

NEW HAMPSHIRE INVASIVE SPECIES FACT SHEETS



Iris & Kudzu

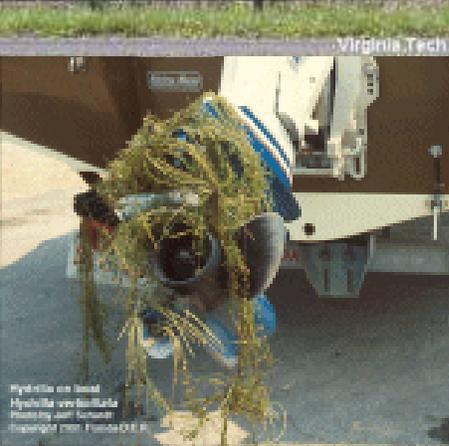
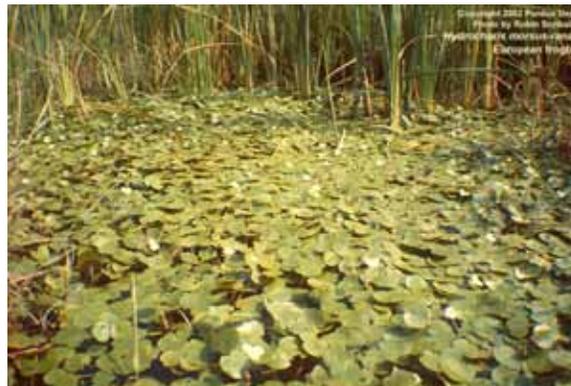


Table of Contents

Introduction	1
Invasives Plants List	2
Invasive Plants	3-110
Elements of a Comprehensive Invasives Control	111
Control of Invasive Plant Species	111
General Herbicide Directions	111
Safety Instructions	111
NCC Liability Exemption	111
Herbicides	112
Application to Terrestrial Plants	112
Glyphosates	112
Aquatic herbicides	113
Disposal	113
Additional References	113
Plant Part Identification	114
Plant Terminology Glossary	115-120



Prepared by the Nashua Conservation Commission, November 20, 2004

New Hampshire regulation requires a permit to work in wetlands from the NH Department of Agriculture's Division of Pesticide Control. Only property owners or certified pesticide professionals can apply chemicals in NH. The herbicides mentioned can destroy other plants, and could harm humans. Published herbicide safety instructions should be strictly adhered to. The mention of a product's brand name does not constitute endorsement by the Nashua Conservation Commission.

Nashua, New Hampshire – Invasive Species Guidelines

Next to habitat lost to land development and transformation, invasive species pose the greatest threat to the survival of native biota in the United States, and many other areas of the world. An "invasive species" is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. (Executive Order 13112). Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions. <http://www.cga.state.ct.us/2002/olrdata/env/rpt/2002-R-0131.htm> , <http://www.invasivespecies.gov/>.

The sale, purchase and/or planting of plants considered invasive has been banned both at Federal and some State levels. This list of New Hampshire plants considered invasive is derived from:

- Invasive plants banned or on the "watch list" in New Hampshire (*NH Prohibited Invasive Species Regulations* http://www.agriculture.nh.gov/pdf/topics/Rules_Final_Proposal.pdf)
- NH Prohibited Exotic Aquatic Weeds per RSA 487:16-a: <http://www.des.state.nh.us/factsheets/bb/bb-40.htm>
- Plants banned Federally that may be found in NH *National Plant Board State Regulated Noxious Weeds*: <http://www.aphis.usda.gov/npb/statenw.html>

The purpose of these lists is to prevent the further spread of non-native invasive species throughout the state by prohibiting their collection, possession, importation, transportation, sale, propagation, transplantation and cultivation. Although relevant to the state of New Hampshire in general, this reference was created specifically for commercial and personal property owners (or their representatives) in the city of Nashua, New Hampshire, to aid in the identification of invasive plants, detail possible means for eradication of these invasives, and suggest native alternatives to the pests.

Disturbed and recently cleared areas are breeding grounds for invasive plants. While true year-round, disturbance during summer months when seed dispersal is the greatest is particularly discouraged. The following invasive-control methods may be stipulated by the NCC for projects that are invasive-sensitive: (1) Erosion control methods often include the use of hay bales which commonly carry invasive seeds. Even if seed-free, the heat that hay creates while decomposing can attract seed. No hay bales should be used in or near wetlands in the City of Nashua. (2) The Applicant shall remove existing invasives in impacted areas and dispose in a manner that leaves them nonliving and nonviable, being careful in the removal process not to spur further seed dispersal. Plants on the "watch" list are exempt from this option. (3) Replanting of native species or pre-approved conservation mix should occur as soon after disturbance as practicable. (4) Monitoring of invasives will protect the applicant's landscaping investment and should be conducted for up to five years after site completion.

While these pages include reference to certain chemical products to aid in destruction of hard-to-control invasives, please keep in mind the following:

- New Hampshire State regulation prohibits the use of chemicals in or near wetlands by any party other than property owners or state-certified herbicide applicators. A permit will be needed from the New Hampshire Department Agriculture's Division of Pesticide Control. The Nashua Conservation Commission urges potential herbicide users to contact this state agency for restrictions and regulations pertaining to their control specifics.

CHAPTER Pes 600 AQUATIC APPLICATION OF PESTICIDES Statutory Authority: RSA 430:31 -- Pes 601.01 Special Permit Required.: (a) No person, firm, corporation, any agency of state or local government or other legal entity shall apply any pesticide to or in any surface water without receiving a special permit from the division. <http://www.gencourt.state.nh.us/rules/pes600.html>
- The products mentioned have been suggested via internet research for the particular invasive plants described – the Nashua Conservation Commission does not endorse any product in particular.
- The herbicides mentioned can destroy other plants, as well as harm humans. Please observe all safety precautions on the product labels.

Note: to enlarge an image for better details, activate it with your cursor, then drag a corner. This material is not-for-profit. References are included as links per each invasive plant.

NH Prohibited (and watch) Invasives Species Lists –&– Federal Noxious Plant List (noted with *)

Latin Name	Common Name	1 plant	2-10 plants	11-99	> 99 plants	Pg.
Aquatics						
<i>Butomus umbellata</i> *	Flowering rush					9
<i>Cabomba caroliniana</i> *	Fanwort					11
<i>Egeria densa</i> *	Brazilian elodea					19
<i>Hydrilla verticillata</i> *	Hydrilla					25
<i>Hydrocharis morsus-ranae</i> *	European frogbit					27
<i>Myriophyllum aquaticum</i> *	Parrot's feather					47
<i>Myriophyllum heterophyllum</i> *	Variable milfoil					49
<i>Myriophyllum spicatum</i> *	European water-milfoil					51
<i>Najas minor</i> *	European naiad					53
<i>Nymphoides peltata</i> *	Yellow floating heart					55
<i>Potamogeton crispus</i> *	Curly-leaf pondweed					63
<i>Trapa natans</i> *	Water chestnut					71
Non-Aquatics						
<i>Ailanthus altissima</i>	Tree of heaven					3
<i>Alliaria petiolata</i>	Garlic mustard					5
<i>Berberis vulgaris</i>	European barberry					7
<i>Celastrus orbiculatus</i>	Oriental bittersweet					13
<i>Cynanchum nigrum</i>	Black Swallow-wort					15
<i>Cynanchum rossicum</i>	Pale Swallow-wort					17
<i>Elaeagnus umbellata</i>	Autumn olive					21
<i>Heracleum mantegazzianum</i>	Giant hogweed					23
<i>Iris pseudacorus</i>	Water-flag Iris					29
<i>Ligustrum obtusifolium</i>	Blunt-leaved privet					31
<i>Lonicera bella</i> (pretty)	Showy bush honeysuckle					33
<i>Lonicera japonica</i>	Japanese honeysuckle,					35
<i>Lonicera morrowii</i>	Morrow's honeysuckle					37
<i>Lonicera tatarica</i>	Tartarian honeysuckle					39
<i>Lythrum alatum</i> Lythraceae*	Winged loosestrife					
<i>Lythrum salicaria</i> *	Purple loosestrife					43
<i>Lythrum virgatum</i> *	Wand Loosestrife					
<i>Phragmites australis</i> *	Common Reed					57
<i>Polygonum cuspidatum</i>	Japanese knotweed					61
<i>Rhamnus carthartica</i>	Common buckthorn					65
<i>Rhamnus frangula</i>	Glossy buckthorn					67
<i>Rosa multiflora</i>	Multiflora rose					69
Ban to go into effect in NH 1/1/2007						
<i>Acer platanoides</i>	Norway Maple					75
<i>Berberis thunbergii</i>	Japanese barberry					77
<i>Euonymus alatus</i>	Burning Bush					73
Watch List						
<i>Centaurea maculosa</i> --	Spotted Knapweed					79
<i>Cirsium arvense</i> --	Canada thistle					81
<i>Coronilla varia</i> --	Crown vetch					83
<i>Elaeagnus angustifolia</i> --	Russian olive					85
<i>Euonymus fortunei</i> –	Wintercreeper					87
<i>Glyceria maxima</i> --	Sweet reedgrass					89
<i>Ligustrum vulgare</i> --	Common Privet					91
<i>Lonicera maackii</i> --	Amur Honeysuckle					93
<i>Lysimachia nummularia</i> –	Moneywort					95
<i>Microstegium vimineum</i> --	Japanese stilt grass					97
<i>Phalaris arundinacea</i> --	Reed canary grass					99
<i>Populus alba</i> --	White Poplar					101
<i>Pueraria lobata</i> –	Kudzu					103
<i>Robinia pseudoacacia</i> L. --	Black Locust					105
<i>Ulmus pumila</i> --	Siberian Elm					107
<i>Ampelopsis brevipedunculata</i> --	Porcelain-berry					109

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Ailanthus altissima -- Tree of heaven

New Hampshire Prohibited Invasive Species List



seeds

tree in seed

bark

leaves

Description: Tree-of-heaven is a small to medium-sized tree in the mostly tropical Quassia family which can reach 80 feet in height; 40 feet in width. It has smooth gray bark. The leaves are typically 2-4 inches long with broad, flat, compound, alternate, odd-pinnate, with 11-25 lanceolate leaflets. The alternate leaves emerge bronzed in spring (left), and quickly transition from medium to dark green as they expand to about two feet in length, with an even number of leaflets (right). There is no significant color change in fall. Most leaflets have one to three coarse teeth near their base. Crushed leaves and stems emit a distinctive, offensive odor. Flowers occur in panicles at the ends of branches in late spring; male flowers produce a strong odor which has been described as "the smell of burnt peanut butter." Seeds (1.5 inches) are centered in a papery sheath called a samara which are slightly twisted or curled, and twirl as they fall to the ground (September/October).

Habitat: Tree-of-heaven establishes itself readily on disturbed sites where polluted conditions and poor, rocky soils prohibit anything but weeds to grow. These include vacant lots of the inner city, railroad embankments, highway medians, fence rows and roadsides. In naturally forested areas, disturbance created by severe storms or insect infestations can open the way for tree-of-heaven infestation.

Distribution: Tree-of-heaven is native to a region extending from China south to Australia. It was imported into the United States in 1784 by a Philadelphian gardener. In the western states it was brought over by Chinese immigrants who use it for medicinal purposes. One tree-of-heaven can produce up to 350,000 seeds in a year. Seedlings establish a taproot three months from germination. Thus, they quickly outrace many native plant species in competition for sunlight and space. Seeds may blow by wind great distances from the parent.

Similar Plants: Tree-of-heaven leaves may be confused with those of sumac or black walnut.

Differences:	Ailanthus:	Staghorn Sumac:
Leaves:	smooth-edged often with single lobe at the bottom	Toothed
Seeds:	winged, in red and gold clusters	Fuzzy berries (lime to deep red)
Fall:	Turns tan	Turns red, (from purple to orange)
Buds:	Shield-shaped bud scars;	U-shaped
Bark:	Smooth with vertical streaks on older trees	Horizontal streaks
Winter:		twigs velvety, like deer antlers.
Height:		Rarely grows higher than 15 feet

Threats: Tree-of-heaven produces a toxin in its bark and leaves. As these accumulate in the soil, the toxin inhibits the growth of other plants. This toxin is so effective it is currently being studied as a possible source for a natural herbicide. Leaves are toxic to domestic animals. Gardeners who fell the tree may suffer rashes. It has a foul smell that can cause headache and nausea, rhinitis and conjunctivitis. The root system is capable of doing damage to sewers and foundations – is capable of lifting sidewalks.

Control: Tree-of-heaven is very difficult to remove once it has established a taproot. It has persisted in certain areas despite cutting, burning and herbiciding. **Manual:** Seedlings should be removed by hand as early as possible, preferably when the soil is moist to insure removal of the entire taproot. Larger

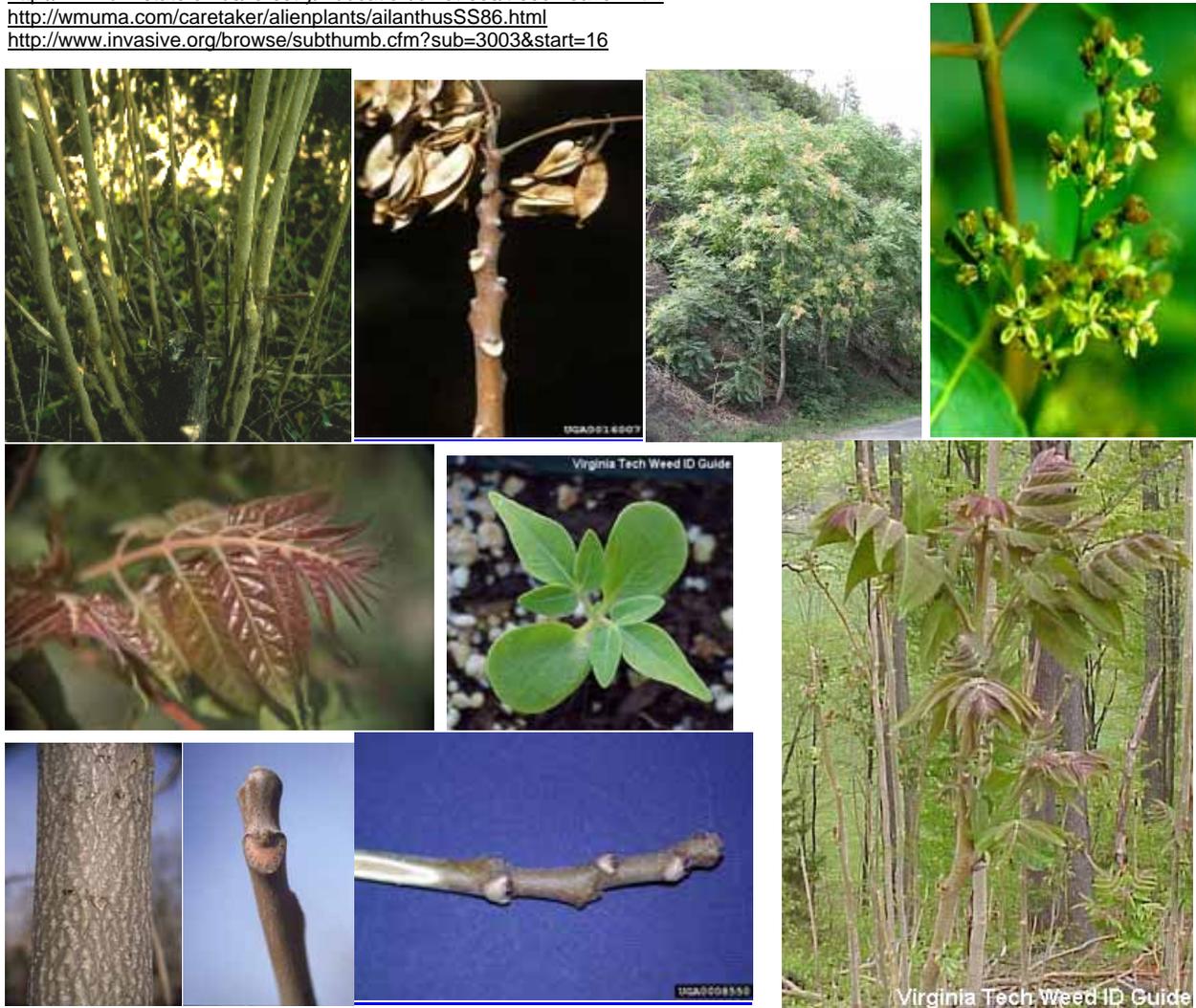
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plants should be cut; two cuttings a year may be necessary, once in the early growing season and once in the late growing season. Initially, this will not kill the plant; it will vigorously resprout from the roots. But seed production will be prevented and the plants will be lowered in stature. If continued over a period of several years, cutting during the growing season stresses the plants and may eventually kill them.

Chemical: A glyphosate herbicide, either sprayed onto the leaves or painted onto a freshly cut stump will kill the plant. However, to insure the herbicide gets into the root system, it is best to apply this herbicide in the late growing season while the plant is translocating nutrients to its roots.

Alternatives: *Acer negundo* (Box Elder), *Amelanchier arborea* (Downy Serviceberry), *Amelanchier laevis* (Allegheny Serviceberry), *Carya illinoensis* (Pecan), *Diospyros virginiana* (Persimmon), *Gymnocladus dioica* (Kentucky Coffeetree), *Maclura pomifera* (Osage Orange), *Ostrya virginiana* (Ironwood), *Rhus typhina* (Staghorn Sumac), *Sassafras albidum* (Sassafras).
<http://www.newfs.org/conservation/docs/invalt2.pdf>

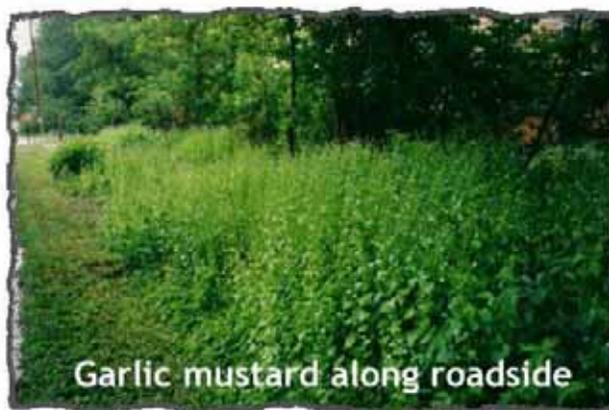
LINKS: http://www.chicagobotanic.org/research/conservation/invasive/ailanthus_altissima.html
<http://www.nps.gov/plants/alien/fact/aial1.htm>
<http://www.vnps.org/invasive/invalian.htm>
http://www.hort.purdue.edu/newcrop/duke_energy/Ailanthus_altissima.html
<http://www.dnr.state.oh.us/forestry/Education/ohiotrees/treeofheaven.htm>
<http://wmuma.com/caretaker/alienplants/ailanthusSS86.html>
<http://www.invasive.org/browse/subthumb.cfm?sub=3003&start=16>



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Alliaria petiolata -- Garlic mustard

New Hampshire Prohibited Invasive Species List



Description: Garlic mustard is a cool-season biennial herb that ranges from 12 to 48 inches in height as an adult flowering plant. First year plants consist of a cluster of 3 or 4 round, scallop edged leaves rising 2 to 4 inches in a rosette. Second-year plants generally produce one or two flowering stems with numerous white flowers that show early April through May with four separate petals. Basal leaves are dark green and kidney shaped. Stem-leaves are alternate, large sharp toothed, and triangular in shape and can be 2 - 3 inches across in fruiting plants. Petioles are longer on the leaves towards the base. Each plant usually produces a single, unbranched (or weakly branched) flower stalk. Garlic mustard can also be distinguished by its uproot, which is slender, white, and "s"-shaped at the top of the root. Garlic mustard is the only plant of this height in our woods with white flowers in May. Robust plants have been recorded with up to 12 separate flowering stalks. Fruits are slender capsules 1 to 2.5 inches long that produce a single row of oblong black seeds with ridged seed coats. Leaves and stems emit the distinctive odor of onion or garlic when crushed (particularly in spring and early summer, mature plants have less odor). Flowering plants average 27-40 inches in height, but tiny 2 inch tall flowering specimens have been observed. The mustard-like flowers consist of four white petals that narrow abruptly at the base with 6 (2 short and 4 long) stamens. The flowers are 0.25 inches in diameter with 0.0125 - 0.25 in long petals. Fruit ripen between mid-June and late September.

Habitat: Garlic mustard invades forested communities and edge habitats, in upland and floodplain forests, savannas, yards, and along roadsides, occasionally in full sun. It is shade-tolerant, generally requiring some shade. It cannot tolerate acidic soils. The invasion of forests usually begins along the wood's edge, and progresses via streams, campgrounds, and trails. It grows on sand, loam, and clay soils, and has also been found on limestone and sandstone substrates.

Distribution: *Alliaria petiolata* was first collected in the USA in 1868 on Long Island, New York, being native mostly to the northern areas of Europe. As an invader, it has spread to North Africa, India, Sri Lanka, New Zealand, and North America. In the USA, it is most abundant in New England and midwestern states. A single plant produces 2-422 fruit (the average is 22). Since each fruit contains an average of 16 seeds, a single plant produces up to 6752 seeds. The seeds are black, cylindrical (0.01 in x 0.04 in) and grooved. The seeds lay dormant for at least one year before germinating in the spring. The plant dies after setting seed. Its seeds can remain viable for 5 years. *Alliaria petiolata* will set seed even if pollinators are not present. Garlic mustard spreads exclusively by seed. Seeds are spread mostly by floodwaters or on humans, animals, and vehicles. Wind dispersal is minor.

Similar Plants: In the basal rosette stage, *Alliaria petiolata* can easily be confused with many other plants, but its strong garlic odor (in the spring and summer) is distinctive. Each plant has a slender white taproot with an "S" curve at the top, just below the crown.

Threats: Garlic mustard is currently displacing native understory species in the forests of northeastern America and southern Canada. Native wildflowers include spring beauty, wild ginger, bloodrot,

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Dutchman's breeches, hepatica, toothworts, and trilliums. It displaces native herbaceous species within 10 years of establishment. Garlic mustard can invade undisturbed areas as well as disturbed areas. Garlic mustard is also a threat to species that depend on the native understory species because of its toxicity.

Control: Where populations are established, seed production must be prevented for 2-5 years to deplete the seed bank. Check for garlic mustard in very early spring or late fall for immature rosettes. Monitor in early to mid spring for flowering adults. **Manual:** Immediately remove small populations before seeds are produced. Hand pulling works well but must be continued until the seed bank is exhausted. The plant pulls easiest early in the season. Remove the plant and at least the upper half of the root. Adventitious buds on the upper half of the root can send up new flower stalks if not removed. Natural mortality of seedlings is high (approximately 95%). **Chemical** control is most economical in late fall or early spring. Fair control was observed with a 3% concentration of glyphosate (Roundup) applied with a sprayer in Indiana. A decline in population was observed with a 5% solution of glyphosate (Roundup) sprayed on in Kentucky. 2,4-D is not effective for the control of garlic mustard. A spring application of triclopyr (Garlon 3A) killed 92% of garlic mustard rosettes in a small test. Triclopyr was applied at 7 oz/5 gal water (a little over 1%). Cutting before seed set is effective if the infestation is minor. Cutting of large infestations are not as effective. Repeated cuttings at ground level produce the best control results. If feasible, cut stems should be removed.

LINKS: <http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/garlic.htm>
http://www.columbia.edu/itc/cerc/danoff-burg/invasion_bio/inv_spp_summ/Alliaria_petiolata.html
<http://www.drjump.com/images/gmustard-road.jpg>
http://www.hort.uconn.edu/cipwg/art_pubs/images/alliarica2.jpg



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 vulgaris



Berberis xottawensis



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



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Butomous umbellate -- Flowering rush**Federal Noxious Weed List**

Description: *Butomus umbellatus* is a perennial, aquatic herb that grows on freshwater shorelines. It can be found in water several feet deep, and its flowering stem can reach up to 3.3 feet above the surface of the water. The 2 – 3 foot long ensiform leaves can be erect or floating on the water's surface. The leaves are three angled, fleshy and have twisted ends. This exotic is easiest to identify in flower. Flowers grow in umbrella shaped clusters and each individual flower has 3 whitish pink petals. Plants only produce flowers in very shallow water or on dry sites. Flowering rush has green stems that resemble bulrushes but are triangular in cross section. The leaf tips may be spirally twisted. The plants flower from the summer to the fall depending on the depth of the water. The flowers are arranged in a bracted umbel. The bracts are purple-tinged, and numerous flowers are on long, slender ascending pedicels. The flowers and sepals are numerous and are 0.8-1.0 inches in diameter. They can be white to deep pink, to purplish brown in color. The submersed form of this plant does not have flowers, and has narrow, long thin leaves. The flowers produce beaked fruits that are dark brown 0.4 inches long which split at maturity releasing the seeds. Often, the plant does not flower (as is the case with some populations in Connecticut) which makes its identification more difficult.

Habitat: *Butomus umbellatus* was first observed in 1897 in LaPrairie, Quebec (near Montreal, Canada). It is mostly found on shores of lakes, ponds and riverbanks. It is intolerant of salt or brackish water.

Distribution: Flowering rush is probably spread over long distances by people who plant it in gardens. Once in a watershed it spreads locally by rhizomes and root pieces that break off and form new plants. Muskrats may use parts of the plant to build houses and probably contribute to its local spread. Boaters can transport flowering rush on their equipment. Water and ice movements can easily carry flowering rush to new areas of a water body.

Similar Species: *Sparganium* spp. (Bur-reeds). The leaves of *Butomus umbellatus* and *Sparganium* spp. look similar -- when *Butomus umbellatus* is in flower, these plants do not look alike.

Threats: *Butomus umbellatus* can displace native riparian vegetation, and can be an obstacle to boat traffic. Its very wide range of hardiness (zones 3-10) makes it capable of being widely invasive in the United States.

Control: Flowering rush is very difficult to identify, especially if it is not in flower. It closely resembles many native emergent plants, such as the common bulrush. Do not remove unless the plant is correctly identified. (1) **Manual** - Cutting flowering rush below the water surface is an effective method of control. Cutting will not kill the plant but it will decrease the abundance. Multiple cuts may be required throughout the summer as flowering rush grows back from the root. All cut plant parts must be removed from the water. Hand digging can be used to remove isolated plants that are located downstream of larger infestations. Extreme care must be taken to remove all root fragments. Any disturbance to the root

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system will cause small reproductive structures on the roots to break off and spread to other areas of the waterbody. Therefore, methods such as raking or pulling which disturb the root system, but do not remove it, are not recommended control strategies. (2) It is very difficult to kill flowering rush with **herbicides**. Herbicides easily wash away from the narrow leaves of this plant. Herbicides are more effective on dry banks or in very shallow water. There is no herbicide that is selective for flowering rush and care must be taken to avoid damage to valuable wetland plants such as cattails. DISPOSAL METHODS - Once removed from water, flowering rush can still grow and spread, mainly by sending out new shoots from the root stalk. Thoroughly dry all flowering rush plant and plant pieces that are removed from the water. Aquatic plants make excellent compost, but do not compost flowering rush next to a wetland or along a lakeshore. Large piles of flowering rush should be turned frequently and spread to allow for better drying.

