½ to 1¼ inches wide. The leaves turn a bright red in the fall before dropping. Occurring in May to early June, the green flowers are inconspicuous, small, but are followed by hanging, dark red capsular fruits that partially dehisce when ripe, exposing scarlet, arillate seeds; each seed hangs by a funicular thread (the funiculus is the stalk that attaches the ovary to the placenta in the angiosperm fruit.) Winged burning bush produces four-angled, initially photosynthetic stems that gradually develop distinctive, thin, corky wings (see photo above, right).

Habitat: Native to northeastern Asia to central China, winged burning bush was introduced into this country about 1860 as an ornamental shrub. It is very adaptable to a variety of soils, including being pH adaptable, performing best in well drained soils and poorest in waterlogged soils. It grows well in full shade and full sun but shows stress in soils subject to drought.

Distribution: Because of its spectacularly red autumn foliage, winged burning bush, is one of the most popular shrubs on the market. Consequently, its distribution is limited only by its hardiness, extending from New England south to northern Florida and the Gulf Coast. It is commonly used in landscaping, especially for yards, malls and highways. Winged burning bush may spread by seed from wherever it is used as an ornamental shrub. Birds are attracted to the brightly colored, spinning arils.

Threats: Burning bush euonymus shades out native herbs and crowds out native shrubs, thereby reducing native habitat for the wildlife community. The shrub may become one of our most troublesome plants because of the ease with which its seeds are spread, the readiness of germination, its adaptability to various soils, its tolerance of full shade and its spectacular fall foliage.

Control: Stumps can be cut and treated with herbicide immediately afterwards. Where populations are so large that cutting is impractical, herbicide (glyphosate) can be sprayed on. This is most effective during the early summer months. It is not successful to cut or mow down the plants and treat with glyphosate after several days or weeks. Control is considered difficult once a parent plant has become established. It will probably not be much of a problem in cities, towns or thickly developed areas, but any nearby woodland where birds can roost may quickly become infested. Therefore, abstaining from using the plant becomes the most important step toward control.

Alternatives: A native shrub of rather limited availability that is not invasive to natural landscapes is red chokeberry (*Aronia arbutifolia*). It is spectacular in October when the foliage turns a brilliant red. The growth is more lax and less compact than the winged burning bush. The cultivar “Brilliantissima” is recommended for more brilliant red foliage in the fall. Another choice would be the non-invasive exotic Koreanspice Viburnum (*Viburnum carlesii*), which may have reddish to wine-red fall color; however, fall selection is advised to be certain of the color one may expect.

LINKS: botit.botany.wisc.edu/.../Rhamnaceae/Rhamnus/
<http://tncweeds.ucdavis.edu/photos/euoa101.jpg>
<http://www.dcr.state.va.us/dnh/fseual.pdf>
<http://www.huis.hiroshima-u.ac.jp/~nomura/N/niskig3.gif>
<http://www.lastgreatplaces.org/berkshire/issues/art6403.html>

Euonymus alatus -- Burning Bush Ban to go into effect in New Hampshire 1/1/2007



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Rhamnus cathartica -- Common buckthorn

NH Prohibited Invasive Species List



Description: Common buckthorn is a shrub or small tree in the buckthorn family (Rhamnaceae) that can grow to 22 feet in height and have a trunk up to 10 inches wide. The crown shape of mature plants is spreading and irregular. The bark is gray to brown, rough textured when mature and may be confused with that of plum trees in the genus *Prunus*. When cut, the inner bark is yellow and the heartwood, pink to orange. Twigs are often tipped with a spine. In spring, dense clusters of 2 to 6, yellow-green, 4-petaled flowers emerge from stems near the bases of leaf stalks. Male and female flowers are borne on separate plants. Small black fruits about 0.25 inches in cross-section and containing 3-4 seeds, form in the fall. Leaves are broadly oval, rounded or pointed at the tip, with 3-4 pairs of upcurved veins, and have jagged, toothed margins. The upper and lower leaf surfaces are without hairs. Leaves appear dark, glossy green on the upper surface and stay green late into fall, after most other deciduous leaves have fallen.

Habitat: Common buckthorn prefers lightly shaded conditions. An invader mainly of open oak woods, deadfall openings in woodlands, and woods edges, it may also be found in open fields. It is tolerant of many soil types, well drained sand, clay, poorly drained calcareous, neutral or alkaline, wet or dry.