LINKS: Minnesota Department of Natural Resources website: <http://www.seagrant.umn.edu/exotics/rush.html>
http://www.chicagobotanic.org/research/conservation/invasive/butomus_umbellatus.html



Flowering rush
Butomus umbellatus
 Photo provided by
 Nick Proulx, Minnesota DNR

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Cabomba caroliniana* -- Fanwort**Federal Noxious Weed List**

Description: *Cabomba caroliniana* is a submersed, rhizomatous, aquatic perennial that can have stems up to 6.5 feet long. It has two types of leaves. The petioled, submersed leaves are opposite, and sometimes whorled, peltate in form, and are 0.75 - 2 inches wide. These leaves are repeatedly divided into filiform segments. There are a few of the small floating leaves which are linear-elliptic in shape, have entire margins and often have a basal notch. The leaves are 0.25 - 0.75 inches long. Fanwort flowers July through September. The long-peduncled 1.2 - 4 inches flowers are most often white with yellow at the center, but can infrequently be pink or purplish in color. The sepals and petals are about 0.5 inches across. The petals are auriculate at their bases, and obovate in shape. The 3 ripened carpels are flask shaped.

Habitat: *Cabomba caroliniana* prefers to live in lakes and ponds, but can also be found in slow-moving rivers and streams. It normally lives in 3-10 feet of water. **It is found on the Nashua River in Nashua.**

Distribution: Considered native to the southeastern United States as well as some parts of South America, *Cabomba caroliniana* was most likely introduced in the northern part of the country as an aquarium plant. It can be dispersed by seed but is more often spread by vegetative parts which adhere to birds, boats, or by floating downstream.

Similar Species: This excellent link compares exotics with native New Hampshire aquatics: <http://www.des.state.nh.us/wmb/exoticspecies/identify.htm> *Myriophyllum* spp. (watermilfoils): The leaves are whorled and the plants have small, axillary flowers. *Ranunculus aquatilis* (water buttercup) has alternately arranged leaves as compared with the opposite arrangement of *C. caroliniana*. *Megalodonta beckii* has yellow, composite flowers and sessile leaves, while *C. caroliniana* has white flowers and petioled leaves.

Threats: *Cabomba caroliniana* has the ability to form extremely dense stands and clog drainage systems. It also interferes with recreational activities such as swimming and boating. This plant is still sold in the aquarium trade, so it is often discarded in local waterbodies. The plants are able to root from vegetative parts and thus, are easily spread. In the north, it appears that the seeds do not readily germinate, however, viable shoots have been observed in January beneath ice.

Control: (1) **Mechanical/Physical** - Fanwort can be removed by raking or seining it from the pond but will reestablish from any remaining roots. (2) **Aquashade** is a non-toxic dye or colorant. It prevents or reduces aquatic plant growth by limiting sunlight penetration, similar to fertilization. However, Aquashade does not enhance the natural food chain and may suppress the natural food chain of the pond. (3) **Biological** - Grass carp (a known species of fish known to be invasive) can be minimally effective in

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certain environments for reducing fanwort after an extended period. They are illegal in New Hampshire. (4) **Chemical** - active ingredients that have been successful in treating fanwort include diquat (G), endothall (E), and fluridone

Reward is a liquid diquat formulation that has been effective on fanwort. It is a contact herbicide. Contact herbicides act quickly and kill all plants cells that they contact.

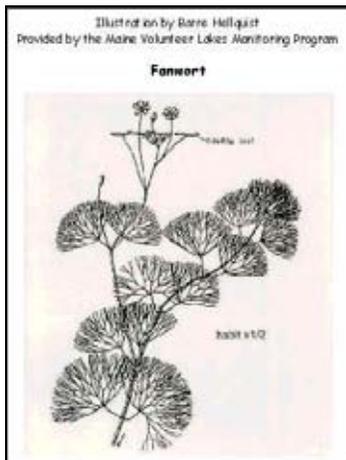
Aquathol, Aquathol K, and Aquathol Super K are dipotassium salts of endothall and comes in both liquid and granular formulations. These endothall products have been effective on fanwort and can be mixed with copper compounds for additional effectiveness. Contact herbicides act quickly and kill all plants cells that they contact.

Hydrothol 191 is an alkylamine salt of endothall and comes in both liquid and granular formulations. It is a contact herbicide and has been effective on fanwort. Contact herbicides act quickly and kill all plants cells that they contact. Hydrothol can be toxic to fish.

Sonar and Avast are fluridone compounds, come in both liquid and granular formulations, and have been effective on fanwort. These are broad spectrum, systemic herbicides. Systemic herbicides are absorbed and move within the plant to the site of action. Systemic herbicides tend to act more slowly than contact herbicides.

One danger with any chemical control method is the chance of an oxygen depletion after the treatment caused by the decomposition of the dead plant material. Oxygen depletions can kill fish in the pond. If the pond is heavily infested with weeds it may be possible (depending on the herbicide chosen) to treat the pond in sections and let each section decompose for about two weeks before treating another section. Aeration, particularly at night, for several days after treatment may help control the oxygen depletion. One common problem in using aquatic herbicides is determining area and/or volume of the pond or area to be treated.

LINKS: <http://www.des.state.nh.us/factsheets/bb/bb-25.htm>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=42#images>
www.fishpalace.org/C_caroliniana_fish2u.jpg
http://www.optimalie.net/invites/on/aquaon_1.htm
http://aquaplant.tamu.edu/Submerged%20Plants/Fanwort/Fanwort_Control.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.



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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.

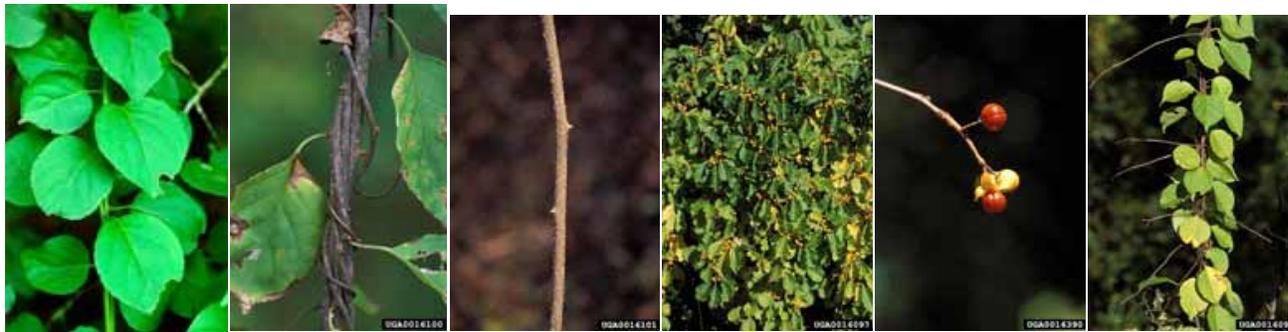
LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=27>

<http://www.nps.gov/plants/alien/fact/ceor1.htm>

http://www.srs.fs.usda.gov/pubs/gtr/qtr_srs062/03_vines.pdf

http://www.chicagobotanic.org/research/conservation/invasive/celastrus_orbicuatus.html

<http://www.se-eppc.org/manual/bittersweet.html>



Cynanchum nigrum - Black Swallow-wort New Hampshire Prohibited Invasive Species



Description: *Cynanchum louiseae* (*Cynanchum nigrum*, *Vincetoxicum nigrum*) is an herbaceous, perennial vine, in the milkweed family, 3.0 - 6.5 feet in height. Flower size: 0.125 inch across, the 5-lobed corolla is dark purple-brown (almost black) color occurring June to September. It is unbranched and twining in habit, its simple, opposite, dark green leaves have entire margins, are glabrous and shiny, and have short petioles. Leaves are ovate or ovate-lanceolate in shape, are 2-5 inches long and 0.5-2.5 inches wide with a tapered point. Clusters of 6-10 flowers are produced in opposite, axillary cymes; peduncles are 0.2-1.2 inches long. The fleshy flower lobes are shaped like an equilateral triangle, 0.05-0.1 inches long, with short straight, white hairs on the upper surface. The minutely toothed corona is weakly 5-lobed, its segments joined by a connective membrane that is 2/3 their length. Fruits are slender, elliptical follicles, 1.5-2.75 inches long, similar to that of milkweed but narrower. Immature pods are green, turning brown with maturity. Seeds are brown, flattened 0.2-0.3 inches long and ovoid with a membranous wing along the margin and a tuft of white hairs at the narrow end. Stems persist at the end of the season frequently bearing open pods with some seeds remaining inside. The fruit grows in pairs, and resembles slender milkweed pods. Plants grown in shaded areas can reach 3-6 feet by twining on nearby shrubs and vines. While black swallow-wort serves as a sink for monarch butterfly eggs, their larvae cannot survive.

Habitat: roadsides, fields, edges of woods, rocky areas, pastures, fence-rows, and disturbed sites. They have a wide tolerance to light and moisture conditions, but are not found in standing water. Although its history of introduction is uncertain, the first record for *Cynanchum louiseae* is from Cambridge, Massachusetts, in Middlesex County, where it was collected in 1878. It may have come from the Harvard Botanic Garden. In the United States its range extends from the Atlantic coast to the mid west and as far south as Kentucky and Missouri. It is present in all New England States. Monospecific stands of Black swallow-wort can cover several acres of land.

Distribution: Mainly by wind-dispersed seeds – if they fall into moving water, they will float and be transported downstream. Fallow fields are quickly taken over by swallow-wort, impeding succession and providing a seed source for nearby natural areas. Over-wintering buds on the root crowns sprout readily when the plant is mowed or partially pulled.

Similar Species: Another invasive -- *Cynanchum rossicum* (Kleopov) Barbarich (Pale swallow-wort)

The chart below allows for differentiation between *Cynanchum louiseae* and *Cynanchum rossicum*.

Character	<i>Cynanchum louiseae</i>	<i>Cynanchum rossicum</i>
Shape of corolla lobes	Deltoid	2x as long as broad
Corolla lobe color	Dark purple	Pale yellow-purple to reddish Pale yellow/purple to reddish purple
Inner corolla lobe surface	Pubescent with short white hairs	Glabrous

Cynigrum has tiny hairs on the petals while *Cyrossicum* petals are smooth

Threats: *Cynanchum louiseae* is a vine that can grow rapidly—overgrowing native vegetation. It also has the ability to dominate the understory of a woodland. It even may supercede Oriental Bittersweet.

Control: When it is cut, this plant resprouts vigorously, making control difficult. Some success was found by hand-pulling young plants and removing seed pods found on the ground at Walden Pond, MA.

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In New York state, long-term testing of several methods bore out that over time, foliar spray applications of glyphosate (3.1 and 7.8 kg ae ha⁻¹) worked best, with subsequent applications required to effect long-lasting control. Only one insect, the tarnished plant bug (*Lygus lineolaris* [Palisot de Beauvois]), has been reported feeding on *Vincetoxicum* species in North America (Lawlor, 2000), but damage was minimal.

Alternatives: Family: Milkweed (Asclepiadaceae)

LINKS: education.stonehill.edu/.../swallowwort8fl.jpg
<http://lachlan.bluehaze.com.au/usa2001/june2001/04jun2001d/mvc-006f.jpg>
<http://omega.cc.umb.edu/~conne/jennjim/cynanchum.html>
<http://tncweeds.ucdavis.edu/esadocs/vincniqr.html>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=5>
<http://www.bioone.org/bioone/?request=get-abstract&issn=0043-1745&volume=050&issue=02&page=0179>
http://www.friendsofalewifereservation.org/2003_08_01_summerbridge.htm
<http://www.invasive.org/eastern/biocontrol/16SwallowWorts.html>
<http://www.ipcnys.org/invasive%20species/black%20swallow-wort.htm>



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Cynanchum rossicum - Pale Swallow-wort New Hampshire Prohibited Invasive Species

Description: Pale Swallow-wort is a herbaceous perennial vine in the milkweed family, 2 to 6 feet in height. *Cynanchum rossicum* is vegetatively very similar to *Cynanchum louiseae*. Flower size: 0.125 inch across, small and fleshy, with 5 pink to maroon colored petals. They are borne in loose clusters and are visible in late May through mid July. The stems can reach 5 feet in length. The petioles measure 0.4 inches long. The leaves are opposite in arrangement, oval to wedge-shaped, with pointed tips. Generally, the leaves are 2.5 to 4.5 inches long and 2 to 2.75 inches wide. They are glossy and medium-green in color. In summer, the leaves display a warm yellow color. The fruit is a smooth, slender, pointed pod. The pods are light-green in color and are frequently borne in pairs. They are abundant during July and August. Like milkweed, the pods open in late summer, disseminating large numbers of downy seeds.

Habitat: Pale swallow-wort can be found almost anywhere, including woodlands, fields, and along roadsides, floodplains, urban areas and utility rights-of-way. It does well in almost any upland situation.

Distribution: Pale swallowwort was introduced from Europe in the 19th century. Although its history of introduction is uncertain in New England, the first record for *Cynanchum rossicum* is from New Haven, Connecticut, in 1881. In the United States, it has been reported from Missouri, Michigan, Indiana, Pennsylvania, New York and New Jersey. The seeds of *Cynanchum rossicum* are dispersed primarily by wind. If they were to fall into moving water, they would float and be transported downstream.

Similar Species: The flowers of *Cynanchum rossicum* and *Cynanchum louiseae* differ. The corolla of *Cynanchum rossicum* is glabrous and ranges in color from maroon to dark pink, its lobes are longer than wide and are shaped like an isosceles triangle while the membrane connecting the segments of the corona is approximately half their length. The peduncles are 0.8-2.0 inches long; the follicle is 1.6-2.4 inches long and 0.2 inches wide.

Threats: The threats presented by *Cynanchum rossicum* are similar to those of *Cynanchum louiseae*. Currently, *Cynanchum rossicum* is more restricted in its range than *Cynanchum louiseae*, however, *Cynanchum rossicum* is still a vine that can grow rapidly over native vegetation. It also has the ability to dominate the understory of a woodland. Wind-dispersed seeds allow it to disperse over long distances.

Control: When it is cut, this plant resprouts vigorously, making control difficult. Once established, pale swallow-wort is difficult to control. Small patches must be dug out by hand. The entire crown must be removed and destroyed. Large stands can be managed to prevent seed crops by mowing when pods are very small (early July). Large stands can also be cultivated on a yearly basis to achieve control over time. Stay out of infested areas during seed dispersal to prevent seed dissemination to unaffected areas. Likewise, clean boots, ATVs and other equipment when coming out of infested areas.

LINKS: http://webapps.lib.uconn.edu/ipane/jpg/images.cfm?unique_identifier=uconn_ipane_cyanrossi_08
<http://invasives.eeb.uconn.edu/ipane>
http://www.pathologyimagesinc.com/wildflowers/part-s_t/swallowwort-pale/swallowwort-pale.html
<http://www.swallow-wort.com/>

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<http://www.ct-botanical-society.org/galleries/cynanchumross.html>



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Egeria densa* -- Brazilian elodea

Federal Noxious Weed List



Description: Brazilian elodea (*Egeria densa*) is an attractive, robust plant well-suited to aquarium life. It was commonly sold in pet stores under the name "anacharis." It was also sold in plant nurseries as an "oxygen" plant. Brazilian elodea is a very bushy plant with dense whorls of bright green leaves (except when growing with insufficient light, in which case the leaves are widely spaced). Brazilian elodea usually has four leaves per whorl (arranged around the stem) and each leaf is at least 0.8 inches long.

Habitat: It can be found in both still and flowing water, including lakes, ponds, small streams and ditches. In the Northeast, it is usually found in small ponds.

Distribution: Brazilian elodea grows very well in lakes when thoughtless people dispose of aquarium contents or when boaters carry it from an infested lake into an uninfested waterbody. Once introduced, Brazilian elodea reproduces by the spread of plant fragments. Because all the Brazilian elodea plants in the United States are male, no seeds are produced. Branches sprout from "double nodes" located at about eight inch intervals along the stems. If a Brazilian elodea fragment does not have a "double node", it can not grow into a new plant. **NH sites:** http://www.des.state.nh.us/wmb/exoticspecies/milfoil_list.htm

Similar Species:

Character	<i>Egeria densa</i>	<i>Hydrilla verticillata</i>	Native Elodea
	Bushy plant with dense whorls of bright green leaves (except when growing with insufficient light, in which case the leaves are widely spaced)	Has tiny spines along the leaf margins. The midrib of each leaf is often reddish. Produces tubers - small potato-like structures	
Leaf lengths	0.5 – 1.6 inches	0.24 – 0.70 inches	0.24 – 0.7 inches
Leaf whorls	4 (6)	(2), 4 - 6	3
Leaf margins	Fine teeth seen with 10x lens	Conspicuously toothed	Appearing entire
Lower leaf midrib	Toothless	May be toothed	Toothed
Flower size	Large (> 0.6 inches)	Small (< 0.4 inches)	Small (< 0.4 inches)

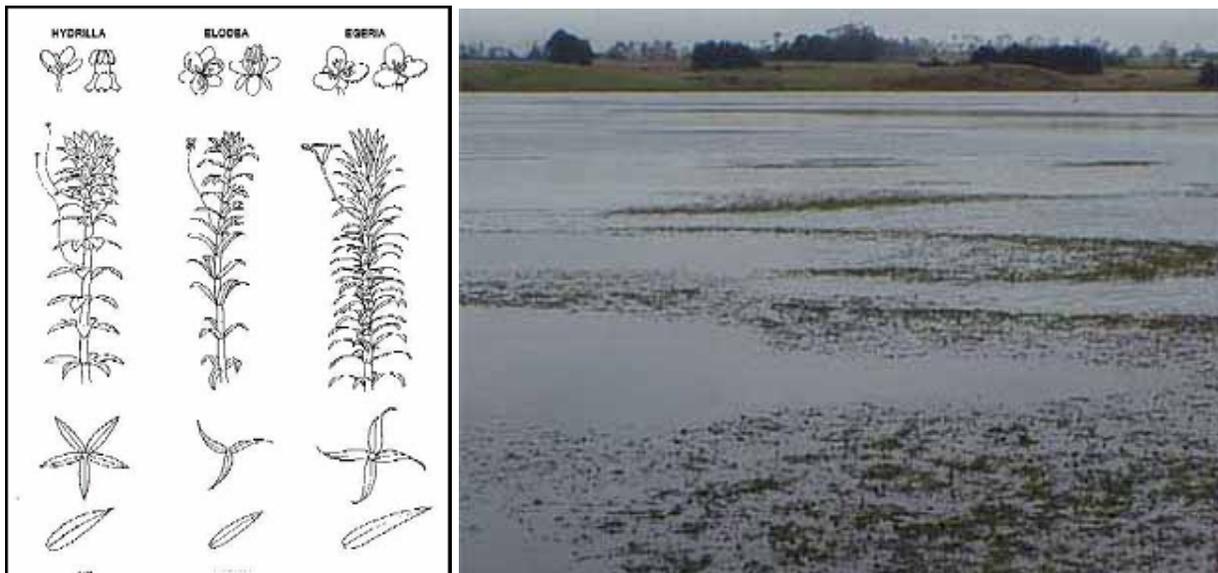
Threats: When introduced to a lake, *Egeria densa* forms dense, unsightly mats that choke out native aquatic plants and provides a very poor habitat for fish. This plant interferes with fishing, boating, swimming, and other recreational activities.

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Control: Because Brazilian elodea is from South America and was originally imported disease and insect free for the aquarium trade, it has few natural predators to keep its growth in check. In lakes where Brazilian elodea is established, it may outcompete Eurasian watermilfoil (milfoil). Harvesting tends to spread the plant around and some aquatic herbicides do not effectively control its growth. Stocking sterile (triploid) grass carp does show promise as a control technique because Brazilian elodea is highly palatable and older grass carp will eat it in preference to other plants. However, stocking grass carp is illegal in New Hampshire. Lake residents face big bills for control costs when Brazilian elodea becomes established. California allocated two million dollars in 2000 to manage the problems with Brazilian elodea in the Sacramento-Delta area.

Alternatives: Canadian elodea or American waterweed (*Elodea canadensis*) looks very similar to Brazilian elodea. Because it is a native species, American waterweed does not create the same kind of serious problems as Brazilian elodea, although it has been known to become weedy in nutrient-rich waters.

LINKS: http://www.des.state.nh.us/wmb/exoticspecies/milfoil_list.htm
<http://www.ecy.wa.gov/programs/wq/plants/weeds/egeria.html>
http://www.chicagobotanic.org/research/conservation/invasive/egeria_densa.html
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=17>



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***Elaeagnus umbellate* -- Autumn olive**

New Hampshire Prohibited Invasive Species List



Description: Autumn Olive is rounded woody shrub or small tree reaching 15 - 20 feet in height. **Leaf:** Alternate, simple, elliptic to ovate in outline, 1 to 3 inches long, 1 to 1.5 inches wide, lanceolate in shape with an entire margin. Leaves are green and distinctly scaly on top and a silvery-green on the bottom. Leaf margins are often wavy (undulate) and are untoothed. **Flower:** Bell-shaped, 0.5 inches long, very fragrant, lacking petals, yellow to cream colored, appears in May. Occur in clusters of 5 to 10 in the region between the central stem and branches (axillary clusters). Individual flowers are approximately 0.5 inches long, and are also covered with silvery 'scales'. **Fruit:** Berry-like, red covered with silver scales, 0.25 to 0.33 inches long, sweet and juicy. Bunches of berries start as a spotted light green in mid-summer turning red in the autumn. They occur in axillary clusters throughout the plant. Annual fruit production starts at about five years and ordinarily is very heavy. **Twig:** Young branches are silvery and scaly, and may bear thorns. Later developing a light brown color. Buds are small, silvery-brown and rounded, covered with 4 scales. **Bark:** Smooth and gray when young, becoming split and furrowed later.

Habitat: Found in pastures, hay fields, roadsides, and rights-of-way, Autumn Olive tolerates many types of soils and substances that are toxic to other species. This olive thrives in sand, glacial till, and disturbed soils, as the Elaeagnaceae family can fix atmospheric nitrogen. Root nodules on the autumn olive are infected by an endophyte that maintains a symbiotic relationship with the roots and help provide nitrogen or nutrients for the plant by fertilizing themselves making them able to thrive in nutrient deficient soils. Autumn olive prefers dry conditions but will grow in semi-wet sites. It also prefers full sun or partial sun; full dense shade will kill them over a long period of time, often several years.

Distribution: Autumn olive was introduced into the United States from east Asia in the 1830's. Autumn olive is found from Maine to Virginia, and west to Wisconsin. Autumn olive was planted in large numbers because of its fast growth, easy propagation, nitrogen-fixing abilities, tolerance to high pH soils, drought, and pollutants. *E. umbellata's* ability to fruit heavily and be spread rapidly by berry-loving birds makes autumn olive a greatly successful invasive species. A mature specimen can produce 2 to 7.7 lbs. of seed per year, with the number of seeds ranging from 20,000 to 54,000. Four species of upland game birds, two migratory game birds, twenty non-game birds, and four mammals eat the fruits.

Similar Species: Similar to Russian Olive. Both are woody, invasive shrubs with a silvery cast and conspicuous red berries. Russian olive has leaves that are much more elliptic to lanceolate, and has branches that are usually thorny.

Threats: In New England, Autumn olive is a particular threat to open and semi-open areas. Russian olive may also escape from cultivation, but is less common thus far. Both Autumn olive and Russian olive are tolerant of poor soil conditions and may alter the processes of natural succession. Due to nitrogen-fixing capabilities, these species have the capacity to adversely affect the nitrogen cycle of native communities that may depend on infertile soils. Both species produce large amounts of fruit which are readily consumed and dispersed by birds. Autumn olive resprouts vigorously after fire or cutting. Over

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time colonies of these shrubs can grow thick enough to crowd out native plants. Use of these species for plantings along roadways has led to high mortality rates for some species of birds.

Control: A combination of hand weeding small plants in the spring when the ground is moist and cutting down large plants near the ground and following up with a stump or crown herbicide treatment with a Roundup, a glyphosate herbicide, at 10 to 20% concentration in the autumn works best.

Manual: (1) Mowing, cutting, girdling and fire each encourages thicker, stronger growth. These create short-term control or if continued over time, a constant maintenance issue. Cutting with a chainsaw or handsaw may be used to expose the stump for herbicide treatment. A brush mower will create more debris and mess. (2) Hand pulling-- Young seedlings can be hand-pulled or, if slightly larger, may be dug out in early spring (easily seen then as it leafs out much earlier than most native species) when soil is moist enough to make it easy to pull out the plant including all the roots. Digging up larger plants is not recommended because it disturbs the soil more than needed.

Biological: Currently the only methods of biological control attempted on autumn olive have been the use of sheep and goats to browse on the plants. However, these animals will eat all species in the area including non-target species.

Chemical: Four main types of chemical controls may be used to eradicate Autumn Olive, with varying degrees of success as described below

1. Cut stump or crown treatment- is the suggested method. Cut the plant as close to the ground as possible, then apply a liquid herbicide (with a pressurized sprayer, or wiped on to the stump with a sponge-type applicator) to the stump or crown. Roundup has been proven effective at controlling autumn olive at a 10 –20% concentration, although the Roundup label suggests a 50-100% concentration. Banvel, Crossbow, and 2,4-D have also proven effective. This works best late in the growing season (July to September) but is also effective in the dormant season.
2. Soil application- although granular herbicide should be avoided in most sites (as it can be dangerous for the ecosystem and persist in the soil for a long time), Spike pellets can be effective.
3. Stem and bark treatment- a liquid sprayed or dripped onto the stems and bark of the plant without cutting down or trimming the plant. Thin-line basal bark treatments with Garlon 4, a triclopyr herbicide, have demonstrated a 95% kill. Undiluted Garlon 4, or mixed 50:50 with diesel fuel, should be applied in a thin line around the base of the plant, 6-12 inches above the ground. The herbicide may also be applied with a hand-held sprayer directly to the lower stems of the plant in the dormant season to minimize risk to non-target species. Garlon 4 should not be applied if rain is forecasted in the next four days.
4. Foliar application- While a liquid sprayed on the foliage July to August, can be effective (with 2,4-D, Ally, Banvel, and Crossbow), it is not advised because of chemical drift to non-target plants.

Alternatives: The following native plants are suggested as alternatives to autumn olive or Russian olive in revegetation and wildlife habitat plantings: sweet-fern (*Comptonia peregrina*), bayberry (*Myrica pensylvanica*), shining sumac (*Rhus copallina*), fragrant sumac (*Rhus aromatica*), staghorn sumac (*Rhus typhina*), black-haw (*Viburnum prunifolium*), shadbush (*Amelanchier arborea*, *A. laevis*), clammy locust (*Robinia viscosa*), redbud (*Cercis canadensis*), New Jersey tea (*Ceanothus americanus*).

LINKS: www.vnps.org/invasive/inveleag.htm

<http://www.cnr.vt.edu/dendro/dendrology/syllabus/eumbellata.htm>

<http://www.hort.agri.umn.edu/h5015/00papers/stark.htm>

<http://www.state.me.us/doc/nrimc/mnap/factsheets/invasivesfacts/Eumbellata&angustifolia.pdf>

Virginia Tech Weed Guide Identification



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Heracleum mantegazzianum - Giant hogweed

NH Prohibited Invasive Species List



Description: Giant hogweed is a member of the carrot or parsley family and its most impressive characteristic is its massive size. Giant hogweed is a biennial or perennial herbaceous plant that reaches up to 15 feet in height. Its leaves grow up to 5 feet wide. The hollow stems of the plant are 2 to 4 inches in diameter. Large numbers of small white flowers are borne on the umbel-shaped inflorescence that extends 2.5 feet across the top. The many seeds produced by each plant can remain viable in the soil for up to seven years.

Habitat: Giant Hogweed grows particularly well where the soil has been disturbed: along roadsides, rights-of-way, vacant plots, streams and rivers, ravines, gardens, barnyards, orchards, railway lines, wastelands, where erosion combined with a good supply of groundwater provide ideal conditions. During winter it causes soil erosion because Giant Hogweed dies off and exposes bare riverbanks where other plants would otherwise be. Because it often grows in wet areas, it could be considered to be an invasive freshwater weed.



Distribution: Giant hogweed is a perennial which takes several years from germination to produce the first flowering stalk. It is believed to be monocarpic, dying after first flowering and seed set. Individual plants however, may produce additional crowns which continue to flower and set seed. Seed longevity is known to be greater than seven years. Reproduction is through seed and perennating buds formed on the crown and tuberous root stalk. Abundant seed production, a persistent root stalk, and vegetative reproduction from perennating buds are cited as reasons for its capability to colonize rapidly and expand populations. In New England, it has been found in New York, Connecticut and Vermont.

Similar Species: It looks very similar to cow parsnip, which is a common native plant in the northwest.



Cow Parsnip



Angelica



Hemlock

Threats: Giant Hogweed is a public health hazard. The plant exudes a clear watery sap from the leaves and particularly the stem. The sap contains a glucoside called furanocoumarin, which renders skin photosensitive. This means that exposure to sunlight following contact causes severe blistering, burns to the

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affected areas and sometimes inflamed linear lesions on the skin. Blisters can develop into purplish or blackened scars. This reaction can occur up to 48 hours after contact and in some cases results in recurrent dermatitis. Contact with the eyes can lead to temporary or possibly permanent blindness. As the leaf hairs can penetrate fabrics, protective clothing should be worn to safeguard against contact with the sap. If you do come into contact with the plant, you are advised to wash the affected areas immediately, keep them out of direct sunlight and seek medical advice at the earliest opportunity. Treatment with topical steroids early in the reaction can reduce its severity - this must be done after taking medical advice. Otherwise it is a case of preventing infection, covering with light dressings and waiting for recovery.

Control: Manual: If undertaking manual removal, avoid skin and eye contact with the sap of giant hogweed. Wear waterproof gloves, long sleeves, protective clothing and eye protection (glasses or goggles) if you plan to cut down or handle the plants. Do not use a "weed-whacker" or brush-cutter blade to cut giant hogweed because its sap could be splattered on you as stems are cut. A long, sharp serrated knife is the best tool for cutting hogweed stalks or leaves. Have several large plastic trash bags ready in preparation for disposing of hogweed flowers and seeds. Clear trash bags are best to solarize the contents to help destroy seed viability, but dark bags are suitable as well. Double or triple bag the plant parts to prevent ripping of bags by cut stems. Carefully cut off all inflorescences (flower heads) and place in trash bags. If seeds have formed, be especially careful to avoid shedding of seeds onto ground during the cutting and bagging process. It is best to do this prior to seed formation, because more mature seeds tend to shed easily. If seeds are shedding, contain them within as small an area as possible. To prevent re-flowering, carefully dig out the roots and allow plants to thoroughly dry before disposal.

Chemical: Spray leaves with a herbicide containing glyphosate as the active ingredient ("Roundup" or similar product). Either apply a ready-to-use spray, or dilute a concentrated glyphosate product according to the label directions. It is best to apply during the summer months when hogweed leaves are green and actively growing. Be patient: glyphosate is a slow-acting herbicide, so it may take up to 1 week before symptoms begin to appear as the plant eventually dies. Do not cut or dig up the plant until the top growth has died back. If the leaves remain green 2 weeks after initial treatment, spray them with glyphosate again.

Maintenance: Check the site and surrounding areas for the next several years for emergence of any hogweed seedlings or regrowth from previous year's plants. Reports suggest that giant hogweed seeds can remain viable in the soil for 7 years, so long-term monitoring is paramount.

LINKS: <http://www.ceinfo.unh.edu/common/documents/gianthg.htm>
<http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua012.html>
http://www.hort.uconn.edu/cipwg/giant_hogweed.html
http://www.aphis.usda.gov/oa/pubs/poster_phhogweed.pdf
<http://www.appliedvegetationdynamics.co.uk/hogweed/habitat.htm>



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Hydrilla verticillata** -- Hydrilla*Federal Noxious Weed List**

Description: *Hydrilla verticillata*, a wholly submerged branching perennial herb with sales prohibited in the United States by Federal law, has invaded water bodies across the United States. **Stems:** Pale green, vertical, slender, branching above and rooting freely from the lower nodes, to 26 feet long depending on water depth; stolons are short slender lateral stems forming on or slightly below the surface of the bottom mud. Vegetative reproductive organs, tubers and turions are produced, respectively, on the stolon and stem apices and as short lateral branches along the upper stems. **Leaves:** Pale to bright green, often red-streaked on the prominent midrib and margins, sessile; upper leaves in distinct whorls of 4 to 6, sometimes 3 to 8, linear-lanceolate, 0.4 to 1.2 inches long, margins with strong forward-pointing teeth; lower leaves smaller and fewer, often in opposite pairs only. **Flowers:** Solitary, inconspicuous, 0.12 inches across, exerted from spathes in leaf axils and carried to the surface on thread-like perianth tubes (hypanthia), perianth segments 6; female flower, spathe sessile, usually one in each leaf whorl, 3 filamentous stigmas, male flower, exerted from spathes on short stems, usually several to each leaf whorl, stamens 3. **Fruit:** Cylindrical, 0.12-0.6 inches long, 0.12-0.24 inches diameter, develops within spathe and contains 0 to 6 seeds. **Seed:** Green to dark brown, shiny, 0.08-0.1 inches long, seedcoat extended at each end. **Root:** Filamentous, rising from the lower stem nodes. (Parsons and Cuthbertson, 1992).

Habitat: *Hydrilla verticillata* is found in a variety of aquatic habitats including warm freshwater ponds and slow-moving streams, but rarely in swift-flowing water. Can grow in cool and brackish water. The plant is normally firmly rooted in the bottom mud but occasionally breaks free and forms free-floating mats.

Distribution: Reproduces both sexually and asexually. Male and female flowers are usually borne on separate plants but occasionally plants are bisexual. Local extension may occur from tubers and stolons. Most commonly, pieces break free and float to new locations. Hydrilla can spread rapidly by fragmentation and produces numerous tubers in the hydrosol and turions in the leaf axils; these reproductive structures allow the plant to survive drawdowns and cold winters. It has not yet been documented in New Hampshire, but has been spotted in Connecticut.

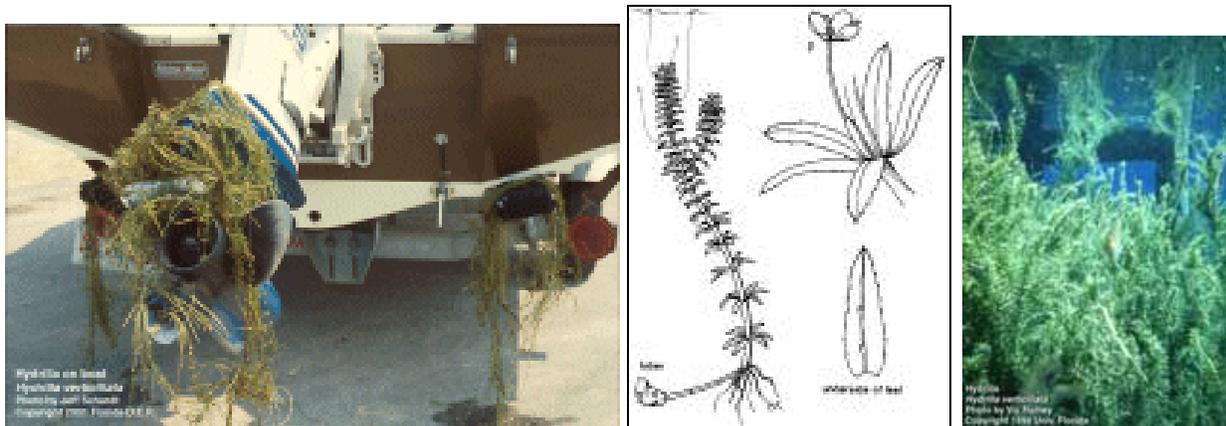
Similar Species: Hydrilla is often confused with Brazilian Elodea (*Egeria densa*—another invasive) and two native species of American Elodea (*Elodea spp.*). *H. verticillata* has sharply serrated leaf margins (usually visible to the naked eye), red veins, spinous midrib and scabrous texture, and has anthers that open explosively. However, leaf morphology, the variation in the number of leaves per node, and variation in hydrilla under different conditions make misidentification common.

Threats: Hydrilla can elongate 0.8-1.2 inches per day as it approaches the water surface. Near the surface, it branches profusely, with 50% of the standing crop occurring in the upper 0.1 inches of the water column. The large mats of surface vegetation intercept sunlight thus excluding other submersed plants. Both inorganic and organic sediment levels increase with increasing hydrilla abundance. Such increases may themselves have effects on aquatic community composition. In natural systems, as well as in channels and rivers providing urban and agricultural water supplies, hydrilla slows the movement of water. Supply, drainage and irrigation uses are hampered. Recreational uses (e.g., boating) are also degraded.

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Control: 1) **Manual and Mechanical:** Specialized machines are used for mechanically removing *H. verticillata*, often costing over \$1000 per acre. Up to six harvests may be required annually due to the rapid growth rate of *H. verticillata*. Mechanical removal is mainly used for *H. verticillata* management only in areas that are in close proximity to domestic water supply intakes, in rapidly flowing water, and or when immediate removal is necessary. Mechanical methods are usually only temporarily effective, and may serve to spread the plant. 2) **Drawdowns** can be effective if done while subterranean turions are developing in the fall, and prior to regrowth in the spring. Drawdowns are limited to lakes or ponds having water control structures and hydrologic characteristics permitting water levels to be controlled. Even in drained dewatered lakes and ponds, subterranean turions may remain dormant and viable in organic substrates. 3) **Chemical:** "In flowing water acrolein is used extensively, and controlled delivery of fluridone. In ponded waters overseas, chelated copper compounds, diquat, paraquat, diuron and granular formulations of endothal and 2,4-D have given good control. The length of exposure required to give effective control varies with the herbicide used, the bipyridyls, diquat and paraquat, usually giving the quickest kill." The most effective herbicides are the contact poisons copper sulfate (brand name Komeen and others) and endothal (brand name Aquathol and others), and the systemic herbicides fluridone and bensulfuron methyl. For both methods, concentration in the water column and exposure time are key variables determining effectiveness. Copper sulfate and endothal are non-selective herbicides -- copper sulfate is highly toxic to fish. Fluridone has been used to control *H. verticillata* in Lake Okeechobee in Florida with minimal to no long-term impact on native aquatic plants. Application varies by water depth, water chemistry, whether the water is still or moving, and the size of the infestation. Getsinger and Netherland (1997) report that the following formulations have been shown effective: for endothal, 2.0 mg ae/L for 48 hours or 3.0-5.0 mg ae/L for 24 hours; for fluridone, 15-30 ug/L for 20-40 days (minimum of 4 ug/L); and for bensulfuron methyl, 25 ug/L and higher for in excess of 42 days. The use of plant growth regulators such as fluridone and bensulfuron methyl is relatively recent, and is intended to reduce, but not to necessarily eliminate, *H. verticillata*. Less vigorous remnant plants may perform useful functions such as providing oxygen, stabilizing sediment loads, and creating habitat. Acetic acid in concentrations of 9-26 mmol/L for 24 hours reduced growth by 50% in laboratory studies. 4) **Biological:** The white amur or Chinese grass carp has been used, but this species of fish is invasive (and illegal in NH). Grass carp is recommended for small ponds or lakes and canal systems where the fish can be retained within the water body and where the removal of all vegetation is acceptable. There is no adequate method of recapture. Since Chinese grass carp prefer food other than *H. verticillata*, the likely impact on natural areas, and even managed systems is a reduction in the overall abundance of native aquatic plants, and the potential reduction in food and habitat for invertebrates, other fish, and waterfowl, are to be expected. Over 40 species of insects have been found that feed on *H. verticillata*. Several are presently being evaluated as potential *H. verticillata* biosuppressants biocontrols in the US.

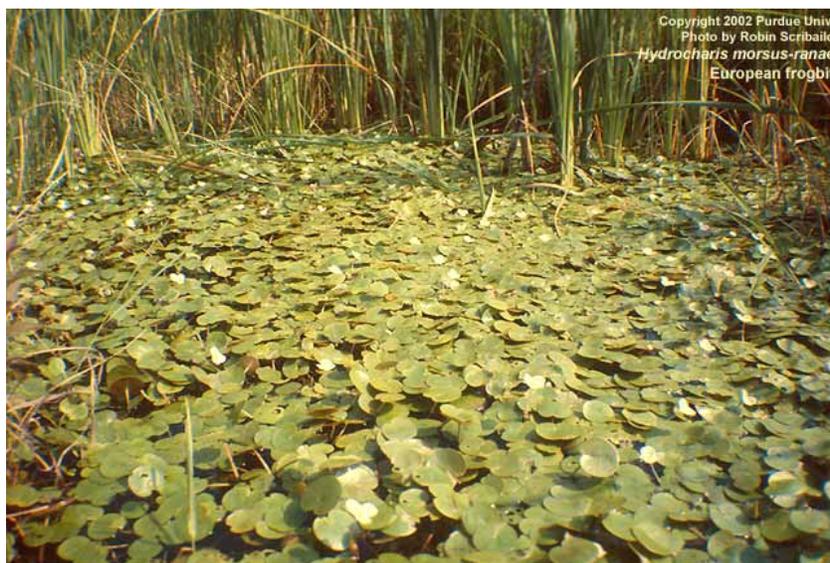
LINKS: <http://www.des.state.nh.us/wmb/exoticspecies/fourteen.pdf>
<http://tncweeds.ucdavis.edu/esadocs/documnts/hydrver.html>
http://www.hear.org/pier/species/hydrilla_verticillata.htm
<http://www.anr.state.vt.us/dec/waterq/ans/objects/hfs.pdf>
<http://www.cropsci.ncsu.edu/aquaticweeds>
<http://www.iisgcp.org/EXOTICSP/images/hydrilla/hydrver3.jpg>



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Hydrocharis morsus-ranae* -- European frogbit

Federal Noxious Weed List



Description: *Hydrocharis morsus-ranae* is an herbaceous, annual aquatic that can reach 8 inches in length. The plant is free-floating (unattached to the bottom of the water body). The leaves of this plant are usually floating, but if the vegetation is dense enough, they can be emergent. The leathery, glabrous leaves are cordate-orbicular in shape and measure 0.5 - 2.25 inches long and 0.5 - 2.5 inches wide. The lower leaf surfaces are often dark purple in color. The lateral veins of the leaves are broadly arching, making a 75 to 90 degree angle in relation to the midvein. *Hydrocharis morsus-ranae* is a dioecious plant. One to five staminate flowers are contained in spathes borne on pedicels that measure 1.5 inches long. There is only 1 pistillate flower on each plant. The 3-petaled pistillate flowers are white in color with a yellow spot in the center. These flowers measure 0.4 inches across. The pedicels of the pistillate flowers measure 3.5 inches long. The seeds of *Hydrocharis morsus-ranae* are around 0.04 inches in size. It can also produce stolons, which allow it to reproduce asexually. It is able to form large colonies that appear as dense floating mats of vegetation.



Habitat: Aquatic Lake or Pond River or Stream -- *Hydrocharis morsus-ranae* does well in quiet open water. It can be found in marshes, ditches and swamps. It grows well in sheltered coves and along the still water shorelines of rivers, lakes and streams.

Distribution: *Hydrocharis morsus-ranae* is native to Europe. In North America it has spread from original sites in Ottawa, Canada to Quebec, the St. Lawrence River, Lake Erie and Lake Ontario. In the U.S. it is currently found at limited sites in the states of New York and Vermont. *Hydrocharis morsus-ranae* spreads rapidly by way of long cord-like stolons, easily giving rise to a floating mat of interconnected plants. It is capable of over wintering by forming vegetative buds, called turions, located at the base of the plant. *Hydrocharis morsus-ranae* is also capable of sexual reproduction, but seed production is often limited and sometimes non-existent. The nearest documentation of *Frogbit* is in Lake Champlain, VT.

Similar Species: *Limnobium spongia* (Bosc) Richard ex Steudel (American frogbit)

<u>Character</u>	<u><i>Hydrocharis morsus-ranae</i></u>	<u><i>Limnobium spongia</i></u>
Lateral vein angle to midvein	75 to 90 degrees	30 to 80 degrees
Aerenchyma on leaf	Mostly along midvein	Margin to margin

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Threats: Its rapid vegetative spread and ability to form dense mats can limit light penetration and fill the water column in shallow areas. In doing so it can strongly affect native aquatic life. It can also inhibit boat traffic and limit recreational activities.

Control: Either this plant is getting less attention than other invasive aquatics, or I've had less luck finding controls for this one. Several publications say, "No control measures have yet been reported for European frog-bit. However, mechanical (i.e., hand removal) removal of mats where they have become a nuisance to boaters may provide a temporary solution."

The Mississippi State University Extension Service states the following two methods are effective:

- (a) 2,4-D Amine (2,4-D Dimethylamine salt) -- 1 gallon of any 2,4-D Amine containing 4 pounds acid per gallon, 8 ounces of detergent, and 50 gallons of water per surface acre. Mix and spray evenly over plants.
- (b) Diquat -- ½ to 1 gallon per surface acre. Mix with enough water to allow even coverage, and spray directly on plants.

LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=56>
<http://www.des.state.nh.us/wmb/exoticspecies/fourteen.pdf>
<http://ipm.ncsu.edu/Agchem/chptr8/823.pdf>
<http://msucares.com/pubs/infosheets/is1030.htm>



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***Iris pseudacorus* -- Water-flag**

New Hampshire Prohibited Invasive Species List



Description: *Iris pseudacorus*: when flowering, the very showy, yellow iris flowers are the best identifying characteristic--they are the only yellow irises in the United States. Otherwise, this is a tall plant with long, dark green, flattened, sword-like leaves, stout rhizomes, 0.4-1.6 inches in diameter; roots are 4-12 inches long. Leaves are erect with upper part arching; leaves flattened, arising in a fan from the soil; raised midrib; sword-like, fine-pointed; 3-4 feet in height. Flowers in early spring in the south (Florida) and in summer in the north (Canada) on erect stalks (peduncles) 3-4 feet in height; bisexual; large, showy, pale to deep yellow; several flowers on each stem; flowers having 6 clawed perianth segments including 3 large downward-spreading sepals and 3 smaller erect petals; on each flower sepal (yellow, large and petal-looking) are patterns of delicate light-brownish to purple veins or flecks fruit a capsule (seed pod); large 1.6 to 4 inches 3-angled cylindrical, glossy green; many flattened brown seeds.

Habitat: *Iris pseudacorus* is native to Europe and the British Isles, North Africa and the Mediterranean region (Cody 1961). It is found throughout most of the US and Canada. It has escaped mainly into freshwater wetlands, but also can be found in floodplain forests, lakes or ponds, rivers or streams, yards or gardens -- in water up to 10 inches deep. It can tolerate high acidity pH 3.6 to pH 7.7, and the upper zones of salt marshes. The plant tends not to favor calcareous substrates, though there are exceptions, like along the Housatonic River of Connecticut. Yellow flag rhizomes can withstand long periods of anoxia (low soil oxygen).

Distribution: especially showy during its short blooming period, this good-looking aquatic plant has been transplanted into well-watered gardens all over the world and has widely escaped. It is also used in sewage treatment, and is known to be able to remove metals from wastewaters. Like cat-tails, yellow iris colonizes into large numbers, forming very dense monotypic stands, out-competing other plants. Unfortunately, the attractive *Iris pseudacorus* continues to be sold through garden centers and plant dealers and over the Internet. It is pollinated by humble-bees and long-tongued flies -- spreads by underground rhizomes and seeds. Its leaves sometimes die back over winter, but persist if winters are mild. It is tolerant of drought; "excavated rhizomes continue growing after three months without water". Seeds germinate and grow well after being burnt in late summer. "Individuals produce from several dozen to several hundred rooted rosettes and flowering shoots connected by durable rhizomes.

Similar Species: *Iris pseudacorus*, especially when not in bloom, might be confused with native irises, which have more-or-less identical leaf structure and size the larger *Typha* (cat-tail) species, which look similar in structure and height.

Threats: *Iris pseudacorus* forms almost impenetrable thickets, in much the same way as cat-tails (*Typha*) do. In its native habitat, this plant is not widely grazed because of the glycosides it contains, making it poisonous to grazing animals. No birds are known to disperse the seeds of this plant. *Iris pseudacorus* is still sold and used for water gardens.

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Control: Care should be taken when pulling or digging yellow iris because resinous substances in the leaves and rhizomes can cause skin irritation (Cooper and Johnson 1984). Mechanical removal in sensitive areas, such as shallow stream beds, can be expected to cause extensive disturbance to the substrate and permit the establishment of other unwanted plants. Cutting followed by herbicide (glyphosate) treatment with a dripless wick may be the best method for controlling plants in sensitive sites. Once an infestation, with its extensive rhizomes, has taken hold, machines and possibly fire are the only



possibilities for management.

work has been done for this species. *Iris pseudacorus* is susceptible to many registered herbicides, but is resistant to terbutryne.

LINKS: <http://aquat1.ifas.ufl.edu/seagrant/iripse2.html>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=59>
www.uib.es/.../herbari/generes/Iris/pseudacorus/
<http://www.herbarium.com/images/oldflowers/yllwiris.jpg>
http://www.chicagobotanic.org/research/conservation/invasive/iris_pseudacorus.html

No biological control



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***Ligustrum obtusifolium* -- Blunt-leaved privet**

NH Prohibited Invasive Species List



Description: *Ligustrum obtusifolium* is a woody, perennial, semi-deciduous shrub that grows to 10 feet in height. It is many stemmed and pubescent branchlets. Its opposite leaves are elliptic to oblong-ovate in shape and measure 1-2 inches long and 0.3-1 inches wide. The apex of the leaf can be either acute or obtuse in shape. The upper leaf surface is dark green -- the lower surface is pubescent, or only pubescent on the mid-rib. The white flowers of *Ligustrum obtusifolium* are unpleasantly scented and are borne in nodding panicles that measure 0.75-1.5 inches long. The flowers appear on the plant in June. The fruit are black or blue-black in color and somewhat globose in shape, measuring 0.25 inches long. Fruit appear on the plant in September and persist on the branches into the winter. Stems - Multiple to single from base, branching, woody, to 10 feet tall. Twigs are pubescent with distinct long and short hairs. It turns reddish-purple in fall; is not showy.

Habitat: Blunt-leaved privet prefers partial shade or partial sun to full sun with moist soil. It is found in yards or gardens, moist woods, stream banks, abandoned field, early successional forest, floodplain forest, open disturbed area, roadside, vacant lot, wet meadow.

Distribution: native to Japan, this is a popular landscaping hedge which can be purchased at nurseries, garden centers and over the internet. *Ligustrum obtusifolium* reproduces by seeds often dispersed by birds that eat its fruits and defecate the seeds. Improper yard waste disposal can spread this invader. It is found in most of the northeastern and midwestern states, and as far south as Tennessee and North Carolina. It has been reported in all of the states of New England except Maine.

Similar Species: Identifying the privets that escape and become naturalized is problematic at best. A positive identification can only be made when the plants are in flower. This usually occurs during a few weeks in June. Even then, exact determinations can be difficult because of the possibility of hybrids, cultivars, synonyms, and incorrect determinations. It is also unclear exactly what species occur in the region. To date, we know that *Ligustrum obtusifolium*, *L. ovalifolium* and *L. vulgare* have been reported in New England. Other species may be erroneously reported or represent species not currently documented from the region. Privets are often confused with shrub honeysuckle.

Character	<i>Ligustrum obtusifolium</i> California privet	<i>L. ovalifolium</i>	<i>L. sinense</i> Chinese privet	<i>L. vulgare</i> European privet
Corolla tube	0.1 - 0.12 inches	0.2 - 0.4 inches	0.2 - 0.4 inches	0.1 - 0.12 inches
Anthers	Not reaching the tips of the corolla lobes	Surpass the corolla lobes	Reach nearly to the tip of the corolla lobes	Surpass the corolla lobes
Twigs	Minutely puberulent	Glabrous	Pubescent	Densely pubescent

Threats: Like *L. vulgare* and *L. sinense*, this plant is capable of escaping to form dense thickets that can crowd out native species.

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Control: Mowing and cutting are appropriate for small initial populations or environmentally sensitive areas where herbicides cannot be used. Stems should be cut at least once per growing season as close to ground level as possible. Repeated mowing or cutting will control the spread of *Ligustrum* spp., but may not eradicate it. *Ligustrum* spp. can also be effectively controlled by manual removal of young seedlings. Herbicide control measures include foliar spraying in late autumn or early spring with glyphosate, triclopyr, or metsulfuron; cut stump applications using glyphosate or triclopyr; and basal bark applications of triclopyr. Some reports indicate that burning top-kills *L. vulgare* and *L. sinense* and, if repeated, can eliminate them over time.

LINKS: http://tncweeds.ucdavis.edu/esadocs/documnts/liqu_sp.html
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=61>
http://www.google.com/search?hl=en&lr=lang_en&ie=UTF-8&oe=UTF8&q=mississippi+flora+Ligustrum+&btnG=Google+Search
<http://www.hort.purdue.edu/hort/courses/HORT217/images%20-%20group%201>
http://www.pwrc.usgs.gov/history/herbarium/ligustrum_obtusifolium.htm
<http://www.hort.uconn.edu/plants/l/ligobt/ligobt3.html>
The Mississippi Flora WebSite:



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Lonicera bella (pretty) -- Showy bush honeysuckle NH Prohibited Invasive Species

General Honeysuckle Description: Exotic bush honeysuckles are dense, upright deciduous shrubs (3 to 10 feet in height) with shallow roots; opposite, simple, and oval or oblong leaves; and yellow, orange, or red berries. The shaggy-barked older stems and branches of the shrubs are often hollow. Flowering occurs during May and June, and produces fragrant, tubular initially white flowers arranged in pairs that yellow as they age. Bush honeysuckles are easy to find in early spring when they begin leaf development one to two weeks before native shrubs. Similarly, they hold their leaves later into the fall than natives.