Distribution: Native to Eurasia, common buckthorn was introduced to North America as an ornamental shrub, for fence rows, and wildlife habitat. Common buckthorn has become naturalized from Nova Scotia to Saskatchewan, south to Missouri, and east to New England. It is a dioecious plant, meaning that each plant produces only male or female flowers and fruiting trees are always female. Most of the fruits fall directly beneath the shrubs, creating a dense understory of seedlings characteristic of common buckthorn stands. The plentiful fruit is eaten by birds and mice and is known to produce a severe laxative effect, helping distribute seeds through birds, often far from the parent plant.

Similar Species: See glossy buckthorn for a similar menace, which does not have a spine at twig tips, leaves are not toothed, and the undersides of the leaves are hairy. Several native American buckthorns that occur in the eastern U.S. could be confused with the exotic species. *Rhamnus caroliniana* (pictured



left and center), with finely toothed leaves somewhat resembling those of black cherry, and are smooth on the underside; it produces attractive fruits from August to October. Alder buckthorn (*Rhamnus alnifolia* - right), is a low-

growing shrub that may grow to a maximum of 3 feet in height, and has leaves with 6-7 pairs of veins. http://biology.smsu.edu/Herbarium/Plants%20of%20the%20interior%20Highlands/Plants_of_the_Interior_Highlands_R.htm

Threats: Exotic buckthorns tend to form dense, even-aged thickets, crowding and shading out native shrubs and herbs, often completely obliterating them. Dense buckthorn seedlings prevent native tree and shrub regeneration. Buckthorn control is also of interest to small grain producers; the shrub is an alternate host of the crown rust of oats, which affects oat yield and quality.

Control: Prescribed fire in spring, as soon as leaf litter is dry. Fire will top kill a mature plant, but resprouting does occur. Burning every one to two years may be required for 5-6 years or more. Unfortunately, buckthorn seedlings often grow in low litter areas, unsuitable for frequent prescribed fire. In dense stands, seedlings and saplings may be cut and dropped on site, creating fuel for future fires. Uprooting of 0.5 inch diameter seedlings by hand or up to 1.5 inch diameter using a weed wrench is effective, but care should be taken to avoid excessive disturbance to the soil, which can release buckthorn seeds stored in the soil. **Chemical:** Applications made during the winter or in early spring prior to greenup are preferred. A triclopyr herbicide at the rate of 1:4 herbicide-water with dye on cut stumps during the growing season, from late May to October or during winter. Or, mix 1 part triclopyr to 7 parts oil on cut stumps, or a 1 part triclopyr to 16 parts oil mixture applied as a basal bark treatment to stems less than 3 inches across. Apply the herbicide directly to the lower 10-12" of stems on plants with stems less than 4-6" in diameter since the bark on larger stems reduces herbicide absorption. Garlon 4 (an ester formulation) is the preferred herbicide for this application, and is mixed with oil in order to increase movement through the bark. The product label suggests avoiding treatment during the spring sap flow. Frill application (applying herbicide into the cambial layer of fresh cuts on the tree trunk) using the 1:4 rate of triclopyr herbicide with oil and dye was also effective. For fall applications, a 1 part glyphosate herbicide to 5 parts water mixture was applied immediately to cut stumps using a hand sprayer – initial checks showed over 85 percent control at the test site. Garlon (triclopyr), Ortho Brush-B-Gone, and Roundup are labeled for cut-surface treatments. Dyes can be mixed with the herbicide solution to help keep track of areas that have been treated.



Alternatives: Try red chokeberry (*Aronia arbutifolia*), black chokeberry (*Aronia melanocarpa*), American elderberry (*Sambucus canadensis*), ninebark (*Physocarpus opulifolius*), kinnikinnick (*Cornus amomum*), silky dogwood (*Cornus racemosa*), arrow-wood (*Viburnum recognitum* or *V. dentatum*), witch-hazel (*Hamamelis virginiana*), bladdernut (*Staphylea trifoliata*), nannyberry (*Viburnum lentago*), ninebark (*Physocarpus opulifolius*).

LINKS: <http://www.weeds.iastate.edu/mgmt/2001/buckthorn.htm>
project.bio.iastate.edu/.../Rhamnus/Rham_flowers.html
wisplants.uwsp.edu/photos/RHAALN_EJJ4.jpg
http://www.chicagobotanic.org/research/conservation/invasive/rhamnus_cathartica.html



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Rhamnus frangula -- Glossy buckthorn

NH Prohibited Invasive Species List



Description: Like common buckthorn, glossy buckthorn is a deciduous shrub or small tree. It can readily be distinguished from common buckthorn by several obvious characters. Glossy buckthorn has similarly shaped leaves, but they are glossy or shiny and lack teeth on their margins. Flowers are also similar, but have five petals on glossy buckthorn. Plants of both species reach seed-bearing age quickly, and both produce drupes (berries).

Habitat: Glossy buckthorn typically inhabits wetter, less shaded sites than common buckthorn. It grows in any soils. Habitats include alder thickets and calcareous or limestone-influenced wetlands.

Distribution: Glossy buckthorn is native to North Africa, Asia, and Europe. In North America, glossy buckthorn occurs from Nova Scotia to Manitoba, south to Minnesota, Illinois, New Jersey and Tennessee. These species were probably introduced to North America before 1800, but did not become widespread and naturalized until the early 1900s. In the past they have been cultivated for hedges, forestry plantings, and wildlife habitat. In Maine, common buckthorn is documented in nearly every county, while glossy buckthorn has only been documented in four counties.



Similar Species: Care should be taken not to mistake the native alder-leaved buckthorn for these non-natives. Alder-leaved buckthorn can be distinguished by the lack of thorns at the end of its twigs, and it can be distinguished from glossy buckthorn by the presence of small teeth on its leaves



Threats: Although seedlings of common and glossy buckthorn invade apparently stable habitats, they grow most successfully where there is ample light and exposed soil, in thinned or grazed woods, along woodland edges, and in openings created by windfalls. Buckthorns have long growing seasons and rapid growth rates, and resprout vigorously after being topped. In North America, both species leaf out prior to most woody deciduous plants, and can retain their leaves well into autumn. Buckthorns rapidly form dense, even-aged thickets in both wetlands and in woodland understories. The large leaves and continuous canopy create dense shade – and are tolerant of moist, dry, or heavy clay soils which increases its success in many types of habitats. Dispersal is accelerated by the birds and mammals that feed on the fruit.

Control: Controls include cutting, mowing, girdling, excavation, burning, and “underplanting.” Repeated cutting reduces plant vigor. Mowing maintains open areas by preventing seedling establishment. Glossy buckthorn girdled with a two- to three-centimeter-wide saw-cut, completely through the bark at the base, does not resprout. Girdling may be done at any time of the year. A five-second flame torch application

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around the stem kills stems less than 4.5 centimeters in diameter. Seedlings or small plants may be hand-pulled or removed with a grubbing hoe. Larger plants may be pulled out with heavy equipment. Excavation often disturbs roots of adjacent plants, or creates open soil readily colonized by new seedlings. This technique may be most useful to control invasion at low densities, or along trails, roads and woodland edges. See Common Buckthorn for details on herbicide application.

Alternatives: Try red chokeberry (*Aronia arbutifolia*), black chokeberry (*Aronia melanocarpa*), American elderberry (*Sambucus canadensis*), ninebark (*Physocarpus opulifolius*), kinnikinnick (*Cornus amomum*), silky dogwood (*Cornus racemosa*), arrow-wood (*Viburnum recognitum* or *V. dentatum*), witch-hazel (*Hamamelis virginiana*), bladdernut (*Staphylea trifoliata*), nannyberry (*Viburnum lentago*), ninebark (*Physocarpus opulifolius*).

LINKS: <http://biology.smsu.edu/Herbarium/Plants%20of%20the%20interior%20Highlands/Flowers/Rhamnus%20frangula%20'cultivar'%20-%202.JPG>
<http://www.borealforest.org/shrubs/shrub32.htm>
<http://bny.agriculture.purdue.edu/buckthorn/page10.asp>
http://www.chicagobotanic.org/research/conservation/invasive/rhamnus_frangula.html
<http://www.paflora.org/Rhamnus%20frangula.pdf>
<http://www.umext.maine.edu/onlinepubs/htmpubs/2505.htm>
http://www.uwgb.edu/biodiversity/herbarium/invasive_species/rhafra01.htm



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***Celastrus orbiculatus* - Oriental bittersweet** New Hampshire Prohibited Invasive Species

Description: Oriental bittersweet is a deciduous, woody, perennial vine (to 60 feet in tree crowns) in the staff-tree family (Celastraceae), sometimes occurring as a trailing shrub. Also known as round-leaved and Asiatic bittersweet, stems of older plants sometimes grow to four inches in diameter. Stems of *Celastrus orbiculatus* have dark brown to brown striated bark. The twigs are dark brown, brown or light gray and are smooth and glabrous. The buds along the stem are axillary. The alternate, spiral leaves have only one per node. They are evenly placed around the stem. Leaves have a light green color and are widely elliptic or ovate to obovate or circular. The flowers, which bloom in May to early June, are axillary in their position on the stem. There are 3-4 small greenish flowers per inflorescence and they are 0.07-0.15 inches long 0.1-0.2 inches wide. The fruits of *Celastrus orbiculatus* are produced from July to October and are yellow in color. The yellow ovary walls will begin to fall from the fruit after frost. They are globose in shape 0.24-0.35 inches long and 0.28-0.4 inches wide. The fruit splits open at maturity revealing 3 red-orange axils that contain the seeds. The fruits of oriental bittersweet are very popular in floral arrangements.