L. Bella specific Description: As *Lonicera xbella* is the hybrid of *L. tartarica* and *L. morrowii*, identification is difficult because of its many intermediate characteristics. *Lonicera xbella* tends to be taller than either of its parents, reaching up to 20 feet in height. The ovate to ovate-elliptic opposite leaves measure 1-2.5 inches long and are slightly pubescent on their lower surface. Leaf bases are rounded or subcordate. Characters of the flowers of *Lonicera xbella* are quite variable, measuring 0.6-0.75 inches in size. Flowers are on peduncles that are longer than the subtending petioles, measuring around 0.4 inches long. The outside of the corolla of the flower is usually glabrous. The bracteoles are half as long as the ovary when the flower is fully open. The berries of this plant are rather flat, spherical, red in color and found in pairs, ripening in late summer or early fall.

Habitat: Bush honeysuckles can live in a broad range of plant communities with varying moisture and shade levels. Bush honeysuckles thrive in sunny, upland habitats, yet are also relatively shade-intolerant including forest edges, roadsides, pastures, and abandoned fields, fens, bogs, and lakeshores, sandplains and other uncommon habitat types.

Distribution: Bush honeysuckles are native to Asia and western Europe. Distribution is typically near large urban areas usually the result of horticultural plantings; rural infestations have occurred where the species were introduced to provide wildlife with cover and a food source. The seeds appear to require a cold stratification period to break dormancy. Seedlings establish in sparse vegetation, and are usually found growing under tall shrubs or trees. In the eastern United States, over twenty species of birds feed on the persistent fruits and widely disseminate seeds across the landscape.

Similar Species: Tartarian honeysuckle has smooth, hairless, bluish-green leaves with pink to crimson flowers. Morrow's honeysuckle has downy leaves, while bella honeysuckle is a hybrid between the Tartarian and Morrow's varieties. Non-tartarian species flowers are white and yellow as they age. These species can be discerned from a distance during their flower and fruit periods in late spring and midsummer. All native honeysuckles of the *Lonicera* genera--grape honeysuckle (*Lonicera reticulata*), yellow honeysuckle (*Lonicera flava*), and red honeysuckle (*Lonicera dioica*)--are woody vine-like twining species. The exotics are stout, erect shrubs. *Diervilla* species are native bush honeysuckles with yellow flowers found in dry or rocky sites.

Threats: Their vigorous growth inhibits development of native shrub and ground layer species; eventually they may entirely replace native species by shading and depleting soil moisture, competing for pollinators, and nutrients and they may release toxic chemicals. The early leafing of these species is particularly injurious to spring ephemerals, which have evolved to bloom before trees and shrubs have

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leafed out. Honeysuckle fruits, while abundant and rich in carbohydrates, do not offer migrating birds the high-fat, nutrient-rich food sources needed for long flights, that are supplied by native plant species.

Control: Mechanical Control: Since honeysuckle roots are fairly shallow, small- to medium-sized plants can often be dug or pulled. Plants are particularly easy to remove in spring when the soil is moist with a shovel or grubbing hoe -- a mattock or weed wrench can also be used. In sensitive areas, this type of removal may disturb the soil and lead to more invasions, in which case it should be avoided. Soil should be tamped down to discourage further establishment of honeysuckle seedlings. In shaded forest habitats where exotic bush honeysuckles tend to be less resilient, repeated clippings to ground level during the growing season may result in high mortality. Clipping must be repeated at least once yearly because bush honeysuckles that are cut once and left to grow will often form stands that are more dense and productive than they were prior to cutting. In fire-adapted communities, spring prescribed burning may kill seedlings and top-kill larger plants, although results have been mixed. Resprouts may occur, so repeated prescribed burning annually or biennially for several years may be necessary. **Chemical Control:** Seedlings of exotic bush honeysuckles can also be controlled by application of a systemic herbicide, like glyphosate (e.g., Roundup), at a 1 percent solution, sprayed onto the foliage or applied by sponge. Well established stands of exotic bush honeysuckles are probably best managed by cutting the stems to ground level and painting or spraying the stumps with a slightly higher rate of glyphosate (2-3%). In all instances, control should be initiated prior to the seed dispersal period (late summer to early autumn) to minimize reinvasion of treated habitats. Cut stems at the base with brush-cutters, chain saws or other tools then treat immediately with a 20% active ingredient (a.i.) glyphosate solution using a low-pressure, hand-held sprayer, sponge applicator, or contact solution bottles. Stumps can be treated after cutting with the same herbicide solution, although it may not be as effective. Two cuts per year--the first in early spring followed by one in early autumn--are recommended. If not followed by herbicide treatment, cuts made in winter will encourage vigorous resprouting when the plant comes out of dormancy. Triclopyr formulated for water dilution is not effective on this species: triclopyr formulated for dilution in diesel fuel can be used for applications on cut stumps throughout the year, although winter application has in some cases proven to be 100% effective, whereas spring treatment has shown 70-80% effectiveness. If stump treatment is not done at the time of cutting, spraying foliage on the resprouts with a 1.5% glyphosate solution can be effective. Spraying in the early spring just after the bushes emerge, but prior to the emergence of native shrubs and ground flora is the safest time to spray. In wetlands, glyphosate formulated for use over water must be used (Rodeo). Both mechanical and chemical control methods must be repeated for at least three to five years in order to stop new plants emerging from the seed bank. Re-invasion by bush honeysuckles may be aided by "underplanting" disturbed areas with tolerant native species. No biological control agents are currently available for these plants.

Alternatives: Native plants make excellent substitutes for exotic bush honeysuckles for home landscaping and wildlife planting. In the eastern U.S., examples include spicebush (*Lindera benzoin*), ink-berry (*Ilex glabra*), gray dogwood (*Cornus racemosa*), northern bayberry (*Myrica pensylvanica*), red chokecherry (*Aronia arbutifolia*), and arrowwood (*Viburnum dentatum*).

LINKS: http://tncweeds.ucdavis.edu/esadocs/documnts/lonj_sp.pdf
<http://www.botany.wisc.edu/wisflora/scripts/detail.asp?SpCode=LONxBEL>
<http://www.inhs.uiuc.edu/chf/outreach/VMG/bhnysockl.html>
<http://www.nps.gov/plants/alien/fact/loni1.htm>



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Lonicera japonica -- Japanese honeysuckle

NH Prohibited Invasive Species List



Photo by Matthew C. Perry



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://lchlan.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





***Lonicera morrowii* -- Morrow's honeysuckle**

NH Prohibited Invasive Species List



Description: *Lonicera morrowii* is a woody, perennial shrub that reaches 8 feet in height. The stems of this shrub are hollow. The oppositely arranged leaves are oblong to narrowly elliptic in shape and measure 1-2.5 inches long. The apex of the leaves are usually obtuse, but can be somewhat acute. The leaves are fairly thick, grayish and tomentose on their lower surface. The peduncles (stems) are 0.2-0.6 inches in length and very hairy and can become 3.5 feet high. The bractlets, sepals and corolla are also pubescent. The bracteoles are more than half as long as the ovary when the flower is fully open. The paired flowers of *Lonicera morrowii* measure 0.5 inches long and are usually white—fading to yellow with age, appearing late May to early June. Fruits are red in color, found in pairs and are spherical in shape, measuring 0.25 inches in diameter. The berries appear in mid summer and are usually gone by fall.

Habitat: *Lonicera morrowii* can be found in a wide variety of habitats ranging from yards and gardens to fields and open forests. It prefers mesic soils, but does well in dry, sandy soils in calcareous areas.

Distribution: *Lonicera morrowii* is native to Japan. In the United States it has been reported from the east coast, south to South Carolina and west to Minnesota, Iowa, Missouri and Arkansas. In New England, it has been reported in all states. The seeds of *Lonicera morrowii* are mainly dispersed by birds which eat the fruits, and then disperse the seed. Honeysuckles are also sold at nurseries.

Similar Species: See *Lonicera bella* for similar species. One way to differentiate between the invasive bush honeysuckles and the native is that the invasive honeysuckles have hollow stems, while native stems are solid.

Threats: *Lonicera morrowii* can form thickets that prevent other native plants from being established. It hybridizes with *L. tatarica* to form the hybrid *L. xbella* which is also extremely invasive. It can then subsequently backcross with the hybrid forming a “hybrid swarm.”

Control and Alternatives: - see *Lonicera bella*.

LINKS: faculty.etsu.edu/mcdowelt/webplantlist.htm
<http://home.hiroshima-u.ac.jp/~shoyaku/photo/Japan/Hiroshima/505Lonimorro.jpg>
<http://mini-bonsai.com/kongetu/1998/100505/k100505-7-2.jpg>
http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=LOMO2&photoID=lomo2_1h.jpg
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=67>
http://www.chicagobotanic.org/research/conservation/invasive/lonicera_morrowii.html
tncweeds.ucdavis.edu/esadocs/loni_spp.html
www.asahi-net.or.jp/~db3t-kjmt/kigi/hyotanbk.htm
www.ppws.vt.edu/scott/weed_id/morrowshnysckle6-2b.jpg

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Lonicera tatarica -- Tartarian honeysuckle

NH Prohibited Invasive Species List



Description: *Lonicera tatarica* is a woody perennial shrub that grows 10 feet in height. The stems of this plant are hollow. The oppositely arranged leaves are ovate to oblong in shape and measure 1-2.25 inches long. The bases of the leaves are subcordate to truncate in shape. The lower surface of the leaves as well as the young twigs are glabrous, or nearly so. The flowers are pink to almost red (rarely white). The shape of the flower is irregularly and deeply 5-lobed. The flowers measure 0.75-1 inches long and are borne in pairs on axillary peduncles. The corolla is glabrous on its outer surface. The flowers appear in late May to June. The paired fruit of *Lonicera tatarica* is red in color (rarely yellow) and spherical in shape, measuring 0.25 inches in diameter. These fruit appear in midsummer to early fall.

Habitat: In its native range, *Lonicera tatarica* grows in a variety of habitats including forests, mountains and swamps. It is also found in Yard or Garden, Abandoned Field, Early Successional Forest, Edge, Floodplain, Forest Open Disturbed Area, Pasture Planted Forest Roadside Utility Right-of-Way Vacant Lot. It can handle different light regimes, but grows most profusely in full sun.

Distribution: *Lonicera tatarica* was introduced into cultivation in North America in 1752, when it was used as a popular landscape plant. It most likely made its way into New England by being planted in gardens. *Lonicera tatarica* is native to Central Asia and Southern Russia. In the United States it has been reported from the northeast down to Virginia and west to Montana and Nevada. It is present in all the states of New England, and is more commonly encountered away from cultivation in the northern states. The seeds in the fruit of *Lonicera tatarica* are mainly dispersed by birds while the plants can be found at nurseries..

Similar Species: *Lonicera xbella* Zabel (Bell's honeysuckle—a hybrid between *L. morrowii* and *L. tatarica*) *L. morrowii* Gray (Morrow's honeysuckle) *L. maackii* (Rupr.) Herder (Amur honeysuckle) *L. xylosteum* L. (Dwarf honeysuckle). *One way to differentiate between the invasive bush honeysuckles and the native shrub honeysuckles is that the invasive honeysuckles have hollow stems, while native stems are solid.*

Threats: *Lonicera tatarica* can form extremely dense which suppress the growth of other native species. However, in New England, compared to *L. morrowii* and *L. xbella*, it seems to not be quite as aggressive. The difficulty with identifying the different honeysuckles has also had an impact on how well understood the impact of each individual species is on the landscape.

Control and Alternatives: see *Lonicera bella*.

LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=68>
<http://www.carsoncity.k12.mi.us/~hsstudent/wildflowers00/caprifoliaceae/tartarianhoneysuckle1.jpg>
http://www.chicagobotanic.org/research/conservation/invasive/lonicera_tatarica.html
http://www.colby-sawyer.edu/images/image_1217.jpeg
http://www.dnr.state.wi.us/org/land/er/invasive/images/LONxbel_MC.jpg

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www.cedarcreek.umn.edu/plants/album/Ionicera.html



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***Lythrum alatum* Lythraceae* - Winged loosestrife** *Federal Noxious Weed List*



Description: 4-angled stem, and leaves alternate, opposite, or even whorled distinguish this species from all others. **Stems:** 1-several, erect, stiffly branching, glabrous, smooth, 4-angled, up to 3.5 feet tall. **Leaves:** Upper usually alternate, lower usually opposite or even whorled, simple, linear to broadly lanceolate, pointed at the tip, more or less rounded at the base, the largest up to 2 inches long, without teeth, smooth - some alternate near apex, sessile, oblong, entire, acute, glabrous. **Flowers:** Solitary in the axils of the upper leaves, pinkish-purple or rose-pink, with very short stalks borne at edge of floral tube, with purple midvein. **Sepals:** Usually 6, green, united below to form a tube as long as or longer than the petals. **Petals:** Usually 6, purple, free from each other, up to 0.25 inches long. **Stamens:** Usually 6, sometimes protruding above the petals, sometimes not, unequal, adnate about 0.5 way up floral tub. **Pistils:** Ovary superior. **Fruits:** Capsules somewhat longer than broad, with numerous minute seeds. **Inflorescence -** Single or paired flowers from leaf axils in upper portion of stems. Leaves greatly reduced in inflorescence to small bracts. Flowering portion of stem to 10 inches long. Pedicels -- 0.4 inches long, with two minute opposite bracts.

Habitat: Margins of streams, wet meadows, ponds and ditches, wet prairies, marshes and wetlands.

Distribution: *Lythrum alatum* Lythraceae is found in Southern Canada and most of the eastern United States, although most commonly west of the Appalachian Mountains. It is also found in the plains region and the Rocky Mountain states.

LINKS: <http://www.npwrc.usgs.gov/resource/othrdata/plntguid/species/lythalat.htm>
<http://www.nearctica.com/flowers/iton/lythrus/Lalat.htm>
http://www.missouriplants.com/Pinkopp/Lythrum_alatum_page.html
<http://www.botany.wisc.edu/wisflora/scripts/detail.asp?SpCode=LYTALAALA#> (Richard Bauer and Kitty Knhout)



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Lythrum virgatum* -- Wand Loosestrife**Federal Noxious Weed List**

Description: *L. virgatum* is a purple-flowered loosestrife, somewhat similar to *L. salicaria*, but distinctive in that it is glabrous throughout, with leaves narrowed at the base. It reaches 2-3 feet in height with an 18 inch spread, although some cultivars reach 4 feet. The leaves of *L. salicaria* are wide (cordate) at the base and more or less covered with fine hairs (downy).

Habitat: *L. virgatum* is hardy in zones 3 to 9. Advertisements for the plant say it prefers partial shade or partial sun to full sun; soil should be dry to moist. It is found in naturalized areas and borders. It seems to have escaped from cultivation in local areas in Massachusetts and New Hampshire; it does not seem to be spreading beyond these areas.

Distribution: Self sows.

Similar Species: It is very similar to *L. salicaria* except it is smaller. Cultivars include “Morden Glean” and “Morden pink”.

LINKS: <http://www.npwrc.usgs.gov/resource/1999/loosstrf/field.htm>
http://www.jmu.edu/csmres/.../Lythrum_virgatum.html
<http://www.horticopia.com/hortpix/html/pc3493.htm>
<http://www.ag.auburn.edu/landscape/dbpages/526.html>
<http://www.msue.msu.edu/imp/modzz/00000918.html>



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Lythrum salicaria* -- Purple loosestrife**Federal Noxious Weed List**

Description: Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, has 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat. Some ornamental cultivars of purple loosestrife, like "Morden's Pink", are reported to be sterile. However, research has shown that while they may be self-sterile, they can cross with other cultivars and produce viable seed.

Habitat: Purple loosestrife is found in wetlands such as cattail marshes, sedge meadows and open bogs. It also occurs along streams, riverbanks, and lakeshores. It is opportunistic in areas that have experienced recent soil disturbance. It is not uncommon to find it growing in man-made storm-water retention ponds and in ditches next to parking lots and roads. Purple loosestrife grows best in highly organic soils, but tolerates a wide range of soils including clay, sand, muck and silt. Generally, the plant is found in full sun, but it can survive in partial shade.



Distribution: Purple loosestrife was introduced as a garden perennial from Europe during the 1800's, but may have come over even earlier as ballast in ships. To this day it is promoted by some horticulturists as a landscape plant, and by beekeepers for its nectar-producing capability. Most states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. The plant's reproductive success can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators also contributes to its proliferation in North America. Seeds blow on the wind or float down streams. Seed may be introduced via hay which was cut on a contaminated site. Hay is often used as a method for erosion control on disturbed wetland sites. Additionally, hay creates heat as it degrades which also attracts seed – alternate erosion control methods (straw, which is inert is better) should be used instead of hay.

Most seedling establishment occurs in late spring and early summer when temperatures are high. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 6.5 feet high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer. Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire

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wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Similar Species: Purple loosestrife may be distinguished from winged loosestrife (*Lythrum alatum*), by its generally larger size (native loosestrife has an average height of only 2 feet) and its opposite leaves (native loosestrife's upper leaves are usually alternate). The flowers of native loosestrife are also more widely spaced than those of purple loosestrife. Two more lythrum species have been added to the NH invasive list, including *lythrum alatum* and *lythrum virgatum*.

Threats: Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. Infestations of purple loosestrife appear to follow a pattern of establishment, maintenance at low numbers, and then dramatic population increases when conditions are optimal. This plant flourishes in wetland habitats that have been disturbed or degraded by draining, natural water drawdown in dry years, bulldozing, siltation, shore manipulation, cattle trampling, or dredging. Mudflats exposed following drawdowns will quickly be colonized if a loosestrife seed source is present. Seeds are usually present in such large numbers and germinate in such high densities that growth of native seedlings is prevented. High seed viability and prolific seed production can build up a seedbank of massive proportions. The buildup of debris around the roots enables loosestrife to invade deeper water and to form dense stands that shade out other emergent plants and push out floating vegetation by closing open water spaces. <http://www.umext.maine.edu/onlinepubs/htmlpubs/2508.htm>

Control: Prevention can't be stated strongly enough. Loosestrife seeds germinate in moist, exposed soil and do especially well in disturbed areas. Avoid any water drawdown during the growing season when mudflats are exposed where seeds can germinate. Keep disturbance by construction equipment to a minimum and closely monitor disturbed sites. **Early Detection:** Survey disturbed sites at least every three years to pinpoint locations of new infestations which are easier to control when small. Survey high risk areas, i.e., those near disturbance such culverts or beaver lodges annually. **Manual Pulling:** Early detection of the plant is important as small populations (less than 100 plants) and isolated stems are more successfully controlled than large, entrenched populations. Small populations of purple loosestrife may be removed by hand pulling. This method should be avoided after flowering so as not to scatter seed. The entire rootstock must be pulled out since regeneration from root fragments is possible. Be sure to minimize disturbances to the soil and native vegetative cover. Remove uprooted plants and broken stems from the area since the broken stems can resprout. Follow-up treatments may be needed in subsequent years to remove new plants which sprout from seed persisting in the ground. Digging plants out is not recommended as this creates disturbance, which may favor the spread of the species. **Biological:** Research by the US Fish and Wildlife Service (USFWS) and Cornell University in the 1980's identified several natural enemies of this difficult-to-control weed, having the greatest success with two species of host-specific beetles, *Galerucella californiensis* and *G. pusilla*. The biology of the *Galerucella* species is the best understood. Adult beetles emerge from over-wintering conditions about mid-May



Photo: Robert Wiedenmann



Photo: David Voegtlin

(depending on spring conditions), and begin feeding, showing characteristic "shot-hole" feeding damage. Oviposition begins soon and eggs and beetle larvae are seen beginning in June. Eggs often are laid in

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the leaf axils; after hatching, first-instar larvae often feed in the meristem. This feeding can damage the growing tip, preventing growth, flowering and, therefore, production of seeds. Later-instar larvae feed on the leaves, skeletonizing the leaves. Full grown larvae then move down the plant stems to pupate below the plant. New adults emerge in late summer, feed and prepare for diapause. One generation per year is the norm, though a partial second generation may be seen. Although these creatures do not always completely eliminate purple loosestrife from a site, they can reduce populations to more manageable and less harmful densities. The key is being able to get hold of these insects (check with the State Entomologist) and set up the correct conditions for their reproduction, as they are not immediately released into the field. **Chemical:** In areas where hand-pulling is not feasible (e.g., populations exceeding 100 plants) spot application of a glyphosate herbicide to individual purple loosestrife plants is the recommended treatment. However, over-spray can cause native vegetation to die back, and ultimately lead to even greater explosions of loosestrife invading from the seedbank. Spot application directly onto plants can ensure that no large holes appear in adjacent vegetation and that competition is relatively unaffected. Rodeo, the herbicide of choice for use in wetlands, is the most commonly used glyphosate-containing herbicide to control purple loosestrife. The safest method is to cut off stems at about 6 inches (the flower heads should be cut, bagged, and removed from the site prior to application to prevent seed set). Rodeo should be painted or dripped onto the cut surface as a 1.5% solution (2 oz. Rodeo/gallon clean water) with the addition of a wetting agent, as specified on the label. For spot spraying use a 1.0 to 1.5% solution plus .5% of nonionic surfactant. A wiper application can be used with a 33.3% solution of Rodeo, plus 5 to 10% surfactant, at the full-flower stage. Application is most effective when plants have just begun flowering (in Southern New Hampshire, usually early to mid-July). Spraying should be done again after the period of peak bloom, usually late August. It is critical that any control effort be followed up the same growing season and for several years afterwards since some plants will be missed, new seedlings may sprout from the extensive seedbank, and some plants might survive the treatment. For larger infestations where spot application of glyphosate is not practical, broadleaf herbicides can be used. They have the advantage of not harming grasses and other grass-like species, which are the dominants in most wetlands. Application of ghyphosate from a vehicle-mounted sprayer is usually necessary in areas with extensive stands of purple loosestrife. The most effective control: begin treatment at the periphery of large patches and working toward the center in successive years, allowing native vegetation to reinvade the treated area as the loosestrife is eliminated.



A Utah website says, "We like Garlon® 3A as it does not take out grasses under the target plants. Garlon® 3A can also be used near some waterways with caution. Quoting from the Garlon® 3A label: "It is permissible to treat non-irrigation ditch banks, seasonally dry wetlands, flood plains, deltas, marshes, swamps, bogs and transitional areas between upland and lowland sites. Do not apply to open water such as lakes, reservoirs, rivers, streams, creeks, salt water bays or estuaries." We use Rodeo® and an approved surfactant on purple loosestrife where underlying grass damage doesn't matter or it is desirable. The cost per gallon of applied herbicide is a bit more with the Rodeo®.



http://www.co.weber.ut.us/weeds/control/loosestrife_control.asp

A combination of 2,4-D and Banvel (dicamba) has been used on a limited basis. This formulation is broadleaf specific and apparently would not hurt the dominants if sprayed in a cattail marsh. Once the loosestrife has reached 10-15% of its mature growth, it can be sprayed with good results. Repeat treatment once during the growing season. <http://www.npwrc.usgs.gov/resource/othrdata/exoticab/effilyth.htm>

Integrated Management in Riparian Sites: Hand-pull or dig out small infestations. Apply a labeled herbicide to larger infestations to reduce their size for mechanical treatment. Apply 2,4-D to early growing plants to avoid killing desirable vegetation with use of Rodeo.

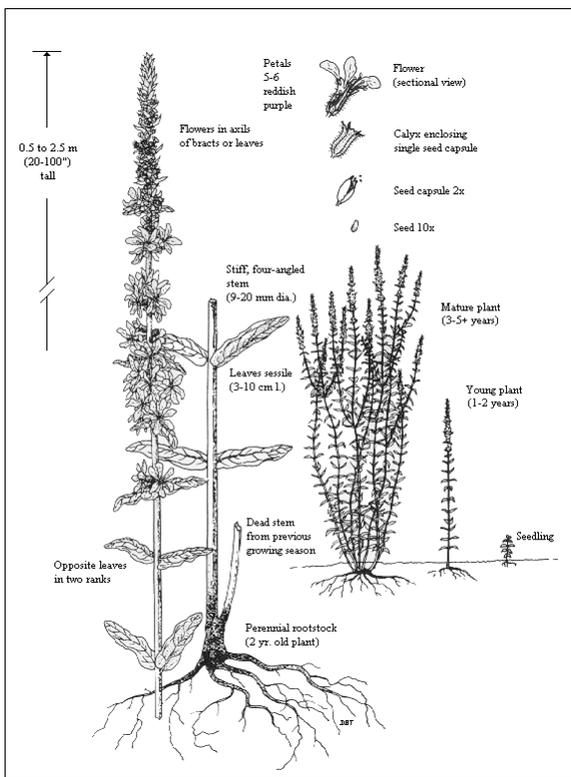
http://www.colostate.edu/Depts/CoopExt/Adams/weed/loosestrife_id.htm

Perhaps the best way to describe control of Purple Loosestrife is to depict the work at Acadia National Park in Maine where park staff have been actively managing purple loosestrife since 1988. A group of

exotic plant experts gathered at the park to review the program after ten years of implementation. They concluded that their management program is one of only a few examples of successful exotic species control due to the use of several strategies and control techniques that are integrated into an overall plan.

Alternatives: Some species which are similar in appearance to purple loosestrife but are not invasive to natural areas include the following: obedient plant (*Physostegia virginiana*) produces flowers shaped like dragon heads and the seed are a source of food for songbirds. The pink flowers of spiked blazing star (*Liatris spicata*) and button blazing star (*Liatris squarrosa*) provide food for butterflies and hummingbirds, and the seeds are eaten by songbirds. Whenever buying native species of plants, check that they are nursery-grown from seed and not taken from the wild. Collecting plants from the wild for resale can damage ecological communities and assist further spread of invasive species.

LINKS: <http://www.inhs.uiuc.edu/cee/biocontrol/weedfeeders/purpleloosestrife/purpleloosestrife.html>
http://www.chicagobotanic.org/research/conservation/invasive/lythrum_salicaria.html
<https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Invasive/wetlands.html>
<http://www.agf.gov.bc.ca/cropprot/weedquid/purplloo.htm>
<http://www.lastgreatplaces.org/berkshire/issues/art6403.html>



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Myriophyllum aquaticum* -- Parrot's feather**Federal Noxious Weed List**

Description: Parrot's feather, a member of the water-milfoil family (*Halo-ragaceae*), is a herbaceous aquatic perennial that gets its name from the feather-like appearance of its gray-green leaves. The leaves are arranged around the stem in whorls of four to six, and may be submerged or emergent. Stiff, bright green, emergent leaves are 1 to 2 inches long with 10 to 18 segments per leaf. The stem and leaves can grow up to a foot above the water surface, giving the appearance of small fir trees. The submerged leaves are limp, but the stems are stiff and very vigorous. When attached to a bank, the plant can extend several yards across the water. Male and female flowers are on different plants, but only the female plants have been found in North America.

Habitat: Parrot's feather is a native of the Amazon River and was introduced to North America in the Washington, D.C., area around 1890. It appears to prefer warmer, milder climates and has spread quickly via plant fragments through waterways and drainage systems and intentional plantings.

Distribution: This plant has spread throughout the southern United States and northward along both coasts by seed and fragmentation. Besides parrot's feather and another non-native, Eurasian water-milfoil (*Myriophyllum spicatum*), eight native species of *Myriophyllum* are found in eastern North America.

Similar Species: Coontail (coarse, roughly divided leaves.), and Eurasian Watermilfoil.

Threats: Because of its appearance and ease of cultivation, parrot's feather has been used extensively in both indoor and outdoor aquaria and as a popular water garden plant. It has escaped cultivation, however, and while parrot's feather may provide cover for some aquatic organisms, it can seriously change the physical characteristics of lakes and streams. The shade from dense infestations can alter aquatic ecosystems, and the thick growth can clog irrigation and drainage canals. Many municipalities are spending hundreds of thousands of dollars annually to control parrot's feather. Flooding, drainage and irrigation problems, and increased mosquito populations are all legacies of this single aquatic plant. Yet it continues to be a challenge to persuade garden centers to remove it from their inventories.

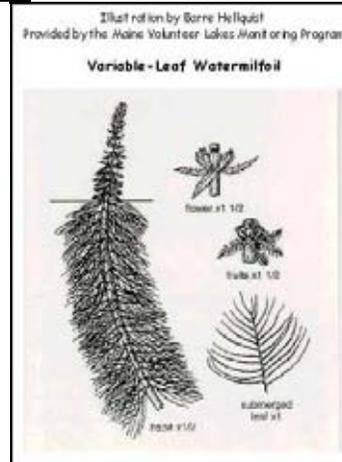
Control: Although it is considered by some to be susceptible to herbicides (especially when applied to young, actively growing plants), achieving complete control is difficult. The emergent stems and leaves have a waxy cuticle that requires a surfactant (harmful to most aquatic organisms) for penetration. One nursery owner killed a severe infestation in his irrigation pond by drawing down the pond in winter and freezing the plant out, apparently completely eradicating it. Fungal control options exist, as well. An isolate of *Pythium carolinianum* Matt. collected in California has shown some promise as a potential biocontrol agent. Parrot feather stems that were experimentally inoculated with this fungus produced significantly less growth than control plants. **Mechanical Methods:** Because this plant spreads readily through fragmentation of rhizomes, mechanical controls such as cutting, harvesting, and underwater tilling should be used only when infestations are very well established. Using mechanical controls while the plant is still invading will tend to enhance its rate of spread. **Biocontrol Potentials:** No biocontrol agents are currently available, although insects and diseases from its native range show promise.

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LINKS: *Invasive Alien Plant Species of Virginia Parrot's Feather (Myriophyllum aquaticum (Vell.) Verd.)*
<http://www.des.state.nh.us/wmb/exoticspecies/fourteen.pdf>
http://www.chicagobotanic.org/research/conservation/invasive/myriophyllum_spicatum.html
<http://www.vnps.org/invasive/invfsmyaq.htm>
http://www.dnr.state.md.us/bay/sav/key/parrot_final.html
<http://www.malibuwater.com/002/ParrotsFeather.html>



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Myriophyllum heterophyllum** -- Variable milfoil*Federal Noxious Weed List**

Description: *Myriophyllum heterophyllum* is a submerged, herbaceous aquatic plant characterized by feathery leaflets surrounding a thick, reddish main stem up to 0.1 inches in diameter. The leaves are green and in whorls of 4-6. There are two types of leaves: 1) highly variable emergent leaves are bracts and can reach 4-6 inches above the water. These leaves are stiff and can be serrated to lobed along the margins, lanceolate or lance-spatulate to elliptic. They are 0.2-1.2 inches long and 0.06-0.2 inches wide. 2) The submerged leaves are feather-like, pinnate 0.8-2 inches long and 0.75-1.5 inches wide. They have 4-10 paired pinnae. Mudflat forms have 4-5 paired pinnae. The flowers appear between July and August via a stalk that emerges above the water surface and contains small green leaves and are small, and the reddish, oval shaped petals are 0.0625-0.125 inches long. The fruit are subglobose in shape, have a scabrous texture and are 0.04-0.05 inches long and wide. Each of the mericarps is 2-ridged on the back, however it is rounded on the sides and prominently beaked.

Habitat: This plant is found in a variety of different aquatic habitats, such as lakes, ponds, swamps, rivers and mudflats in water up to 6 feet deep. Milfoil prefers relatively calm and shallow (less than 20 feet) waters with a muddy bottom.

Distribution: Variable milfoil is native to the southern part of the United States from Florida to Texas. It is now found from North Dakota to Maine and Quebec and is present in all New England states except Vermont. Fragments that break off the plant and grow roots are the primary form of reproduction and spreading. Wind, current, boats and waterfowl transport these fragments. Milfoil is a hearty plant growing up to one inch per day and even continues growing beneath the ice during winter. Variable milfoil fragments tend to establish new plants in water depths of less than 15 feet and in muddy or disturbed areas, such as dredged coves. In New Hampshire the variable milfoil is the most problematic of the milfoil species, infesting nearly 50 waterbodies, **including the Nashua River in Nashua.**

Similar Species: Unfortunately, identification of variable milfoil versus the 5 native, noninvasive species can be difficult and must be performed by an aquatic biologist. Look-alikes include: *Myriophyllum spicatum* L. (Eurasian watermilfoil), *M. verticillatum* L. (whorled watermilfoil), *M. pinnatum* (Walt.) B.S.P. (cutleaf watermilfoil). Many of the New England specimens are hybrids between *Myriophyllum heterophyllum* and *M. pinnatum*.

Threats: This vegetative replacement alters the ecosystem negatively affecting water quality and threatening ecosystem biodiversity. It can completely congest waterways and crowd out other species of aquatic plants. It also hinders recreational activities such as boating, swimming and fishing. The dense growths that form also provide breeding areas for mosquitoes and degrade the quality of the water for fish and other aquatic wildlife.

Control: Unlike Eurasian milfoil that is a problem in any waterbody it enters in the United States, variable milfoil is actually native and adaptive to the southern United States. Invasive infestations of variable

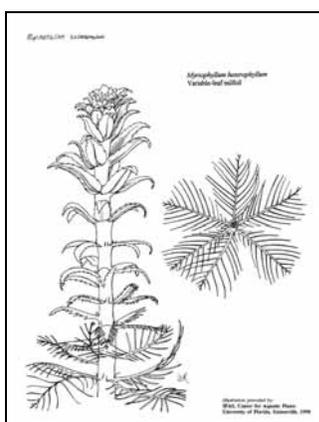
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milfoil are only problematic in four northern states where it has been introduced. The current focus in New Hampshire is to encourage eradication research and to implement management techniques to minimize or control the infestation. By law, any education and management program must be under NHDES supervision. Approaches include **1. Education:** Signs identifying the presence of invasive milfoil to raise public awareness to minimize spreading should be posted at all launching facilities. Literature should be distributed to boaters on invasive plants. All plant fragments should be removed from boats and trailers. **2. Prevention of fragment spread:** Frequently inspect your boat by tipping up your engine or outdrive and remove any fragments. Please inspect after passing through an area with infestation. Don't prop wash fragments off — you'll create many new plants! Dispose of any fragments or plants in your household trash. Distribute hand nets to marinas and encourage removal and desiccation (sun drying) of fragments. **3. Identification of infested sites:** Train volunteers to recognize different aquatic plants, and survey local areas. Remove any fragments and pull rooted variable milfoil plants. NHDES should be notified of new infestation sites. **4. Prevention of growth of rooted plants:** Hand pulling is effective. **5. Herbicides for aquatics** require permitting through the NH Division of Pesticide Control and includes an application process. For young and rapidly growing plants, the following are useful in NH in late May or early June. (1) Diquat dibromide ("Reward") is a non-selective contact herbicide that is rapidly absorbed through the leaf cuticle thereby interfering with photosynthesis. This herbicide, which is applied as a liquid, generally kills only the plant material it comes in contact with, having little to no effect on the root system. It is quickly inactivated upon contact with soil. It can eliminate plants after only 24 hours of exposure. (2) The other herbicide recommended for this invasive in NH is 2,4-D, ("Aqua Kleen" and "Navigate"). These are applied to the aquatic environment after being mixed with clay and formed into pellets. On the waterbody bottom, the herbicide is slowly released over time and absorbed by the roots and leaves causing abnormal growth responses, usually killing the plants within two weeks. See <http://www.des.state.nh.us/factsheets/bb/bb-52.pdf> for further information.



Alternatives: Yellow nelumbo (*Nelumbo lutea*), pond weed (*Potamogeton nodosus*), butterweed (*Senecio glabellus*) are some alternative plants to consider for the eastern U.S.

LINKS: <http://www.invasivespecies.gov/community/detweed.shtml>
<http://www.squamlakes.org/sla/milfoil.htm>
<http://www.state.me.us/dep/blwq/topic/invasives/imagesplantlist/vlmilfoilflower.jpg>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=77>



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***Myriophyllum spicatum** -- European water-milfoil** *Federal Noxious Weed List*

Description: Eurasian watermilfoil, also called spike watermilfoil, is an emergent, herbaceous aquatic plant in the Water-milfoil family, or Haloragaceae. Stems grow to the water surface, usually extending 3 to 10, but as much as 33, feet in length and frequently forming dense mats. Stems of Eurasian milfoil are long, slender, branching, hairless, are reddish-brown to whitish-pink, and become leafless toward the base. New plants may emerge from each node (joint) on a stem, and root upon contact with mud. The grayish-green leaves of Eurasian watermilfoil are finely divided and occur in whorls of three or four along the stem, with 12-16 pairs of fine, thin leaflets about 12 inches long. These leaflets give milfoil a feathery appearance that is a distinguishing feature of the plant. Eurasian watermilfoil produces small yellow, 4-parted reddish and very small flowers on a spike that projects 2-4 inches above the water surface. The fruit is a hard, segmented capsule containing four seeds.

Habitat: Typical habitat for Eurasian watermilfoil includes fresh to brackish water of fish ponds, lakes, slow-moving streams, reservoirs, estuaries, and canals. It is tolerant of many water pollutants. Eurasian watermilfoil tends to invade disturbed areas where native plants cannot adapt to the alteration. By altering waterways, humans have created a new and unnatural niche where milfoil thrives.

Distribution: Eurasian watermilfoil originated in Eurasia and Africa. It is found in thirty-three states east of the Mississippi River. Eurasian watermilfoil was accidentally introduced from Eurasia in the 1940s. Since then, it has been reported from most states rather sporadically, indicating multiple introductions. These introductions were either via the dumping of aquaria into local waterbodies, escape from cultivation or by being attached to boats. It has been present in New England since at least 1962. Most regeneration of Eurasian watermilfoil is from rhizomes, fragmented stems, and axillary buds that develop throughout the year. Flower spikes often remain above water until pollination is complete, then resubmerge. Although seeds are usually viable, they are not an important means of dispersal.

Similar Species: *Myriophyllum sibiricum* Komarov. (*Myriophyllum exalbescens* Fern.) (Northern watermilfoil), *M. verticillatum* L. (whorled watermilfoil), *Ceratophyllum demersum* L. (Coon's tail).

Threats: Eurasian milfoil can form large, floating mats of vegetation on the surface of lakes, rivers, and other water bodies, preventing light penetration for native aquatic plants and impeding water traffic. The plant thrives in areas that have been subjected to various kinds of natural and manmade disturbance.

Control: Large harvesting equipment can be used to mechanically remove milfoil in larger areas; a sturdy hand-rake can be used for smaller areas. Other available options include manipulation of water level, light penetration and chemical control. For the single harvest, removal should take place just

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before peak biomass is obtained (early summer). Substantial regrowth may occur if this is done too early. Better results appear with multiple harvests in the same growing season. If multiple harvests are not possible, then sustaining annual harvests is an option. All fragments of milfoil plants must be removed to achieve adequate control. Where water levels are under manual control, raising or lowering of the water can be an effective way to reduce the growth of milfoil. By raising the water level, plants can be "drowned" by not having access to enough light. By lowering the water level, plants can be dehydrated and, at the right time of the year, frozen to death. This type of control is best used in conjunction with herbicides and shade barriers. Bankside **plantings**, floating native plant species, light limiting dyes, or shade barriers are effective ways of reducing the amount of light reaching the plants and may reduce overall growth rates. Barriers can be used to prevent the movement and spread of aquatic weeds in ponds and lakes. A barrier is usually a suspended blocking screen that hangs vertically from a cable to a depth of about 13 feet; the cable is suspended by drum floats. Fluridone (the active ingredient in Sonar AS) is a selective **herbicide** for milfoil and several other exotic aquatic weeds. There are no restrictions on swimming, fishing, or drinking after application, and season-long control can be achieved with one application. Fluridone is available in liquid or granular form, and can be used as a spot treatment or on an entire waterway. For best results, applications should be made before or during the early stages of active growth. **Biological:** The North American weevil, *Euhrychiopsis lecontei* (Dietz) has been found associated with declining populations of Eurasian watermilfoil in northeastern North America. *Euhrychiopsis lecontei* has been found in Washington state feeding on both Eurasian watermilfoil and northern milfoil (*Myriophyllum sibiricum*) plants. Studies have shown that this native weevil appears to be a milfoil specialist and will not feed on other macrophyte species. It can be easily raised in the laboratory and laboratory-reared weevils could be used to augment natural populations, as is being tried in Vermont and in other states.



LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=78>

<http://www.nps.gov/plants/alien/fact/myrsp1.htm>

http://nas.er.usgs.gov/dicots/my_spica.html

<http://www.des.state.nh.us/wmb/exoticspecies/identify.htm>

<http://lakeaccess.org/images/illustrationeurasian.gif>

<http://aquat1.ifas.ufl.edu/myrsp1.html>



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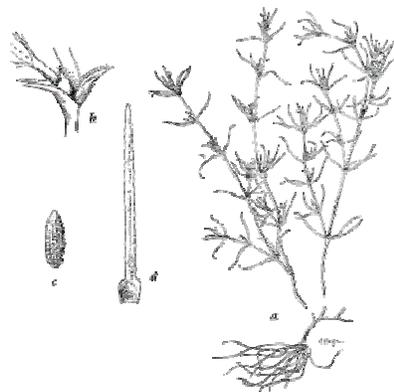
Najas minor* -- European naiad**Federal Noxious Weed List**

Description: *Najas minor* is an herbaceous, aquatic annual with stems that can grow 4 - 7.75 inches long; and up to 0.04 inches thick. The oppositely arranged, dark green leaves become recurved as they age and have serrulate margins with 7-15 small teeth on each side. The apex of the leaf is truncate or auriculate in shape and has 1 or 2 teeth on it. The leaves measure 0.2-1.25 inches long and 0.007-0.05 inches wide. *Najas minor* is a monoecious plant, with 1 to 2 flowers per axil. The male flowers are located distally and are 0.08 inches in size. The involucre has 2 lobes and the beaks are 0.02-0.08 inches long. The female flowers are located in the distal to proximal axils and measure 0.8 inches in size. The spindle-shaped seeds of this plant are 0.05-0.1 inches in size and purple colored.

Habitat: This plant is most often found in ponds, lakes, reservoirs, and slow-moving streams, in depths of 2 to 15 feet.

Distribution: *Najas minor* is native to North Africa, Japan, Turkey, India as well as central and eastern Europe. In the United States, it is located from New Hampshire to Florida and west to Michigan and Oklahoma. In New England, this plant has been reported from New Hampshire, Vermont, Massachusetts and Connecticut. *Najas minor* can reproduce by means of seeds, but its primary method of dispersal is fragmentation. The seeds and plant fragments are most often dispersed by waterfowl that consume the seeds. During the late summer or early fall, the stems of spinyleaf naiad become brittle, and the profusely branched apical portions of the stem break into small fragments. Seeds remain attached in the leaf axils, and the fragments are dispersed by wind and water currents. Populations of *Najas* within reservoirs can fluctuate dramatically over a period of a few years and have been correlated with years of low rainfall and increased amounts of available light.

Threats: *Najas minor* has the ability to form thick stands that can cover or clog a lake or stream. This plant is extremely brittle allowing it to fragment and move via boats, waterfowl and river channels. Waterfowl readily eat and move this plant from waterbody to waterbody. In North Carolina, this plant is reported as out-competing other exotics such as *Hydrilla verticillata*. This plant has not yet caused a major problem in New England, but needs to be watched, contained or removed.



Control: Several types of control methods are used for slender-leaved naiad, including aquatic herbicides, the herbivorous Asian fish known as the grass carp, and bottom barriers (mats anchored to the bottom which block out sunlight). Overwinter drawdowns are not recommended as this method can actually increase the spread of the plant. In Vermont, slender-leaved naiad has rarely been targeted for control because it generally occurs in localized infestations and has not yet proven to be as aggressive as some other invasive exotic plants.

LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=79>
<http://www.anr.state.vt.us/dec/waterq/ans/objects%5Cslnfs.pdf>
http://www.wes.army.mil/el/aqua/apis/plants/html/najas_mi.html
<http://www.npwr.usgs.gov/resource/1999/neflor/species/4/najamino.htm>

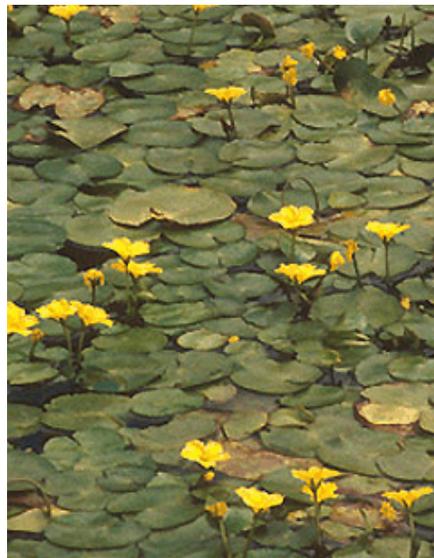
Najas minor* -- European naiad



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Nymphoides peltata* -- Yellow floating heart**Federal Noxious Weed List**

Description: Yellow floating heart is a perennial, waterlily-like plant that carpets the water surface with long-stalked heart-shaped leaves. The showy five-petaled yellow flowers occur on long stalks and rise a few inches above the water, having two to five flowers from each flower stalk. Five petals per flower have a distinctive fringe along the edges of the petals. Petals arranged like the spokes of a wheel. Heart-shaped floating leaves with slightly wavy margins and purplish undersides.



Habitat: Like other floating leaved plants, yellow floating heart grows in dense patches, excluding native species and even creating stagnant areas with low oxygen levels underneath the floating mats. It prefers to grow in slow moving rivers, lakes, reservoirs, and ponds.

Distribution: Yellow floating heart is a native of Eurasia and the Mediterranean. Floating water heart reproduces by water dispersed seeds and by new stolens. Broken off leaves with part of a stem will also form new plants. For obvious reasons, lake residents are strongly discouraged from planting yellow floating heart in lakes or natural waterbodies. These plants appear to be aggressive growers and sometimes "hitchhiker" plants such as hydrilla can also be introduced to our lakes when nursery or mail order species are planted. Because of the attractive yellow flowers, this plant has

been sold as an ornamental water garden plants.

Similar Species: Don't confuse yellow floating heart with Spatterdock (also called yellow pond or cow lily) which has a yellow "ball-shaped" flower and large elephant-ear-shaped leaves. Another look-alike plant, watershield, has small floating leaves with the underside often coated in a gelatinous slime. Watershield has inconspicuous purple flowers. There are also other ornamental species of *Nymphoides* sp. that are sometimes sold at aquatic plant nurseries and may be confused with yellow floating heart.

Threats: These mats make it difficult to fish, water ski, swim, or even paddle a canoe through. Though this plant has not yet become a major problem in New England, it has the potential to shade and crowd out native aquatic plants. In warmer areas, it has formed large stands that can block waterways.

Control: Yellow floating heart has a similar growth habit to the fragrant waterlily and it is expected that methods used to manage waterlilies would also be effective on yellow floating heart. Waterlilies (and yellow floating heart) can be controlled by cutting, harvesting, covering with bottom barrier materials, and aquatic herbicides (Rodeo®).

LINKS: http://www.ecy.wa.gov/programs/wq/plants/weeds/floating_heart.html
http://www.ecy.wa.gov/programs/wq/plants/plantid2/photopages/photo_nymphoides.html
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=80>

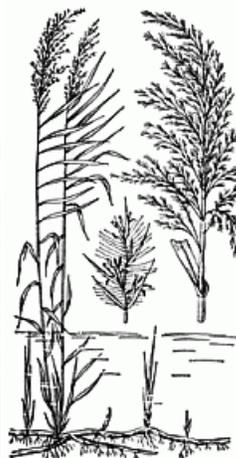
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Nymphoides peltata* Yellow floating heart

Federal Noxious Weed List



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Phragmites australis* -- Common Reed**Federal Noxious Weed List**

Description: *Phragmites australis* is a stout grass that measures 6.5-13 feet in height, most often seen in large colonies. The stems and lanceolate leaves are smooth and glabrous. The gray-green leaves are acuminate in shape, are 10-20 inches long and 0.75-1 inches wide. Long, white hairs are present at the leaf-sheath junction. The light brown to purple inflorescence is 7.5-15 inches long. The spikelets have 3-7 flowers and appear between July and September. The flowers are surrounded by silky white hairs. The first glume is narrowly elliptic and blunt, while the second is linear and is nearly twice as long as the first. The lemmas are narrow, 0.3-0.5 inches wide. The rachilla hairs are white and as long as the lemmas. However, they are not visible until after the flowers bloom. The seeds are brown, light weight, and about 0.3 inches long. In the fall, the plant turns brown, but the inflorescences persist throughout the winter.

Habitat: Common reed grows on wetland fringes, where salt marsh and freshwater wetlands meet. It is found at the upper edges of wetlands, commonly in brackish or fresh water and at the edges of saltwater marshes, or where there are lower marsh water levels and less salty conditions. It also occurs in both acidic and alkaline freshwater marshes, where it may occupy the entire wetland. It is more common near cities than in rural areas. Use of road salt may be promoting common reed along roadsides in New England. It is common in marshes that are in poor health and thrives in environments that kill most marsh grasses. Opportunity for invasion is often linked to human-caused disturbance.

Distribution: *Phragmites australis* is found on every continent in the world except for Antarctica. It is most abundant along the Atlantic Coast and in freshwater and brackish tidal wetlands of the northeastern United States as far south as North Carolina. It is found in every state in the United States except Alaska and Hawaii. It is native to some parts of the United States, and probably came to New England via natural immigration. It is capable of reproduction by seeds, but primarily does so asexually by means of rhizomes. Below-ground rhizomes can result in dense clones with up to 200 stems/m². *P. australis* is wind-pollinated but self-incompatible. Seed set is highly variable and occurs through fall and winter and may be important in colonization of new areas. Germination occurs in spring on exposed moist soils. .



Example of a native phragmites stand

Similar Species: *Phragmites australis* (Cav.) Trin. Ex Steud (Native Phragmites) Native and non-natives are very difficult to differentiate. A comparison of both can be found on the following link which illustrates many of these morphological differences: (<http://www.invasiveplants.net/phragmites/phrag/morph.htm>). Most New England populations are non-native. Differentiation can be made the following way: a leaf sheath wraps around the stem almost entirely. Remove the leaf sheath when checking for stem morphology or texture. Native genotypes leaf sheaths either fall off by themselves or are very easily removed when handling *Phragmites*. In the introduced genotypes, leaf sheaths may fall off at the base of the stem (which is also occasionally reddish or brownish) but on upper nodes are very difficult to remove (hold a stem close to an internode and use a twisting motion to check). In instances where native and introduced clones grow in close vicinity of each other, differences in stem density and stem toughness become obvious on windy days. Introduced genotypes remain sturdy and erect and move little while native genotypes easily bend and swing in the wind. Stems of introduced genotypes are often almost perfectly straight while stems of native genotypes often grow crooked. (Haplotype E, known from the Northeast and Midwest does conform to this pattern but not all other populations). Contact bb22@cornell.edu and collect sample if possible native is found.

Threats: Common reed is a very aggressive, robust, densely growing member of the grass family. Its height and density allow it to form monocultures or near monocultures that outcompete and overrun most nonwoody native wetland plants. The buildup of litter from previous years of growth prevents other species from germinating or establishing. It is capable of occupying and degrading vast areas of important wetland habitat. It is tolerant of a wide variety of environmental conditions. Wetlands composed of mixes of native plants provide habitat for more wildlife species than do wetlands overrun by common reed. Common reed is problematic in both coastal and inland wetland types. In coastal situations, debris trapped within stands of common reed can increase the elevation of marsh surfaces, which can reduce the frequency of tidal inundation and ultimately alter the natural ecosystems.

Control: Numerous methodologies to destroy the prolific *phragmites* abound. These include but are not limited to: manually pulling the plant at the infancy stage; repeated mowing; burning after flowering has ceased; drowning in salt water; heavily shading; covering with plastic, poisoning with herbicides foliarly, via cut stems and aeronautically and exploiting its weaknesses. So far, no dependable biological techniques have been discovered in the US. Areas infested with giant reed are best restored through chemical means. Mechanical control (e.g., repeated mowing) may be somewhat effective, but if small fragments of root are left in the soil, they may lead to reestablishment. Glyphosate (Rodeo) is the preferred herbicide for treatment occurring after the flowering stage. During this time the plant is sending most of its nutrients down to the rhizome, so proper and precise treatment will result in the herbicide being sent down to the rhizomes as well, making it a very effective treatment method. Insert a few drops of glyphosate solution into the hollow stem of every-other cut reed immediately after they are clipped. The herbicide that is applied is usually diluted and it is only applied when there is no chance of precipitation for the next eight hours. As with most treatments, frequent monitoring from season to season is necessary because some re-growth will occur. Prescribed burning, either alone or combined with herbicide applications, may be effective if conducted after flowering. Once giant reed has been reduced sufficiently, remove dead phragmites, then native plants may be seeded or transplanted at the treated site.

Prevention: *Phragmites australis* has two weakness: (1) its poor ability to invade vegetated soils (minimizing disturbance and quickly re-vegetate). (2) its tendency to continue growing when many other wetlands plants have entered fall dormancy. Herbicide applications at this time kill *Phragmites* but do not significantly affect adjacent or underlying desirable species, if proper application procedures are followed.