Habitat: *Celastrus orbiculatus* infests roadsides, old homesites, thickets, alluvial woods, forest edges, open woodlands, fields, hedgerows, coastal areas, salt marsh edges and particularly disturbed lands. Oriental bittersweet is shade tolerant, readily germinating and growing under a closed forest canopy.

Distribution: Oriental bittersweet was introduced into the United States in the 1860s as an ornamental plant and it is still widely sold for landscaping despite its invasive qualities. It occurs from New York to North Carolina, westward to Illinois. Seed dispersal is by birds or small mammals. Seedling germination is generally high (up to 95%) and begins in mid to late spring. The highest rate of seed germination is in lower light intensities. Seedlings increase photosynthesis two-fold when exposed to direct sunlight. The plants develop and expand by layering stolons and rootsuckers (the ability to send shoots up from the roots). Annual growth rate is from 1-12 ft with little additional growth after about seven years. People also spread seed when using the plant for wreaths and ornamental arrangements.



Native Bittersweet
<http://www.bbg.org/sci/nymf/encyclopedia/cel/cel0030c.htm>

Similar Species: Since this plant is easily confused with our native climbing bittersweet vine (*Celastrus scandens*), which flowers at the tips rather than along the stems, it is imperative that correct identification be made.



Threats: Oriental bittersweet is an aggressive invader that threatens vegetation at all heights in forested and open areas by growing over other vegetation, completely covering and killing other plants by preventing photosynthesis, by girdling, and by uprooting trees through excessive weight.

Control: Since Oriental bittersweet produces numerous seeds, extensive seed reserves can become established in the soil within a year or two. These seeds remain viable for several years and control actions must continue until seed sources are eliminated. **Mechanical Control:** Cutting: Cut climbing or trailing vines as close to the root collar as possible. This technique is feasible on small populations; as a pretreatment on large impenetrable sites; in areas where herbicide cannot be used; or if labor resources are not sufficient to adequately implement herbicidal control. It prevents seed production and strangulation of surrounding woody vegetation. Oriental bittersweet will resprout unless cut so frequently that its root stores are exhausted. Treatment should begin early in the growing season and be repeated at two-week intervals until autumn. Grubbing: Use for small initial populations or environmentally sensitive areas where herbicides cannot be used. Remove the entire plant with a pulaski or similar digging tool, including all roots and runners. Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially resprout. All plant parts, including mature fruit, should be bagged and disposed of in a trash dumpster to prevent reestablishment. **Herbicidal Control:** Stump Treatment: Use this method in areas where vines are established within or around non-target plants, or where vines have grown into the canopy.

- Glyphosate: Cut the stem 2 inches above ground level. Immediately apply a 25% solution of glyphosate and water to the cross-section of the stem. This procedure is effective at temperatures (as low as 40°F) and may require a subsequent foliar application of glyphosate.
- Triclopyr: Cut the stem 2 inches above ground level. Immediately apply a 25% solution of triclopyr and water to the cross-section of the stem. This procedure remains effective at low temperatures (<60°F) as long as the ground is not frozen. A subsequent foliar application may be necessary to control new seedlings.

Foliar Spray Method: Use this method to control large populations. It may be necessary to precede foliar applications with stump treatments to reduce the risk of damaging non-target species.

- Glyphosate: Apply a 2% solution of glyphosate and water plus 0.5% non-ionic surfactant to thoroughly wet all foliage. Do not apply so heavily that herbicide will drip off leaves. Glyphosate is a non-selective systemic herbicide that may kill non-target partially sprayed plants. Ambient air temperature should be above 65°F.
- Triclopyr: Apply a 2% solution of triclopyr and water to thoroughly wet all foliage. Do not apply so heavily that herbicide will drip off leaves. The ideal time to spray is after surrounding native vegetation has become dormant (October-November) to avoid affecting non-target species. A 0.5% concentration of a non-ionic surfactant is recommended in order to penetrate leaf cuticle. Ambient air temperature should be above 65°F.

Alternatives: Although our native bittersweet (*Celastrus scandens*) is an excellent alternative plant to use, many nurseries confuse it with the exotic invasive Oriental bittersweet.

LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=27>
<http://www.nps.gov/plants/alien/fact/ceor1.htm>
http://www.srs.fs.usda.gov/pubs/qtr/qtr_srs062/03_vines.pdf
http://www.chicagobotanic.org/research/conservation/invasive/celastrus_orbicuatus.html
<http://www.se-eppc.org/manual/bittersweet.html>



Berberis vulgaris -- European barberry New Hampshire Prohibited Invasive Species List

Description: Perennial, reproducing only by seed; this bushy shrub that's 3 - 10 feet high, has erect stems. Branches are gray to yellowish-gray with short, sharp, slender, 3-branched spines (occasionally single or unbranched) at nearly every node; leaves in clusters or short lateral spurs along the main branches, but distinctly alternate (1 per node) on young, rapidly elongating branches. Branches are covered with a smooth gray bark, inner bark is very yellow. Leaf blades are broadest above the middle, tapering towards the base, prominently net-veined and grayish-green on the undersurface, with numerous, prominent, sharp or spiny-tipped teeth. The leaves are alternate or fascicled and are 0.75 – 2 inches long. It flowers (late May to June) are bright yellow with an unpleasant smell, in elongated, drooping racemes 1 – 2 inches long with 10 to 20 flowers on each. Leaf axils from the ends of branches, small -- each has 6 yellow sepals, 6 yellow petals, 6 stamens and 1 pistil. The yellow sepals and petals fall very soon afterwards, but the bright red berries occurring August through October often hang on all winter. The berries are ellipsoid in shape and around 0.4 inches long, containing 1-3 small, black seeds.

Habitat: Berberis vulgaris is found sporadically in New England, usually in more open-canopied forests and sometimes along roads. It is also very successful in calcareous soils.

Distribution: The fruit of Berberis vulgaris are dispersed by birds. Small mammals can also contribute to their dispersal. When branches come in contact with the soil they can produce new plants.

Similar Plants: It is distinguished from other shrubs by its clusters of bristly toothed leaves, its 3-branched spines, its small yellow flowers in long drooping racemes, and its red berries.

<u>Character</u>	<u>Berberis vulgaris</u>	<u>Berberis xottawensis</u>	<u>Berberis thunbergii</u>
Branch spines	3 (can be 1)	varies	1 (can have up to 3)
Inflorescence*	Raceme	Subumbellate-raceme	Sessile umbel
Leaf margin	Serrate	Most often entire**	Entire
Berry consistency	Juicy	Dry	Dry

Berberis
vulgarisBerberis
xottawensisBerberis
thunbergii

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Threats: This plant is a very important pest because its leaves become infested with the fungus which causes stem rust on oats, barley, rye and wheat; the fungus overwinters in these leaves and spreads from them to cause early-season infections of stem rust on nearby grain crops. Eradication of this shrub is essential to help protect grain crops from the stem rust fungus.

Control: Small isolated plants can be pulled or dug out. Cutting of larger bushes or thickets is difficult due to the spines and thorns of the plants. New shoots grow quickly from cut stumps. Therefore repeated cutting, stump removal or chemical treatment of cut stumps may be required. A small hand sprayer or a power sprayer can be used to spray the bottom foot of the trunks and any exposed roots with herbicide. Wet the bark thoroughly on all sides of the trunks. This treatment is useful on trees with a trunk diameter of up to 6 inches. It is often desirable to cut and remove the shrubs for appearance sake. Spray or paint the freshly cut slumps with an approved herbicide. Killing the stump is the first step towards encouraging it to rot and helps prevent re-growth from the stump. Bushes less than 6.5 feet tall can be sprayed just as the leaves reach full size, usually in late spring to early summer. Spray to wet all stems and foliage thoroughly. Plants taller than 6.5 feet should be cut before treatment, as it is difficult to spray tall shrubs thoroughly and there is an increased risk of spray drift.

Threats: Though *Berberis vulgaris* is not very common on the landscape in most places, there is a risk that it could once again become a serious pest. The fact that it is an alternate host for wheat rust prevents its sale (seeds and plants) in many states.

Alternatives: winterberry holly (*Ilex verticillata*), inkberry holly (*Ilex glabra*), New Jersey tea (*Ceanothus americanus*), bayberry (*Myrica pensylvanica*), wild hydrangea (*Hydrangea arborescens*), ninebark (*Physocarpus opulifolius*), silky dogwood (*Cornus racemosa*), red chokeberry (*Aronia arbutifolia*), black chokeberry (*Aronia melanocarpa*), callicarpa Americana (Beautyberry), vaccinium angustifolium (Lowbush Blueberry) are all excellent alternative shrubs to replace European Barberry.

LINKS: <http://www.newfs.org/conservation/docs/invalt2.pdf>
<http://www.paflora.org/Berberis%20thunbergii.pdf>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=41>



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