Manual: Removal by excavation - *Phragmites* deeply penetrates many soils and for proper control the complete plant, including rhizomes, must be removed. This is very expensive and will only be effective if all underground portions are removed during excavation. It also literally destroys the wetland type to be restored.

Smothering by black plastic - Coverage by black plastic kills plants by depriving them of their ability to make new food, a process which requires light. To be effective plants must remain completely covered for a minimum of three growing seasons until all food reserves are depleted and the plant starves. This requires the area to be cut to a height of less than three inches. Unfortunately, after covering, the plant produces new pointed buds which easily puncture plastic film up to the thickness of swimming pool liners. In the spring and fall, the plastic warms the soil thus making it attractive to small animals like frogs and mice. Large predators like raccoons and foxes tear through the plastic to feed, thereby exposing *Phragmites* to the light it needs. During the summer, the moist soils heat excessively which kills the soil organisms and "good" seed stocks. In summary, this technique does not work and does more harm to the environment than the herbicide alternative.

Repeat harvesting - This starves plants by continuously removing the green tissues which use light to make the plant's food. Mow for a minimum of two growing seasons throughout the growing season as new leaves appear. In principle, this alternative is effective; however, in practice few machines can work in wetlands during the wet season. Any regrowth of *Phragmites* during these periods renders this technique ineffective.

Flooding - kills many types of plants but not wetlands plants unless the water is very deep. *Phragmites* has not been controlled in some areas flooded with 10 feet of water for one year. This treatment did kill other types of desirable wetlands vegetation.

Biological controls - No biological controls have been identified for *Phragmites*.

Burning by itself does not work and in fact encourages more vigorous Glyphosate is the standard ingredient in the over-the-counter herbicide, Rodeo®. The product Roundup® also contains glyphosate, but also has a "surfactant," which is a soap-like ingredient that helps the herbicide spread. This makes Roundup less appropriate for use near water.

Policy needs to be formulated to prevent the inadvertent spread of *Phragmites* by earth-moving machinery and spoil disposal. Marsh management practices need to be reviewed for their effect on *Phragmites* spread. The value of *Phragmites* control for onsite mitigation needs to be clarified. Should that control only be accepted as mitigation if wetland restoration or creation is also included as a part of the mitigation plan?

Alternatives: Native plant species that are adapted to local conditions should be used in restoration projects and as a substitute for giant reed in landscapes and erosion control practices.

LINKS: <http://aquat1.ifas.ufl.edu/nympel.html>
<http://invasives.eeb.uconn.edu/ipane/>
<http://tncweeds.ucdavis.edu/photos.html> John M. Randall
<http://www.fs.fed.us/database/feis/plants/graminoid/phraus/>
<http://www.invasiveplants.net/phragmites/phrag/morph.htm#redpic>
<http://www.lastgreatplaces.org/berkshire/friends/art7512.html>
http://www.massaudubon.org/Kids/Lively_Lessons/Saltmarsh/restoration.html
<http://www.nps.gov/plants/alien/fact/ardo1.htm>
<http://www.umext.maine.edu/onlinepubs/htmpubs/2532.htm>



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Polygonum cuspidatum -- Japanese knotweed NH Prohibited Invasive Species List



Description: Japanese knotweed, a member of the buckwheat family (Polygonaceae), is an upright, shrublike, herbaceous perennial that can grow to over 10 feet in height. As with all members of this family, the base of the stem above each joint is surrounded by a membranous sheath. Stems of Japanese knotweed are smooth, stout and swollen at joints where the leaf meets the stem. Although leaf size may vary, they are normally about 6 inches long by 3 to 4 inches wide, broadly oval to somewhat triangular and pointed at the tip. The leaves begin to show in April. The minute greenish-white flowers occur in attractive, branched sprays in summer and are followed soon after by small winged fruits. Seeds are triangular, shiny, and very small, about 0.10 inches long. **Winter:** During the winter months, Japanese knotweed dies back. The canes, often 8.2 feet high, die off and become brown and leafless. Canes may take up to three years to decompose, and often form a dense litter, thus preventing other plants from growing in. **Spring:** During early spring, the dark red shoots of the new growth appear. Growth is rapid, potentially 4 inches per day at its peak. **Summer:** By mid-summer, Japanese knotweed canes have usually achieved their maximum growth, which can be a height of over 8 feet in mature specimens. During August and September the canes produce their clusters of white flowers. Sterile seed is often produced after flowering.



Habitat: Japanese knotweed can tolerate a variety of adverse conditions including full shade, high temperatures, high salinity, and drought. It is found near water sources, such as along streams and rivers, in low-lying areas, waste places, utility rights-of-way, and around old homesites. It can quickly become an invasive pest in natural areas after escaping from cultivated gardens.



Distribution: Current distribution of Japanese knotweed includes 36 states in the lower 48 from Maine to Wisconsin south to Louisiana, and scattered midwest and western states. It spreads primarily by vegetative means with the help of its long, stout rhizomes. It is often transported to new sites as a contaminant in fill-dirt seeds, sometimes distributed by water, and carried to a lesser extent by the wind. Escapees from neglected gardens, and discarded cuttings are common routes of dispersal from urban areas. The rhizomes can reach a depth of 6.6 feet, and extend 45 to 60 feet away from the parent plant.

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Similar Species: A similar plant, *Polygonum sachalinense* (or “Giant Knotweed”), is much less common and appears to escape only infrequently, if at all. It can be distinguished from *P. cuspidatum* primarily by its larger size, greenish flowers, and heart-shaped leaves which gradually taper to the tip.

Threats: Japanese knotweed spreads quickly to form dense thickets that exclude native vegetation and greatly alter natural ecosystems. It poses a significant threat to riparian areas, where it can survive severe floods and is able to rapidly colonize scoured shores and islands. Once established, populations are extremely persistent.

Control: Grubbing is effective for small initial populations or environmentally sensitive areas where herbicides cannot be used. Using a pulaski or similar digging tool, remove the entire plant 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. **Cut stem treatment:** Use this method in areas where plants are established within or around non-target plants or where vines have grown into the canopy. This treatment remains effective at low temperatures as long as the ground is not frozen. Cut the stem about 2 inches above ground level. Immediately apply a 25% solution of glyphosate (e.g., Roundup, or use Rodeo if applying in or near wetland areas) or triclopyr (e.g., Garlon) and water to the cross-section of the stem. **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. Apply a 2% solution of glyphosate or triclopyr and water to thoroughly wet all foliage. Do not apply so heavily that herbicide will drip off leaves. A 0.5% non-ionic surfactant is recommended in order to penetrate the leaf cuticle, and ambient air temperature should be above 65 °F. Clear the dead stems in late winter leaving clear access to spray the new shoots in early spring. As soon as the area is knotweed-free, replant with natives to discourage future infestation.

LINKS: <http://www.nps.gov/plants/alien/fact/pocu1.htm>
<http://fodm.homestead.com/Japaneseknotweedproject.html>
http://www.hort.uconn.edu/cipwg/art_pubs/TNC/pdf/nat_japhnot.pdf
http://www.cabi-bioscience.org/html/japanese_knotweed_alliance.htm
http://www.nwcb.wa.gov/weed_info/gknotweed.html
www.wildmanstevebrill.com/.../Knotweed.html
<http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua015.html>



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Potamogeton crispus* -- Curly-leaf pondweed **Federal Noxious Weed List**



Description: *Potamogeton crispus* is a submersed aquatic perennial that can reach 1-2.5 feet in length. The turions of this plant are spindle-shaped, measure 0.5-1 inches and can be located terminally or axillary. The stems of this plant are flattened. There are two ranks of leaves that are arranged spirally. The leaves are linear-oblong in shape, measure 1-3 inches long and 0.2-0.5 inches wide. The leaf margins are undulate and the apex of the leaf is obtuse. The base of the leaf is sessile. The stipules of the leaf are small, thin and paper-like, and disintegrate early. The peduncles are 0.75-2 inches in length and can be recurved when the plant is in fruit. The spike is dense and measures 0.4-0.75 inches in length. The body of the red to reddish-brown achene is ovoid and measures 0.1 inches. The achene has 3 keels, with the middle keel having a small tooth projecting out from the base. The beak of the achene is conic and erect, measuring 0.1 inches. This plant has an unusual life history because it flowers and fruits in the late spring to early summer. The plant then dies, leaving only fruits and turions (vegetative reproductive structures) to survive the summer. The turions produce new plants in the late summer or fall, leaving small plants to overwinter, even sometimes under the ice.



Habitat: Aquatic Lake or Pond River or Stream Salt Marsh. *Potamogeton crispus* is tolerant of slightly brackish as well as fresh water. It can survive in low light, low temperatures and prefers high nutrient or alkaline water.

Distribution: *Potamogeton crispus* is native to north Africa, India, the Middle East, Australia and Europe, from Portugal to Turkey and France to Italy, and also in Ireland to the north. It has been reported from all of the states of the U.S. except Alaska, Hawaii, Maine and South Carolina. In New England, this plant occurs in Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island. This plant spreads mostly by means of its vegetative turions that germinate in the fall. *Potamogeton crispus* does produce fruits and flowers, but the seeds do not appear to be viable.

Similar Species: *Potamogeton gramineus* L. (variableleaf pondweed).

Threats: *Potamogeton crispus* can form dense mats of vegetation on the surface of the water. These mats inhibit the growth of native aquatics, as well as interfere with boating and other water recreation. Since these plants germinate in the fall, they overwinter under the ice and are therefore among the first plants out in the spring, giving it a competitive advantage. When the plants die off in the summer, the decaying plant matter can make the water extremely eutrophic.

Control: **Mechanical/Physical** - Curly-leaf pondweed can be removed by raking or seining it from the pond but will reestablish from any remaining roots. **Biological** - Grass carp will seldom control aquatic

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vegetation the first year they are stocked, and are illegal in NH. Grass carp stocking rates to control curly-leaf pondweed are usually in the range of 7 to 15 per surface acre.

Chemical - active ingredients that have been successful in treating curly-leaf pondweed include diquat (G), copper with diquat (G), endothall (E), and fluridone (E). *E = excellent, G = good*

- **Reward** is a liquid diquat formulation that has been effective on curly-leaf pondweed and is more effective if mixed with a copper compound. It is a contact herbicide. Contact herbicides act quickly and kill all plants cells that they contact.
- **Citrine Plus, K-Tea, Captain, Algae Pro, Clearigate** are all chelated or compound copper herbicides and can be used in a mixture with Reward or Aquathol K. Other chelated or compound copper formulations are available but are not linked to this web site.
- **Aquathol, Aquathol K, and Aquathol Super K** are dipotassium salts of endothall and comes in both liquid and granular formulations. These endothall products have been effective on curly-leaf pondweed and can be mixed with copper compounds for additional effectiveness. Contact herbicides act quickly and kill all plants cells that they contact.
- **Hydrothol 191** is an alkylamine salt of endothall and comes in both liquid and granular formulations. It is a contact herbicide and has been effective on curly-leaf pondweed. Contact herbicides act quickly and kill all plants cells that they contact. Hydrothol can be toxic to fish.
- **Sonar** and **Avast** are fluridone compounds, come in both liquid and granular formulations, and have been effective on curly-leaf pondweed. These are broad spectrum, systemic herbicides. Systemic herbicides are absorbed and move within the plant to the site of action. Systemic herbicides tend to act more slowly than contact herbicides.

One danger with any chemical control method is the chance of an oxygen depletion after the treatment caused by the decomposition of the dead plant material. Oxygen depletions can kill fish in the pond. If the pond is heavily infested with weeds it may be possible (depending on the herbicide chosen) to treat the pond in sections and let each section decompose for about two weeks before treating another section. Aeration, particularly at night, for several days after treatment may help control the oxygen depletion.

LINKS: http://aquaplant.tamu.edu/Submerged%20Plants/Curly%20leaf%20pondweed/Curly_Leaf_Control.htm
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=88>





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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-

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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*), kinnikinnik (*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://btny.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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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/invalt2.pdf>
<http://www.invasive.org>
<http://www.lastgreatplaces.org/berkshire/issues/art6403.html>



Trapa natans** -- Water chestnut*Federal Noxious Weed List**

Water Chestnut from Nashua River <http://www.des.state.nh.us/wmb/exoticspecies/photos.htm>

Description: European water chestnut is an aquatic plant, which is usually rooted in the mud and bears a rosette of floating leaves at the tip of the submersed stem. Stems are elongate and flexuous and typically about a 3.3 feet long but may reach about 16.5 feet in length. The conspicuously toothed leaf blades are 0.8-1.6 inches long and rhombic in outline (with four sides); the long, spongy, inflated leaf stalks are up to about 6 inches long and provide the buoyancy for the terminal leafy portion of the plant. Green, feather-like, submersed leaves (considered by some to be roots) with very fine segments are present on the submersed stem and numerous finely branched roots develop along the lower stem that assist in anchoring the plant to the substrate. The inconspicuous flowers with their four white petals, each about 0.3 inches long, are borne singly on erect stalks located in the central area of the leafy rosette. The fruit is a four-horned, barbed, nut-like structure, about 1.2 inches wide, that develops under water. Flowers are produced singly on stalks arising from the center of the floating rosette of leaves. Each flower is bisexual, bearing a two chambered ovary, four stamens and four white petals. Four triangular sepals surround the flower and develop into barbed spines in the mature fruit.

Once the ovules of the insect pollinated flowers are fertilized, the flower stalks curve downward with the result that the fruit develops under water. The fruit matures into a nut-like, barbed spiny fruit. Although there are two chambers in the ovary, each with an ovule, commonly only one seed per flower develops (Groth et al. 1996). The fruit technically is a drupe. Flowering begins in the northeastern United States in July and fruits ripen in about a month. Plants flower until killed by frost.

Habitat: Plants grow in quiet streams, ponds, freshwater regions of estuaries and on exposed mud flats.

Distribution: European water chestnut is native to Eurasia, being found in paleotropical and warm temperate regions. Plants were first introduced to North America in about 1874 and were known to be cultured, in 1877, in the botanical garden of Asa Gray, an eminent botanist at Harvard University. By 1879, plants were already found in the local waters of the Charles River in Massachusetts. The plants have become an aquatic nuisance species in North America because of their ability to reproduce rapidly and form extensive floating mats. Water chestnut is now **found in the Nashua River in Nashua.**

European water chestnut is an annual that grows most commonly as a rooted, floating aquatic. It can, however, also grow on wet mucky substrates. It grows best in shallow, nutrient-rich lakes and rivers (Methe et al. 1993) and is generally found in North American waters with a pH range of 6.7-8.2 and alkalinity of 12-128 mg/l of calcium carbonate. Each seed can give rise to 10-15 rosettes, and each rosette may produce as many as 20. Seeds can remain viable for up to about 12 years. The fruits may be dispersed when individual plants are uprooted and float downstream. Fruits fall to the bottom of the water body in the autumn and the seeds overwinter just as in terrestrial annual species. It has been suggested that in warmer climates some plants may persist as short-lived perennials. Seeds germinate in the spring, with the young root (radicle) perforating the top of the fruit. The young plantlet develops narrow, opposite leaves. As the plant matures, the typical floating, leafy rosettes form at the end of the expanding stem at the surface of the water. Green, feathery submersed leaves (perhaps structurally actually representing adventitious roots) develop along the flexuous stem. The numerous filaments of the feathery structures likely provide a large absorptive surface area for nutrients and, as well, serve as

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photosynthetic organs. As soon as the initial shoot develops floating leaves, additional leafy offshoots are produced at a rapid rate.

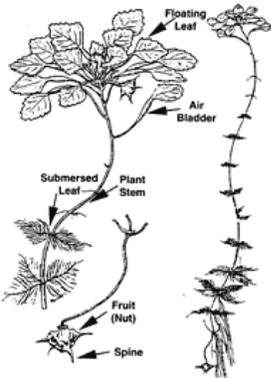


Threats: European water chestnut has become a significant nuisance aquatic weed in the northeastern United States, especially in the Hudson and Potomac Rivers, Lake Champlain and in the Connecticut River Valley. Due to its dense, clonal, mat-forming growths the species impedes navigation; its low food value for wildlife potentially can have a substantial impact on the use of the area by native species. The abundant detritus in the fall of each year and its decomposition could contribute towards lower oxygen levels in shallow waters and impact other aquatic organisms. The sharp spiny fruits can also be hazardous to bathers.

Control: Removing the floating mats via weed harvesters used to unblock waterways is a successful method for control, although it won't provide a long term solution in heavily infested areas of large lakes or streams. Hand removal is also successful. Repetitive harvesting over a number of years may be effective in eradicating this aquatic weed in small enclosed

bodies of water.

LINKS: www.iisgcp.org/EXOTICSP/waterchestnut.htm
<http://24.43.24.85/nbs/ipcan/factnut.html>
www.chicagobotanic.org/research/conservation/invasive/trapa_natans.html
Photo credit: Plate of *Trapa natans* from *Bilder ur Nordens Flora*.
www.iisgcp.org/EXOTICSP/images/waterchestnut/trapa2.jpg



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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>

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



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Acer platanoides Norway Maple

Ban to go into effect in New Hampshire 1/1/2007



Description: Norway maple, a deciduous tree, reaches a height of 40-50 feet occasionally exceeding 90 feet. The leaves are dark green, simple, opposite, 4"-7" wide with 5 lobes. The mature tree has a rounded crown of dense foliage and the bark is grayish-black and furrowed. Norway maple is distinguished from other maples by the milky fluid that oozes from freshly broken leaf petioles (stems). The tree leafs out and produces seeds earlier than other maples. Its normal fall foliage is pale yellow; however, there is a popular cultivar known as "Crimson King" which has deep reddish purple fall foliage. Flower: 5 greenish-yellow petals, in upright or spreading clusters, long-stemmed, in early spring before leaves. Fruit: 1-2" long; paired keys with long wing and flattened body; spreading widely, hanging on long stalk.

Habitat: Norway maple, a "street" tree, is well adapted to various soil extremes, such as sand, clay or acid. It grows in hot and dry conditions, it tolerates ozone and sulfur dioxide air pollution. Norway maples are widely planted in the United States and can be found from the northern border with Canada south to the Carolinas.

Distribution: Norway maples are native to Europe, from Norway southward. Populations in the United States have either escaped from cultivation or originated from individual trees used as ornamental specimens.



Threats: Individual trees produce large numbers of seeds that are wind dispersed and invade forests and forest edges. The dense canopy formed by Norway maple inhibits the regeneration of sugar maple and other tree seedlings, reducing forest diversity. Also, since Norway maple has shallow roots, it competes with other plants in the landscape, including grasses, and can cause damage to pavement in urban settings. As the NH ban on its sale doesn't go into effect until 2007, many nurseries still sell this nuisance tree.

Control: Don't plant Norway maple. To control existing stands, manual, mechanical and chemical means are available. Seedlings can be pulled by hand and small to large trees can be cut to the ground, repeating as necessary to control any re-growth from sprouts. Glyphosate and triclopyr herbicides have been successfully used to control Norway maple.

Alternatives: *Acer rubrum* (Red Maple) has red fall color and is a good wildlife food source. *Acer saccharinum* (Silver Maple) is a good wildlife food source, but may be too large for use as a street tree. *Acer saccharum* (Sugar Maple) is a good wildlife food source, but is susceptible to road salt damage.

LINKS: www.u46.k12.il.us/shs/aldeellen/11497.htm
<http://www.nps.gov/plants/alien/pubs/midatlantic/acpl.htm>
www.hort.uconn.edu/cipwg/art_pubs/docs/norway_maple.pdf
forestry.msu.edu/uptreeid/Species/maples.htm



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Berberis thunbergii Japanese barberry Ban to go into effect in New Hampshire 1/1/2007

Description: Japanese barberry is a compact, spiny shrub that commonly grows from two to three feet tall (although it can grow up to six feet in height). Roots are shallow but tough. The smooth-edged leaves range from oval to spatulate in shape and are clustered in tight bunches close to the branches. The single spines bear small leaves in their axils. Yellow flowers bloom in May, are about one third of an inch wide, and are solitary or in small clusters of 2-4 blossoms. The bright-red fruits mature in mid-summer and hang from the bush during autumn and into winter. The berries are small, oblong, and found singly or in clusters. Several cultivars of this species are sold as ornamentals.

Habitat: Japanese barberry prefers well-drained soils, although it has been found in wet, calcareous situations, (specifically in a black ash swamp). It is typically found in locations of partial sunlight such as a woodland's edge; it can survive well under the shade of an oak canopy. It is also found along roadsides, fences, old fields, and open woods, gardens and commercial landscapes.

Distribution: Japanese barberry was introduced from Japan around 1875. It is commonly planted for ornamental reasons (its scarlet fruit and autumnal foliage in shades of orange, red, and crimson make it an attractive hedge), as well as for wildlife and erosion control. Its range in North America extends from Nova Scotia south to North Carolina, and westward to Montana. A related non-native species, *B. vulgaris*, was widely planted for similar purposes, but has been exterminated because it is the alternate host of black rust, a disease that affects wheat crops. The plant regenerates by seed and creeping roots. Birds and rabbits are known to eat the seeds and distribute the species. Branches root freely when they touch the ground; thus allowing single plants to become quite large. Japanese barberry competes poorly with grasses and may succumb to drought conditions.

Similar Species: A similar species, European barberry (*Berberis vulgaris*) is also an invasive non-native. It can be distinguished from the Japanese barberry by its spiny toothed leaves and flowers in a long raceme. Both species can be controlled using the techniques discussed below.

Threats: *Berberis thunbergii* forms dense stands in a variety habitats ranging from closed canopy forests, to woodlands, wetlands, pastures, meadows and wasteland. . It is a particular threat to open and second-growth forests. An established colony can eventually grow thick enough to crowd out native understory plants. Traversing through dense patches of barberry can be difficult and even painful. It is readily dispersed by birds, which can bring the seeds many feet away from the parent plants.

Control: When hand removal of this invasive is not possible or successful, the use of a glyphosate herbicide is recommended especially on cut barberry stems. (If the barberry is in or near a wetland, however, do not use Roundup, as it contains a surfactant that makes it spread easily in water. Instead, use Rodeo.) Shrubs growing in rock piles may respond especially well to this method of treatment, as hand removal is often incomplete. It's best to apply the herbicide in the late fall or early spring, when most

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native plants are dormant and so not as vulnerable to damage. Herbicides containing triclopyr have also been used as a treatment on cut barberry stems with some success. In either case, application with a brush or sponge is most accurate. A hand-pumped backpack sprayer also works if used properly.

Mechanical Control: Mechanical removal of the plant is recommended in early spring because barberry is one of the first shrubs to leaf out, thereby making identification easier. Cutting, pulling or digging are effective in areas where there are only a few plants. A hoe, weed wrench, or mattock should be used to uproot the bush and all connected roots. Thick gloves are recommended for protection from the shrub's spines. Japanese barberry may be relatively easy to control in fire-adapted communities. Fire is thought to kill these plants and prevent future establishment. **Chemical Control:** Japanese barberry breaks bud earlier in the spring than most woody species. Thus, it is possible to selectively spray its young leaves before other woody species have produced leaves. For such early season treatments, triclopyr is usually more effective than glyphosate. Wait until significant leaf expansion to ensure sufficient absorption of triclopyr. From mid summer to fall, both glyphosate and triclopyr are effective when applied as foliar sprays or as cut stump treatments: ROUNDUP glyphosate[(41%)], Foliar spray: 2 fl. oz./gal., Cut-stump treatment: Diluted with equal part water (1:1), BRUSH-B-GON [triclopyr (8%)], Foliar spray: 4 fl. oz./gal Cut-stump treatment: Undiluted.

LINKS:

<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=26>
http://www.bestgarden.net/Photo_Album/Pages/Berberis_thunbergii.htm
http://www.chicagobotanic.org/research/conservation/invasive/berberis_thunbergii.html
<http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/barberry.htm>
<http://www.hoernursery.com/PlantCatalog/INFO.cfm?EnMasterID=1024>
http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/x10jbarberry.html
<http://www.lastgreatplaces.org/berkshire/issues/art6403.html>
<http://www.paflora.org/Berberis%20thunbergii.pdf>
<http://www.umext.maine.edu/onlinepubs/htmpubs/2504.htm>
imaginatorium.org/sano/megi.htm

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*).



Centaurea maculosa -- Spotted Knapweed

Watch



Description: Spotted knapweed is a biennial or short-lived perennial member of the Sunflower (Asteraceae) family. Its name is derived from the spots formed by black margins on the flower bract tips. Spotted knapweed typically forms a basal rosette of leaves in its first year and flowers in subsequent years. Rosette leaves are approximately 8 inches long by 2 inches wide, borne on short stalks, and deeply lobed once or twice on both sides of the center vein, with lobes oblong and wider toward the tip. The taproot is stout and deep. **Flowering** stems are erect, 8 to 50 inches tall, branched above the middle, and sparsely to densely hairy. Stem leaves alternate along the stem, are unstaked, and may be slightly lobed, or linear and unlobed. Leaf size decreases towards the tip of the stem. Flowers are purple to pink, rarely white, with 25 to 35 flowers per head. Plants bloom from June to

October, and flower heads usually remain on the plant. Flower heads are oblong or oval shaped, ¼ inch wide and ½ inch across, and are single or borne in clusters of two or three at the branch ends. Leaf like bracts surrounding the base of the flower head are oval and yellow green, becoming brown near the base. The margins of these bracts have a soft spine like fringe, with the center spine being shorter than the lateral spines. The brown, oval seeds are 1/16 to 1/8 inch long, with pale longitudinal lines and a short fringe on one end.



Habitat: Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving 8 to 80 inches of rain annually. Spotted knapweed prefers well-drained, light-textured soils that receive summer rainfall, including open forests dominated by ponderosa pine and Douglas fir, and prairie habitats dominated by Idaho fescue, bluebunch wheatgrass, and needle-and-thread grass. Disturbance allows for rapid establishment and spread; however, spotted knapweed is capable of invading well managed rangelands. Spotted knapweed does not compete well with vigorously growing grass in moist areas. In seasonally dry areas, spotted knapweed's taproot allows it to access water from deep in the soil, beyond the reach of more shallowly rooted species.

Distribution: Central Europe, east to central Russia, Caucasia, and western Siberia. Spotted knapweed is a widely distributed species reported to occur throughout Canada and in every state in the U.S. except Alaska, Georgia, Mississippi, Oklahoma and Texas (see map). Spotted knapweed was introduced to North America from Eurasia as a contaminant in alfalfa and possibly clover seed, and through discarded soil used as ship ballast. It was first recorded in Victoria, British Columbia in 1883 and spread further in domestic alfalfa seeds and hay before it was recognized as a serious problem. Spotted knapweed plants in North America generally live 3 to 7 years but can live up to nine years or longer. Plants regrow from buds on the root crown. Reproduction is by seed, and plants are capable of producing 500- 4,000 seeds per square foot per year. About 90% of the seeds are viable at the time of dispersal, and they can remain viable in the soil for 5-8 years. Most seeds are dispersed near the parent plant but can be transported by people, wildlife, livestock, vehicles, and in soil, crop seed, and contaminated hay. Gravel pits, soil stockpiles, powerlines, grain elevators, railroad and equipment yards are important seed distribution points.

Threats: Spotted knapweed infests a variety of natural and semi-natural habitats including barrens, fields, forests, prairies, meadows, pastures, and rangelands. It outcompetes native plant species, reduces native plant and animal biodiversity, and decreases forage production for livestock and wildlife. Spotted knapweed may degrade soil and water resources by increasing erosion, surface runoff, and stream sedimentation. It has increased at an estimated rate of 27% per year since 1920 and has the potential to invade about half of all the rangeland (35 million acres) in Montana alone.

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Control: The most cost effective management strategy for spotted knapweed is to prevent its spread to non-infested areas. Spread by seed can be minimized by avoiding travel through infested areas; by cleaning footwear, clothing, backpacks, and other items after hiking through infested areas; by not grazing livestock when ripe seeds are present in the flower heads; and by using weed free hay.

Manual and Mechanical. Small infestations of spotted knapweed can be controlled by persistent hand-pulling done prior to seed set. Gloves should be worn because of the possibility of skin irritation. Because spotted knapweed can regrow from the base, care must be taken to remove the entire crown and taproot.

Biological control. A variety of natural enemies are used as biological control agents for large infestations of spotted knapweed. Most biocontrol techniques use insect larvae to damage the root, stem, leaf, or flower. Two species of seed head flies, *Urophora affinis* and *U. quadrifasciata*, are well-established on spotted knapweed. The larvae of these species reduce seed production by as much as 50% by feeding on spotted knapweed seed heads and causing the plant to form galls. Three moth species (*Agapeta zoegana*, *Pelochrista medullana*, and *Pterolonche inspersa*) and a weevil (*Cyphocleonus achates*) that feed on spotted knapweed roots have also been released.

The collective stress on the plant caused by these insects reduces seed production and may lead to reduced competitiveness. Biological control agents may be more effective when combined with other control methods such as herbicides, grazing, and revegetation with desirable, competitive plants.

Chemical. Control of spotted knapweed infestations using three chemical herbicides (2,4-D, clopyralid, and picloram) has been reported but is problematic. Existing plants can be killed with 2,4-D but it needs to be reapplied yearly to control new plants germinating from seed stored in the soil. Picloram is a more persistent herbicide and has controlled knapweed for three to five years when applied at 0.25 lb/acre at any stage of plant growth; or with clopyralid (0.24 lb/acre) or clopyralid (0.2 lb/acre) plus 2,4-D (1 lb./acre) applied during bolt or bud growth stage. In the absence of desirable native grasses, longevity of control may be increased by revegetating with competitive grasses and forbs. Picloram may pose a risk of groundwater contamination where soils are permeable, particularly where the water table is shallow.

Other methods. Long-term grazing by sheep and goats has been found to control spotted knapweed. Burning, cultivation, and fertilization typically are not effective on spotted knapweed unless combined with other methods of control.

LINKS: <http://www.nps.gov/plants/alien/fact/ambr1.htm>
www.missouriplants.com/Pinkalt/Centaurea_macu...



Cirsium arvense -- Canada thistle**Watch**

Photographs courtesy of Holt Studios

Description: Canada thistle is an herbaceous perennial in the aster family with erect stems 1½-4 feet tall, prickly leaves and an extensive creeping rootstock. Stems are branched, often slightly hairy, and ridged. Leaves are lance-shaped, irregularly lobed with spiny, toothed margins and are borne singly and alternately along the stem. Rose-purple, lavender, or sometimes white flower heads appear from June through October, generally, and occur in rounded, umbrella-shaped clusters. The small, dry, single-seeded fruits of Canada thistle, called achenes, are 1-1½ inches long and have a feathery structure attached to the seed base. Many native species of thistle occur in the U.S., some of which are rare. Because of the possibility of confusion with native species, Canada thistle should be accurately identified before any control is attempted.

Habitat: Canada thistle was introduced to the United States, probably by accident, in the early 1600s and, by 1954, had been declared a noxious weed in forty three states. In Canada and the U.S., it is considered one of the most tenacious and economically important agricultural weeds, but only in recent years has it been recognized as a problem in natural areas. Canada thistle grows in barrens, glades, meadows, prairies, fields, pastures, and waste places. It does best in disturbed upland areas but also invades wet areas with fluctuating water levels such as streambank sedge meadows and wet prairies.

Distribution: Canada thistle is distributed throughout the northern U.S., from northern California to Maine and southward to Virginia. It is also found in Canada, for which it was named. Canada thistle has been identified as a management problem on many national parks and on preserves of The Nature Conservancy in the upper Midwest, Plains states, and the Pacific northwest. Canada thistle produces an abundance of bristly-plumed seeds which are easily dispersed by the wind. Most of the seeds germinate within a year, but some may remain viable in the soil for up to twenty years or more. Vegetative reproduction in Canada thistle is aided by a fibrous taproot capable of sending out lateral roots as deep as 3 feet below ground, and from which shoots sprout up at frequent intervals. It also readily regenerates from root fragments less than an inch in length.

Threats: : Natural communities that are threatened by Canada thistle include non-forested plant communities such as prairies, barrens, savannas, glades, sand dunes, fields and meadows that have

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been impacted by disturbance. As it establishes itself in an area, Canada thistle crowds out and replaces native plants, changes the structure and species composition of natural plant communities and reduces plant and animal diversity. This highly invasive thistle prevents the coexistence of other plant species through shading, competition for soil resources and possibly through the release of chemical toxins poisonous to other plants.

Control: Management of Canada thistle can be achieved through hand-cutting, mowing, controlled burning, and chemical means, depending on the level of infestation and the type of area being managed. Due to its perennial nature, entire plants must be killed in order to prevent regrowth from rootstock. Hand-cutting of individual plants or mowing of larger infestations should be conducted prior to seed set and must be repeated until the starch reserves in the roots are exhausted. Because early season burning of Canada thistle can stimulate its growth and flowering, controlled burns should be carried out late in the growing season for best effect. In natural areas where Canada thistle is interspersed with desirable native plants, targeted application of a systemic herbicide such as glyphosate (e.g., Roundup or Rodeo), which carries plant toxins to the roots, may be effective. For extensive infestations in disturbed areas with little desirable vegetation, broad application of this type herbicide may be the most effective method. Repeated applications are usually necessary due to the long life of seeds stored in the soil.

LINKS: <http://www.nps.gov/plants/alien/fact/ciar1.htm>
http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=CIAR4
<http://linnaeus.nrm.se/flora/di/astera/cirsi/cirsarv2.jpg>
www.herbiseed.com/cat/im010003.htm



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Coronilla varia -- Crown vetch**Watch**

Description: Crown vetch, a member of the pea family, is a perennial herb with creeping stems that may reach two to six feet in length. The compound leaves bear 15 to 25 leaflets. The pealike, pink to white flowers occur in clusters at the end of extended stalks. The narrow, leathery seed pods may be 2 to 3 inches long. The following three characteristics together distinguish crown vetch from other legumes: 1) its compound leaves have an odd number of leaflets, 2) the leaves and flower stalks arise from the main stem, and 3) the flowers occur in a radiating cluster known as an umbell.

Habitat: Crown vetch prefers open, sunlit areas. It is found along roadsides, railroads, and open fields.

Distribution: The native range of crown vetch is Europe, northern Africa, and southwest Asia. It was introduced into the United States for use in erosion control along highway embankments and as a green fertilizer crop. Crown vetch is widespread throughout Virginia.

Similar Species: Vetches (*Vicia* spp.) look similar except that they have tendrils at the ends of their trailing stems and flowers that are either solitary or grouped in elongated rather than head-like clusters.

Threats: Crown vetch spreads rapidly through seed and its multi-branched, creeping root system. Native plant species are overcome by the dense growth of this aggressive alien. The character of a natural area can be transformed from a richly diverse habitat into just another weedy tract.

Control: For small infestations, hand pulling may work. Late spring mowing will provide some control of this invasive plant. Mowing should be repeated over several years to insure eradication. A prescribed burn in late spring will also control crown vetch. A follow-up treatment with a glyphosate herbicide in the fall and following spring will eliminate plants that regenerate from roots or sprout from seed. Glyphosate herbicide may also be used alone on light infestations of crown vetch.

Alternatives: Moss phlox (*Phlox subulata*), wild ginger (*Asarum canadense*), ragwort (*Senecio aureus*).

LINKS: ispb.univ-lyon1.fr/.../liste%20dicot.htm
<http://www.mdflora.org/publications/invasives.htm>
http://www.missouriplants.com/Pinkalt/Coronilla_varia_page.html
<http://www.issg.org/database/species/SimilarSpecies.asp?si=276&fr=1&sts=>
<http://www.vnps.org/invasive/invcoro.htm>
www.ernstseed.com/Catalog/NaturRec.htm
http://caliban.mpiz-koeln.mpg.de/~stueber/oltmanns02/icon_page_00144.html
cajai.marot.online.fr/images2/

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Elaeagnus angustifolia* -- Russian olive*Watch**

Description: Russian olive is a small, usually thorny shrub or small tree that can grow to 30 feet in height. Its stems, buds, and leaves have a dense covering of silvery to rusty scales. Leaves are egg or lance-shaped, smooth margined, and alternate along the stem. At three years of age, plants begin to flower and fruit. Highly aromatic, creamy yellow flowers appear in June and July and are later replaced by clusters of abundant silvery fruits.

Habitat: Russian-olive is found along streams, fields and open areas. Seedlings are tolerant of shade and it thrives in a variety of soil and moisture conditions, including bare mineral substrates.

Distribution: First cultivated in Germany in 1736, Russian olive was introduced into the U.S. in the late 1800s, and was planted as an ornamental. It subsequently escaped into the wild. Until recently, the U.S. Soil Conservation Service recommended Russian olive for wildlife planting and windbreaks. Russian olive is found primarily in the central and western U.S., as well as in the East (e.g., Virginia to Pennsylvania), where it occurs with its exotic partner, autumn-olive (*Elaeagnus umbellata*). In the West, Russian olive occurs mainly in the Great Basin Desert region at 800-2000 feet elevation and is also abundant in riparian zones of the Great Plains, for example, the Platte River in Nebraska. Establishment and reproduction of Russian olive is by primarily by seed, although some vegetative propagation also occurs. The fruit of Russian olive is a small cherry-like drupe that is readily eaten and disseminated by many species of birds.

Similar Species: Autumn Olive, also an invasive species.

Threats: Russian olive can out-compete native vegetation, interfere with natural plant succession and nutrient cycling, and tax water reserves. Because Russian olive is capable of fixing nitrogen in its roots, it can grow on bare, mineral substrates and dominate riparian vegetation where overstory cottonwoods have died.



Control: Mowing hedges with a brush type mower, followed by removal of cut material may be the most effective method for eradication. Herbivorous animals are not known to feed on it and few insects seem to utilize or bother it. Canker disease is occasionally a problem but not enough to be useful as a control agent.

Alternatives: A few examples of shrubs native to much of the eastern U.S. include spicebush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), pawpaw (*Asimina triloba*), flowering dogwood (*Cornus florida*), Bursting-heart or strawberry-bush (*Euonymus americanus*) and arrowwood (*Viburnum dentatum*).

LINKS: <http://www.nps.gov/plants/alien/shrubs.htm>
<http://www.grzyby.pl/rosliny/gatunki/Elaeagnaceae.htm>
www.swcoloradowildflowers.com/.../4elan.jpg



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Euonymus fortunei -- Wintercreeper**Watch**

Image Courtesy Missouri
Botanical Garden



Description: Climbing euonymus, also known as wintercreeper, Emerald'n Gold, and Gaiety, is an evergreen, clinging vine in the staff-tree (Celastraceae) family. It can form a dense groundcover or shrub to 3 feet in height, or climb 40-70 foot high vertical surfaces with the aid of aerial roots. Dark green, shiny, egg-shaped leaves, from 1 – 2.5 inches long, with toothed margins and silvery veins, occur in pairs along the stems. Stems are narrow, minutely warty, and have abundant rootlets or trailing roots. Clusters of inconspicuous green-white flowers are produced on a long stalk from June to July and are followed in the autumn by pinkish to red capsules that split open to expose seeds adorned with a fleshy orange seed coat, or aril.

Habitat: Climbing euonymus was introduced into the U.S. in 1907 as an ornamental ground cover. Climbing euonymus tolerates a variety of environmental conditions, including poor soils, full sun to dense shade, and a wide pH range. It does not do well in heavy wet soils. Natural forest openings resulting from wind throw, insect defoliation or fire are vulnerable to invasion and provide conditions for satellite populations of climbing euonymus to get started.

Distribution: Climbing euonymus is currently scattered throughout the eastern U.S. in populated areas. Climbing euonymus spreads vegetatively with the help of lateral shoots produced along its long main branches and by new plants that emerge from rootlets also produced along the stem at short intervals. Vines climb rocks, trees, and other supporting structures. Flowers formed in the summer produce mature fruits by fall that are equipped with fleshy edible structures (arils) that are fed on by birds and other wildlife which disperse it. Climbing euonymus also escapes from neglected gardens and is carried by water to undisturbed forest and riparian areas.

Threats: Traits that make climbing euonymus a desirable ornamental plant, such as its rapid growth, evergreen nature and tolerance of harsh conditions, also make euonymus a threat to natural areas. Climbing euonymus can out-compete native vegetation by depleting soil moisture and nutrients, blocking sunlight, and by forming a dense vegetative mat that impedes the growth of seedlings of native species. Vines on trees continue climbing and can eventually overtop them, covering the leaves and preventing photosynthesis.

Similar Species: This vine differs from bittersweet (*Celastrus* spp.) because bittersweet has alternate leaves. It can be distinguished from other *Euonymus* spp. in that it is a vine rather than an erect shrub or tree.

Control: A variety of mechanical and chemical methods are available for management of climbing euonymus. Grubbing, a rather labor intensive method, is effective for small populations or environmentally sensitive areas where herbicides cannot be used. Using a pulaski or similar digging tool, remove the entire plant, including all roots and runners. Juvenile plants can be hand-pulled when the soil is moist and root systems are small. Any portions of the root system remaining may resprout. All plant

parts including stem fragments and mature fruits should be bagged and disposed of in a trash dumpster to prevent reestablishment. Cut stem treatment, using systemic herbicides applied to freshly cut stems, is effective in areas where vines are well established on or around non-target plants, or where they have grown into tree canopies or other vertical surfaces. Cut the stem as close to the ground as possible and immediately apply a 25% solution of glyphosate (e.g., Roundup) or triclopyr (e.g., Garlon) and water to the cut stem. This procedure is effective at temperatures as low as 40 degrees F. Subsequent foliar application of these herbicides may be required. Cutting without the application of herbicides is generally not recommended because this will lead to root sprouting. Foliar applications of herbicide can be used to control large populations. It may be necessary to precede foliar sprays with cut stem treatments to reduce the risk of damage to non-target plants. Apply a 2% solution of glyphosate or triclopyr and water plus a 0.5% non-ionic surfactant to thoroughly wet all foliage but not so heavily that it drips off leaves where it may affect desirable plants. Glyphosate is a non-selective systemic (i.e., travels through the plant vessels) herbicide that may kill even partially sprayed plants. Triclopyr is selective to broad leaf species and is a better choice if desirable native grasses are present. Ambient air temperature should be above 65 degrees F.



Alternatives: There are a variety of native creeping or climbing vines that make good alternatives for climbing euonymus. Some examples from the eastern U.S. include trumpet creeper (*Campsis radicans*), Dutchman's pipe (*Aristolochia macrophylla*), crossvine (*Bignonia capreolata*), trumpet honeysuckle (*Lonicera sempervirens*), American bittersweet (*Celastrus scandens*), and American wisteria (*Wisteria frutescens*), our only native wisteria*. *NOTE: When purchasing or planting wisteria, make certain it is the native American wisteria (*Wisteria frutescens*) and not exotic Chinese wisteria (*Wisteria sinensis*) or Japanese wisteria (*Wisteria floribunda*), both of which are aggressive exotic invaders of natural areas and are difficult to control.

LINKS: <http://www.nps.gov/plants/alien/fact/eufo1.htm>
perso.wanadoo.fr/ckjw/euonym05-04g.jpg
http://www.uark.edu/campus-resources/cotinus/plants1_html/eufo3.jpg
<http://www.conservation.state.mo.us/nathis/exotic/vegman/twentyse.htm>
http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/vines/euonymus_fotunei.html



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***Glyceria maxima* -- Sweet reedgrass**

Watch



Description: *Glyceria maxima* is a rhizomatous perennial grass that grows from unbranched stems that can reach 8.25 feet in height. The leaf blades are flat or slightly folded and are 0.75 inches wide and 8-12 inches long. The blades are shallowly grooved and have prominent mid-ribs. The apex of the leaf is acute, and the leaf margins have stiff, short hairs. The leaf sheaths are rough in texture and have a reddish-brown band at the junction with the leaf. The ligule is about 0.2 in long and obtuse at the apex. The inflorescence of *Glyceria maxima* is in an open panicle, the branches of which have short, stiff hairs similar to those that are on the leaf margins. The panicle measures 6-12 inches in length. The spikelets are 0.2-0.3 inches long. The glumes are keeled in shape. The ovate, obtuse lemma is 0.1 inches in length and the palea is about equal in size to the lemma, is ovate and obtuse and shape, and is very slightly two-cleft. The small seeds are 1.5-0.07 inches long, obovoid in shape, and smooth in texture. They are dark brown in color and have a deep and narrow central furrow. Flowers appear on this plant from June to August.

Habitat: At present, *Glyceria maxima* has only been found at one site in New England – the Ipswich River marsh system in Massachusetts, where quick control action has prevented its spread. It clearly favors freshwater wetland habitats. *G. maxima* reproduces vegetatively, and has the potential to be a serious invader of wetlands. Active monitoring and rapid control action could prevent its spread into other susceptible areas.

Distribution: *Glyceria maxima* is native to northern Eurasia, from the British Isles to Japan and Kamchatka. In North America, it is found in southern Canada, primarily in Ontario, but also in Newfoundland, British Columbia, Wisconsin and Massachusetts. In North America, *Glyceria maxima* appears to reproduce and spread primarily by means of rhizomes. The extent to which it is able to reproduce and spread by seed is not clear, though evidence suggests that only a small percentage of its florets set viable seed.

Similar Species: *Glyceria grandis* S. Wats. (American mannagrass)

Characters	<i>Glyceria maxima</i>	<i>Glyceria grandis</i>
Mature Height	Up to 2.5 m	Up to 1.5 m
Panicles	Erect branches with rough sheaths	Nodding branches with smooth sheaths
Glumes	2 - 3 mm	1.2 - 1.5 mm

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Threats: *Glyceria maxima* forms large, dense monospecific stands capable of crowding out native wetland vegetation. Because it is both a poor food source and a poor nesting substrate for wetland wildlife, it has a significant potential to negatively affect wetland habitat dynamics. *Glyceria maxima* is a poor food-plant and nesting substrate for wetland wildlife. It has been used as a forage crop, but several instances of cattle poisoning have occurred due to cyanide production in the young shoots.

Control: Little is known on the control of this new invader. **Manual:** pulling -- concentrate on removing all pieces of the root or re-sprouting may occur. Cutting may reduce populations of reed sweetgrass by allowing sunlight to reach other, competitive plants. Multiple cuttings (more than three) may reduce the amount of carbohydrates stored in the rhizomes. Cutting during the fall months when carbohydrates and nutrients are stored for the winter may affect spring re-growth. Black plastic used to smother the grass was 100% effective in Massachusetts. However, this method is not feasible over large areas. **Chemical:** A 3% solution of glyphosate (Rodeo) during early summer and late summer months has been effective. Follow-up treatments the year after application is recommended. **Other:** Flooding cut stubble may drown *G. maxima*.

Alternatives:

LINKS: <http://webapps.lib.uconn.edu/jpane/browsing.cfm?descriptionid=54>
<http://tncweeds.ucdavis.edu/alert/alrtglyc.html>
<http://www.stewo.no/G/Glyceria%20maxima%20'Variegata'%202.jpg>
tncweeds.ucdavis.edu/photos/glyma02.jpg
<http://caliban.mpiz-koeln.mpg.de/~stueber/lindman/451.jpg>
<http://www.hostas.com/images/grasses/smanna1.jpg>



Ligustrum vulgare -- Common Privet**Watch**

Description: *Ligustrum obtusifolium* is a woody, perennial, semi-deciduous shrub that grows to 10 feet in height. It is many stemmed and has pubescent branchlets. Its opposite leaves are elliptic to oblong-ovate in shape and measure 1-2 inches long and 0.3-1 inches wide. The apex of the leaf can be either acute or obtuse in shape. The upper leaf surface is dark green in color, while the lower surface is pubescent, or only pubescent on the mid-rib. The white flowers of *Ligustrum obtusifolium* are unpleasantly scented and are borne in nodding panicles that measure 0.75-1.5 inches long. The flowers appear on the plant in June. The fruit are black or blue-black in color and somewhat glaucous. They are subglobose in shape and measure 0.25 inches in length. Fruit appear on the plant in September and persist on the branches into the winter.

Habitat: It is commonly found in: Abandoned Field, Early Successional Forest, Floodplain Forest, Open Disturbed Area, Roadside, Vacant Lot, Wet Meadow, Yard or Garden.

Distribution: *Ligustrum obtusifolium* reproduces by seeds. Like the other exotic *Ligustrum* spp. in New England, it is dispersed by birds that eat its fruits and defecate the seeds. *Ligustrum obtusifolium* is native to Japan. In the U.S. it is found in most of the northeastern and midwestern states, and as far south as Tennessee and North Carolina. It is sold in nurseries and over the internet. It has been reported in all New England states except Maine.

Similar Species: *Ligustrum ovalifolium* Hassk. (California privet), *Ligustrum sinense* Lour. (Chinese privet), *Ligustrum vulgare* L. (European privet). Identifying the privets that escape and become naturalized is problematic at best. A positive identification can only be made when the plants are in flower. This usually occurs during a few weeks in June. Even then, exact determinations can be questionable because of the possibility of hybrids, cultivars, synonyms, and incorrect determinations. It is also unclear exactly what species occur in the region. To date, we know that *Ligustrum obtusifolium*, *L. ovalifolium* and *L. vulgare* have been reported from New England. Other species may be erroneously reported or represent species not currently documented from the region. Cultivars/Varieties '**Cheyenne**' - Marketed as the hardiest form, this plant still may fail in USDA zone 4 or colder. It retains its leaves late into the season. '**Densiflorum**' - This plant maintains an upright form without pruning, making it suitable hedge material. '**Lodense**' - A dwarf, compact plant, this cultivar only reaches 5' tall after many years. Observers have reported that it is plagued by an incurable disease. '**Pyramidale**' - As this cultivar assumes a somewhat pyramidal habit, it is commonly used as a hedge plant.

Threats: Like *L. vulgare* and *L. sinense*, this plant is capable of escaping to form dense thickets that can crowd out native species.

Control: see *Ligustrum obtusifolium* (Blunt Leaved privet).

LINKS: caliban.mpiz-koeln.mpg.de/.../tafel_075.html

http://webapps.lib.uconn.edu/ipane/jpg/images.cfm?unique_identifier=uconn_ipane_ligusbobtus_08

<http://www.hort.uconn.edu/plants/l/ligvul/ligvul02.jpg>

http://www.rumwoodnurseries.co.uk/hedgepics/hedge_ligustrum_vulgare.jpg

www.kulak.ac.be/.../Ligustrum%20vulgare.htm

Ligustrum vulgare -- Common Privet

Watch



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Lonicera maackii -- Amur Honeysuckle**Watch**

Description: *Lonicera maackii* is a woody perennial shrub that can grow up to 16.5 feet in height. The oppositely arranged leaves, dark green above and lighter on the lower surface, are ovate to lance-ovate in shape and measure 1.3 - 3.3 inches long. The tips of the leaves are acuminate -- the veins are pubescent. The 5-parted white flowers, found in late May to early June, (later than the other honeysuckles) are found in erect pairs, on peduncles shorter than the petioles. The top 4 petals are fused together, unlike the similar *L. morrowii*, (another exotic invasive shrub). The flowers measure 0.6-0.75 inches long and are bilabiate corolla white when fresh, fading to a yellowish-white when older, often with some pinkish tinge at base of tube. The fruit are dark red in color, spherical in shape and measure 0.25 in diameter. The fruit become ripe on the plant in the late fall. Stems - Woody, multiple from base. Twigs tomentose, typically hollow.

Habitat: *Lonicera maackii* can tolerate full sun to partial shade conditions. It can be found as an early successional plant or found in mixed forest, Abandoned Field, Early Successional Forest, Edge, Floodplain Forest, Open Disturbed Area, Pasture, Planted Forest, Roadside, Utility Right-of-Way, Vacant Lot, Yard or Garden. Though it grows on many soil types, it grows best in calcareous situations.

Distribution: This aggressive species was brought to North America in 1855 as an ornamental. *Lonicera maackii* is native to China, Korea and Japan. In the United States, this plant has been reported from the east coast west to Texas, Nebraska and North Dakota. In New England, this plant is present in Connecticut and Massachusetts. It is spread by birds and sold by garden centers and over the internet. The USDA Soil Conservation Service encouraged the planting of *Lonicera maackii* from the 1960s to 1984 for soil stabilization, food and cover for wildlife.

Similar Species: *Lonicera xbella* Zabel (Bell's honeysuckle), *L. morrowii* Gray (Morrow's honeysuckle), *L. tartarica* L. (Tartarian honeysuckle), *L. xylosteum* L. (Dwarf honeysuckle), *Lonicera* spp. (Native bush honeysuckles)

Threats: *Lonicera maackii* can form large stands that prevent native shrubs and herbaceous understory plants from growing. The fruits persist on the branches into the winter, when birds feed on them. In the spring, *Lonicera maackii* is one of the first to leaf out, giving it a competitive advantage. This shrub can bear fruit as early as 3 to 5 years of age. Though *Lonicera maackii* has not yet become a major problem in New England, it is very troublesome in the southern and midwestern parts of the country.

Control: See *Lonicera japonica* (Japanese honeysuckle) for control methods.

LINKS: <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=66>
www.delhi.edu/.../Lonicera_maackii/lonmaa.html
www.duke.edu/~cwcook/trees/loma.html
www.missouriplants.com/Whiteopp/Lonicera_maac...
www.suite101.com/article.cfm/shade_gardening/5584

Lonicera maackii -- Amur Honeysuckle

Watch



***Lysimachia nummularia* -- Moneywort**

Watch



Description: This creeping plant with prostrate stems is also called Creeping Jenny and Creeping Charlie. It displays its yellow flowers with 5 petals, arising in pairs from the leaf axils on short flower stalks, from June through August (though very often it does not flower at all). The flowers of *Lysimachia nummularia* are solitary in the leaf axils and have pedicels that are about the same length as the leaves. The sepals are ovate/triangular in shape and 0.2 - 0.35 inches in length. The flower is 0.8 - 1.2 inches and has 5 spreading, broadly ovate petals that are yellow with small dark red spots. Leaves are round, shiny, in opposite pairs. It can grow up to 2 feet long and from 2 - 4 inches high. Its leaves are opposite, nearly sessile, broadly quadrate to subrotund in shape (roundish) and typically 0.4 to 1.2 inches long. Its small seeds are borne in capsular fruits that are roughly as long as its sepals.

Habitat: Moneywort is found on wet ground in disturbed areas including roadsides, ditches, and lawns. *Lysimachia nummularia* is fairly widespread in New England and can be found in a variety of different habitat types; however, it grows most vigorously and poses the biggest threat in moist areas such as wet meadows and along the banks of small water bodies.

Distribution: *Lysimachia nummularia* is native to Europe and southwest Asia. In North America, it is found in eastern Canada and throughout the eastern United States with the exception of Florida. *Lysimachia nummularia* reproduces by seeds that are passively dispersed, possibly by water, birds or humans. It spreads locally by way of its creeping stems. It is used horticulturally as a ground cover, particularly for moist sunny sites such as the banks of ornamental ponds.

Similar Species: Moneywort is an easy plant to recognize, particularly if it is in flower. It looks like *Veronica officinalis* L. (Common gypsyweed), *Glechoma hederaceae* L. (Gill-over-the-ground), *Mitchella repens* L. (Partridgeberry – on the NH watch list). All three of these herbaceous plants are common and have a creeping habit that, when not in flower, could lead to confusion.

Characters	<i>Lysimachia nummularia</i>	<i>Veronica officinalis</i>	<i>Glechoma hederacea</i>	<i>Mitchella repens</i>
Stems	Glabrous	Pubescent	Smooth to minutely Pubescent	Smooth
Leaves	Opposite, nearly round, entire	Opposite, elliptic-obovate, uniformly serrate	Round to kidney Shaped, strongly crenate	Round - ovate, entire
Flowers	Yellow, axillary, single	Light blue, axillary racemes, Multiple flowers, ascending	Blue-violet, Axillary	White, Terminal
Flower size	¾ - 1 ¼" wide	1 1/3 – 3 ¼ inches wide	½ - 1 inch long	0.4 – 0.6" wd

Threats: By spreading quickly and forming dense mats of vegetation, *Lysimachia nummularia* can potentially threaten native vegetation, most notably in moist habitats. For instance, it has been known to choke small springs and seeps in rich woods. It is also a pest in disturbed habitats such as lawns.

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Control: In low wetland woods where it is invading, one possible means of control is by prescribed burning in spring or fall when moneywort is green but most native vegetation is dormant. The plant can be hand pulled where practical. All stems and stem fragments should be removed from the area to prevent the stems from rooting again in the soil. In low-quality buffer areas, prolonged submergence will kill moneywort. At restoration sites, moneywort can be controlled by establishing native grasses to shade it out. Suggested grasses include *Cinna arundinacea* and *Elymus virginicus*. Seeding of native grasses should be used only at restoration sites and not at natural areas. Herbicides such as Roundup or Rodeo may be effective control measures. Mowing is not effective since moneywort adheres closely to the ground due to its many rooting nodes. More research is needed concerning the effectiveness of herbicides. No biological controls that are feasible in natural areas are known.

Links:

<http://aoki2.si.gunma-u.ac.jp/BotanicalGarden/PICTs/lysimachia-nummularia.jpeg>

http://hflp.sdstate.edu/ho311/outdoor_images/Lysimachia-nummularia.JPG

<http://www.nearctica.com/flowers/otos/primula/Lnumm.htm>

<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=106>

<http://www.inhs.uiuc.edu/chf/outreach/VMG/moneywort.html>

www.funet.fi/.../plants-3-English-Photolist.html



Microstegium vimineum -- Japanese stilt grass**Watch**

Description: Japanese stilt grass, also known as Asian stilt grass, Vietnamese stilt grass, Nepal microstegium, and Chinese packing grass, is an annual grass (family Poaceae) with a sprawling habit that may grow to 3 feet in height. Its thin, pale green, lance-shaped leaves, about 3 inches in length, alternate along a branched stalk and have a silvery stripe of reflective hairs down the middle of the upper leaf surface. Delicate spikes of flowers emerge from slender tips beginning in late summer and continue into the fall. Racemes are terminal and may be solitary or in a set of two or three. Spikelets are in pairs, one sessile and one pedicellate, and 0.17-0.2 inches long. Blooms August-September. Grain is yellow to red, ellipsoid 0.1-0.12 in long. Seeds mature over a period of about two weeks in September-October.

Habitat: Stilt grass occurs on stream banks, river bluffs, floodplains, emergent and forested wetlands, moist woodlands, early successional fields, uplands, thickets, roadside ditches, gas and power line corridors and home lawns and gardens. It readily invades and is most common in disturbed shaded areas like floodplains that are prone to natural scouring, and areas subject to mowing, tilling and other soil disturbing activities. Japanese stilt grass appears to be associated primarily with moist, acidic to neutral soils that are high in nitrogen. It occurs opportunistically in areas of open soil that are generally not already occupied by other species.

Distribution: Native to Japan, Korea, China, Malaysia and India. Japanese stilt grass is currently established in sixteen eastern states, from New York to Florida. Japanese stilt grass is a colonial species that spreads by rooting at nodes along the stem. A new plant emerges from each node. It also spreads by seed and each plant can produce an estimated 100-1,000 seeds. Once established at a site, seed stored in the soil will ensure regrowth for several to many years. Studies have shown that stilt grass seed remains viable in the soil for at least three years and germinates readily following soil disturbance. Although seed dispersal of stilt grass is not fully understood, seeds are probably carried by water currents in streamside habitats and floods, and transported widely in hay and soil.

Similar Species: Microstegium may be confused with cutgrass (*Leersia virginica* Willd.) or knotweed (*Polygonum persicaria* L.). Cutgrass has distinctly longer leaves and shorter spikelets than microstegium. Knotweed is distinguished from microstegium by pale to dark pink calyx and glossy black nutlets.

Threats: Japanese stilt grass is adapted to low light conditions and threatens native under story vegetation in open to shady locations. It spreads opportunistically following disturbance to form dense patches, displacing native wetland and forest vegetation as the patch expands.

Control: Whenever possible, prevent the introduction of Japanese stilt grass from invaded sites into adjacent natural plant communities by avoiding disturbance to vegetation and soil in these areas. Early control of new infestations will also greatly reduce the likelihood of its establishment. Because it is shallow-rooted, stilt grass may be pulled by hand at any time, but if done early in the summer, disturbance to the soil may allow for germination of stored stilt grass seed. Hand pulling of plants will need to be repeated and continued for many seasons. A more effective mechanical method might be to wait until late summer (September) when the plants are in peak bloom but before seed is produced, and

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simply cut them back using a mower or "weed whacker". Being an annual plant, Japanese stilt grass cut late in the season will die back for the winter and not produce additional vegetative shoots.

For extensive infestations, where mechanical methods are not feasible, a systemic herbicide like glyphosate (e.g., Roundup), an herbicidal soap that kills the plants back (e.g., Scythe) and herbicides specific to annual grasses may be a more effective choice. If applying glyphosate to stilt grass in wetland sites, use the formulation labeled for wetland areas (e.g., Rodeo). No biological controls are currently available for this plant.

LINKS: <http://www.nps.gov/plants/alien/fact/mivi1.htm>
[http://www.fs.fed.us/ne/durham/4155/fire/MIVI MANA.jpg](http://www.fs.fed.us/ne/durham/4155/fire/MIVI_MANA.jpg)
www.invasive.org/weeds/usfsr8/NB.html
<http://webdogam.com/pic/pic490.jpg>
<http://www.se-eppc.org/manual/japgrass.html>
<http://www.fosc.org/invasives.htm>
<http://user.chollian.net/~yesooj/image9/balengqi104.jpg>
www.se-eppc.org/manual/japgrass.html photos by Ted Bodner & James Miller



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Phalaris arundinacea* -- Reed canary grass*Watch**

Description: Reed canary grass is a large, coarse perennial grass reaching 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3.5 to 10 inches long and .25 to 3/4 inch in width. Leaf blades are flat and have a rough texture on both surfaces – usually green but occasionally striped with white. The leaf ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. It has 4-7 joints that are hard and smooth, sometimes reddish. Single flowers 4 inches long occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color, about 3/4 inch.

Habitat: *Phalaris* favors lakes, riverbanks and seashores, especially rocky. It often grows in rings where *Calla palustris* and *Bidens*-species are found in the middle. Likely “neighbors” include *Phragmites*, *Carex acuta* and *Iris pseudoacorus*. Reed canary grass also grows on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as berms and spoil piles.

Distribution: Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands. Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively, producing leaves and flower stalks 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

Similar Species: Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others.

Threats: *Phalaris arundinacea* threatens native plants through its ready spread via rhizomes. It forms dense monocultures that can spread for acres. These stands cause the seed bank to become depleted of other species. The denseness of the stands does not allow for native species to readily coexist with it. It has little value for wildlife, and can be too dense for use by waterfowl and small mammals as cover. It can get into irrigation banks and ditches and cause an increase in siltation. *Phalaris arundinacea* can be

allergenic due to the abundant pollen and chaff it produces. [This plant is often ignored in wetland systems because it often grows with another invader, *Lythrum salicaria* (purple loosestrife) that attracts more attention. Thus the full extent of the threat may actually be underestimated.]

Control: Reed canary grass is difficult to eradicate; no single control method is universally applicable. In natural communities, mechanical control practices are recommended. In buffer areas and in severely disturbed sites, chemical and mechanical controls may be used. Any control technique to reduce or eliminate reed canary grass should be followed by planting native species adapted to the site. As reed canary grass can enter a wetland area from eroding hill slopes, erosion control and catch-basins around a preserved wetlands are appropriate preventative measures. **Mechanical Control:** Small, discrete patches may be covered by black plastic for at least one growing season; the bare spot can then be reseeded with native species. This method is not always effective and must be monitored because rhizomes can spread beyond the edge of the plastic. Prescribed burns in late spring or late fall may help reduce the reed canary grass population if repeated annually for 5 to 6 years. However, fires may be difficult to conduct due to water levels and/or the greenness of the grass at the time of burning. The application of 1.5% active ingredient solution of glyphosate will "brown off" reed canary grass enough to conduct prescribed burns. Burning is also ineffective in dense stands of reed canary grass that lack competition from native, fire-adapted species in the seed bank. A late-spring burn followed by mowing or wick-applying glyphosate to the emerging flowering shoots will eliminate reed canary grass seed production for that year. Mowing twice yearly (early to mid-June and again in early October) may help control reed canary grass by removing seed heads before the seed matures and exposing the ground to light, which promotes the growth of native wetland species. Discing the soil in combination with a mowing or burning regime may help by opening the soil to other species. Hand-pulling or digging may work on small stands in the early stages of invasion. A bulldozer can be used to remove reed canary grass and rhizomes (12-18" deep), after which native species should be seeded. Discing or plowing can also be employed in this manner. In small areas with few natives, another method involves repeated cultivation for one full growing season followed by dormant seeding near the first-frost date. Disrupting the plant roots every two to three weeks weakens the remaining plants and depletes the seed bank. When combined with spot herbicide application in sections too wet for early or late cultivation, results after two years have been good. Frequent and continued cultivation is important since one or two cultivations would simply cut the roots up and increase the number of individual plants.

Chemical Control: Small, scattered clones (2 feet in diameter) can be controlled by tying the stems together just before flowering, cutting them, and applying glyphosate in a 33% active ingredient (a.i.) solution to cut stems. A formulation of glyphosate designed for use in wetlands will kill reed canary grass (especially young plants) when applied to foliage. Apply in early spring when most native plant species are dormant. Any herbicide application should be done only after removing dead leaves from the previous year in order to maximize growing shoot exposure and to minimize herbicide use. A 5% solution of glyphosate formulated for use over water applied as a foliar spray will kill reed canary grass. Two herbicidal applications may be necessary to ensure complete coverage. Herbicide applied with a wick applicator attached to a tractor affects taller stands of reed canary grass without impacting the shorter vegetation. An alternative method involves wick application of glyphosate in the first to third weeks of June, followed by a late June to mid-July burn. This technique reduces reed canary grass cover, depletes the seed bank, and stimulates native seed banks.



LINKS: www.stauder.net/BILDEARKIVET.htm
<http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/reed.htm>
<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=84>
<http://nepenthes.lycaenum.org/Plants/Phalaris/DMTLU.html>
<http://tncweeds.ucdavis.edu/photos/phaar06.jpg>
http://www.grzyby.pl/rosliny/qatunki/Phalaris_arundinacea.htm
<http://nepenthes.lycaenum.org/Plants/Images/Phalaris.arundinacea.jpg>
http://www.fs.fed.us/r9/wildlife/nnis/herbicide_project/Photos/reed_canary-grass_1_Phalaris_arundinacea.jpg

Populus alba -- White Poplar**Watch**

Description: White poplar, also known as silver-leaved or silverleaf poplar, is a tall member of the willow family (Salicaceae) that, at maturity, may reach 70 feet or more in height and 2 feet in diameter. The smooth, greenish-white bark becomes dark and rough on older trees. Young green or brown twigs are coated with dense woolly hair, especially near the tip. A cross-section of the stem reveals a five-pointed, star-shaped pith. The 2 to 5-inch long leaves are oval to maple-leaf in shape with 3-5 broad teeth or lobes, and are dark green above and covered with dense white hair below. Male and female flowers are borne in catkins on separate trees and appear sometime in March and April. The small seeds are adorned with cottony fluff that is easily blown by the wind in late spring, and is a bane to many landscape maintenance workers.



Habitat: White poplar seems to grow best in full sun habitats such as fields, forest and wetland edges.

Distribution: First introduced to North America in 1748, white poplar is found in 43 states. Local spread of white poplar is primarily by vegetative means, through root suckers which arise from adventitious buds on the extensive lateral root system. Large numbers of suckers from a single tree can quickly develop into a dense colony. Suckering can occur naturally or as a result of damage or other disturbance to the parent plant. While mature white poplar trees produce thousands of wind-dispersed seeds that may be carried long distances, seed germination appears to be very low in the U.S.

Threats: White poplar out-competes many native tree and shrub species in mostly sunny areas, such as forest edges and fields, and interferes with the normal progress of natural community succession. It is an especially strong competitor because it can grow in a variety of soils, produce large seed crops, and resprouts easily in response to damage. Dense stands of white poplar prevent other plants from coexisting by reducing the amount of sunlight, nutrients, water and space available.

Control: White poplar can be controlled using a variety of physical and chemical controls. **Mechanical:** Removal of seedlings and young plants by hand will help prevent further spread or establishment. Hand removal of plants is best achieved after a rain, when the soil is loose. Trees of any size may be felled by cutting at ground level with power or manual saws. Because resprouts are common after cutting, this process may need to be repeated many times until the reserves of the tree are exhausted. Girdling, which kills the tree by severing tissues that conduct water and sugars, also may be effective for large trees, especially if accompanied by application of a systemic herbicide to the cut area. A hatchet or saw is used to make a cut through the bark encircling the base of the tree, approximately six inches above the ground and deep into the bark. Girdling will kill the parent tree but may require follow-up cutting or treatment of sprouts with an herbicide. **Chemical** control of white poplar seedlings and small trees has been achieved by applying a 2% solution of glyphosate (e.g., Roundup) or triclopyr (e.g., Garlon 3) and water plus a 0.5% non-ionic surfactant to the foliage until the leaves are thoroughly wet. Use of low pressure and a coarse spray with large droplet size will reduce spray drift and damage to non-target plants. Triclopyr kills broadleaf (dicotyledonous) plants but causes little or no damage to grasses and is

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useful for areas where desirable grasses are to be maintained. The cut stump herbicidal method should be considered when treating individual trees or where the presence of desirable species precludes the use of foliar herbicides. Stump treatments can be made at any time of year as long as the ground is not frozen. After cutting the tree near ground level, a 25% solution of glyphosate or triclopyr and water is applied to the stump by spray bottle or brush, making sure to cover the outer 20% of the stump. Basal bark herbicidal treatment is also effective throughout the year, as long as the ground is not frozen, and does not require cutting of the tree. A mixture of 25% triclopyr in an ester formulation (e.g., Garlon 4) and 75% horticultural oil is applied to the bark in a wide band around the base of the tree to a height of 12-15 inches from the ground. Thorough wetting is necessary for good control; spray until run-off is just noticeable at the ground line, but not running off-site.

Alternatives: Hundreds of native tree species are available that can be used in place of white poplar. A few examples, for parts of the eastern U.S. only, include white oak (*Quercus alba*), red maple (*Acer rubrum*), American holly (*Ilex opaca*), persimmon (*Diospyros virginiana*), and sweetgum (*Liquidambar styraciflua*).

- LINKS:** <http://www.nps.gov/plants/alien/fact/poal1.htm>
http://www.astma.edu.pl/download/16_800.jpg
http://plants.usda.gov/cgi_bin/large_image_rpt.cgi?imageID=poal7_002_avp.tif
<http://www.standardtrees.co.uk/minipics/popalboq.jpg>
http://www.first-nature.com/trees/images/populus_alba1.jpg
biology.smsu.edu/.../Populus%20alba
www.botany.hawaii.edu/faculty/carr/salic.htm
<http://www.thornhayes-nursery.co.uk/gallery2.htm>
www.arbolesornamentales.com/Populus%20alba.jpg
www.uco.es/.../grupos/rea/temporada/populus.htm
<http://www.homepage.montana.edu/~mlavin/b436/salix/popualba.jpg>



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Pueraria lobata -- Kudzu**Watch**

Description: Kudzu (often referred to as “the plant that ate the South”), is a climbing, semi-woody, perennial vine in the pea family. Deciduous leaves are alternate and compound, with three broad leaflets up to 4 inches across. Leaflets may be entire or deeply 2-3 lobed with hairy margins. Individual flowers, about 0.5 inches long, are purple, highly fragrant and borne in long hanging clusters. Flowering occurs in late summer and is soon followed by production of brown, hairy, flattened, seed pods, each of which contains three to ten hard seeds. So far no Kudzu has been found in New Hampshire, but recent reports find it creeping as close as Plymouth, MA. Should you see this menace in NH, report it immediately to Doug Cygan, Invasives Species Coordinator, NH Department of Agriculture at (603) 271-3488.

Habitat: Kudzu grows well under a wide range of conditions and in most soil types. Preferred habitats are forest edges, abandoned fields, roadsides, and disturbed areas, where sunlight is abundant. Kudzu grows best where winters are mild, summer temperatures are above 80 degrees Fahrenheit, and annual rainfall is 40 inches or more.

Distribution: Native to Asia. Kudzu was introduced into the U.S. in 1876 at the Philadelphia Centennial Exposition, where it was promoted as a forage crop and an ornamental plant. From 1935 to the mid-1950s, farmers in the south were encouraged to plant kudzu to reduce soil erosion, and Franklin D. Roosevelt’s Civilian Conservation Corps planted it widely for many years. Kudzu was recognized as a pest weed by the U.S. Department of Agriculture and, in 1953, was removed from its list of permissible cover plants. Kudzu is common throughout most of the southeastern U.S. and has been found as far north as Plymouth, MA. The spread of kudzu in the U.S. is currently limited to vegetative expansion by runners and rhizomes and by vines that root at the nodes to form new plants. Kudzu also spreads somewhat through seeds, which are contained in pods, and which mature in the fall. However, only one or two viable seeds are produced per cluster of pods and these hard-coated seeds may not germinate for several years.

Threats: Kudzu kills or degrades other plants by smothering them under a solid blanket of leaves, by girdling woody stems and tree trunks, and by breaking branches or uprooting entire trees and shrubs through the sheer force of its weight. Once established, Kudzu plants grow rapidly, extending as much as 60 feet per season at a rate of about one foot per day. This vigorous vine may extend 32-100 feet in length, with stems 0.5 - 4 inches in diameter. Kudzu roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weighing as much as 400 pounds. As many as thirty vines may grow from a single root crown.

Control: For successful long term control of kudzu, the extensive root system must be destroyed. Any remaining root crowns can lead to reinfestation of an area. Mechanical methods involve cutting vines just above ground level and destroying all cut material. Close mowing every month for two growing seasons

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or repeated cultivation may be effective. Cut kudzu can be fed to livestock, burned or enclosed in plastic bags and sent to a landfill. If conducted in the spring, cutting must be repeated as regrowth appears to exhaust the plant's stored carbohydrate reserves. Late season cutting should be followed up with immediate application of a systemic herbicide (e.g., glyphosate) to cut stems, to encourage transport of the herbicide into the root system. Repeated applications of several soil-active herbicides have been used effectively on large infestations in forestry situations. Efforts are being organized by the U.S. Forest Service to begin a search for biological control agents for kudzu.

Alternatives: Native vines such as trumpet creeper (*Campsis radicans*), pipevine (*Aristolochia macrophylla*), passionflower (*Passiflora lutea*), trumpet honeysuckle (*sempervirens*), and native bittersweet (*Celastrus scandens*) have attractive flowers and fruits, provide food for wildlife and make excellent substitutes for kudzu.

LINKS: <http://www.nps.gov/plants/alien/fact/pulo1.htm>
Miller@forestry.Auburn.edu
http://www.oda.state.or.us/Plant/weed_control/gifs/kudzuComp.jpg
http://www.missouriplants.com/Bluealt/Pueraria_lobata_thumb.jpg
<http://www.arhomeandgarden.org/plantoftheweek/Images/Pueraria%20lobata.JPG>
<http://www.le.ac.uk/biology/staff/jpb/pueraria.gif>
www.missouriplants.com/Bluealt/Pueraria_lobat...



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Robinia pseudoacacia L. -- Black Locust**Watch**

Description: Black locust is a fast growing tree in the pea family (Fabaceae) that can reach 40 to 100 feet in height at maturity. While the bark of young saplings is smooth and green, mature trees can be distinguished by bark that is dark brown and deeply furrowed, with flat-topped ridges. Seedlings and sprouts grow rapidly and are easily identified by long paired thorns. Leaves of black locust alternate along stems and are composed of seven to twenty one smaller leaf segments called leaflets. Leaflets are oval to rounded in outline, dark green above and pale beneath. There are two spines at the base of each leaf. Fragrant white flowers appear in drooping clusters in May and June and have a yellow blotch on the uppermost petal. Fruit pods are smooth, 2 to 4 inches long, and contain 4 to 8 seeds. Two other locusts native to the Appalachians, *Robinia viscosa* (with pink flowers), and *Robinia hispida* (with rose-purple flowers), are used in cultivation and may share black locust's invasive tendencies.

Habitat: Black locust is an early successional plant, preferring full sun, well drained soils and little competition. It is commonly found in disturbed areas such as old fields, degraded woods, and roadsides. Due to its rapid growth, black locust has been promoted by state and federal agencies and nurseries, and is sometimes planted in or near prairies, oak savannas and native woodland edges.

Distribution: It is found in the southeastern United States; on the lower slopes of the Appalachian Mountains, with separate outliers. Black locust reproduces vigorously by root suckering and stump sprouting to form groves (or clones) of trees interconnected by a common fibrous root system. Physical damage to roots and stems increases suckering and sprouting, making control difficult. Black locust clones easily spread in quality and restorable natural areas. Although black locust produces abundant seeds, they seldom germinate.



Similar Species: The most similar species is Honeylocust (*Gleditsia triacanthos*), which has yellow flowers and much larger thorns and pods.

Threats: Black locust poses a serious threat to native vegetation in dry and sand prairies, oak savannas and upland forest edges, outside of its historic North American range. Once introduced to an area, black locust expands readily into areas where their shade reduces competition from other (sun-loving) plants. Dense clones of locust create shaded islands with little ground vegetation. The large, fragrant blossoms of black locust compete with native plants for pollinating bees.

Control: Black locust is susceptible to some damage from two native insects, the locust borer (*Megacyllene robiniae*) and the locust leafminer (*Odontota dorsalis*). Mowing and burning are only effective in reducing the further spread of young shoots from a clone or parent tree. To kill a clone, cutting alone is ineffective. Herbicides applied to the stems or cut stumps spread

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into the root system and provide better control. From mid-June to August hand sprayer application of 6.25% glyphosate solution (15:1 water:glyphosate) to stumps cut near the ground has shown some success. Resprouting and suckering from dense clones may require follow up treatment after a few years. Because plants that appear to have been killed can resprout even several years after treatment with herbicide, annual monitoring should be conducted and follow-up treatments made as needed. Throughout the year a 25% triclopyr solution in basal oil (3:1 oil:triclopyr) applied immediately to cut stumps using backpack sprayers has also been successfully used. Thoroughly wet the cut stump and bark below the cut, down to the root collar, but avoid runoff. Any runoff will kill surrounding vegetation, especially if treated in the winter before snow melt. Treat in fall or winter with a basal bark application of Garlon 4 herbicide. Do not cut before application. Or, use Tordon RTU applied to a 1 inch deep cut, which is several inches wide around the tree trunk. This needs to be deep enough to cut through the cambium (deeper than a girdle). Follow herbicide instructions carefully and exercise caution.

Alternatives: For erosion control, soil enrichment, and nectar sources, plant native grasses and other native herbs, shrubs and trees that are appropriate for your soil and moisture conditions. If tree plantings will affect nearby natural communities, plant oak tree species native to your area for timber or shade. Contact the native plant society in your state or a state forester or resource manager for recommendations on appropriate, non-invasive native tree and shrub species for your site.

LINKS: <http://www.nps.gov/plants/alien/fact/rops1.htm>
<http://aquat1.ifas.ufl.edu/robpse1.jpg>
<http://www.duke.edu/~cwcook/trees/rops.html>
<http://www.shorewood-hills.org/departments/forester/reesewoods/reesewoodsplan.pdf>



Ulmus pumila -- Siberian Elm**Watch**

Description: Siberian elm is a fast-growing tree in the elm family (Ulmaceae) distinguished by small toothed leaves about 1-2½ in long and half as wide, and pointed at the tip. Unlike other elms, the leaf base is usually symmetrical, forming a nearly even "V". Leaves are smooth and dark green above, paler and nearly hairless beneath, and alternate from side to side along twigs. Mature trees reach a height of 50-70 feet, with a round crown of slender, spreading branches. The bark is rough, gray or brown, and shallowly furrowed at maturity. Twigs are nearly hairless with small, blunt buds. Flowering occurs in the springtime. The small greenish flowers lack petals and occur in drooping clusters of 2 to 5. After flowering, a single seed forms in the center of each smooth, flattened, circular, ½ in wide fruit.

Habitat: Siberian elm are found in a number of environments: dry and mesic prairies, areas along stream banks, forests, high elevations. Seeds are produced early in spring and spread by the wind. Germination rate is high and seedlings soon establish in the bare ground found early in the growing season.



Distribution: Siberian elm is known to occur in 43 states and reported to be invasive in natural areas in 25 states.

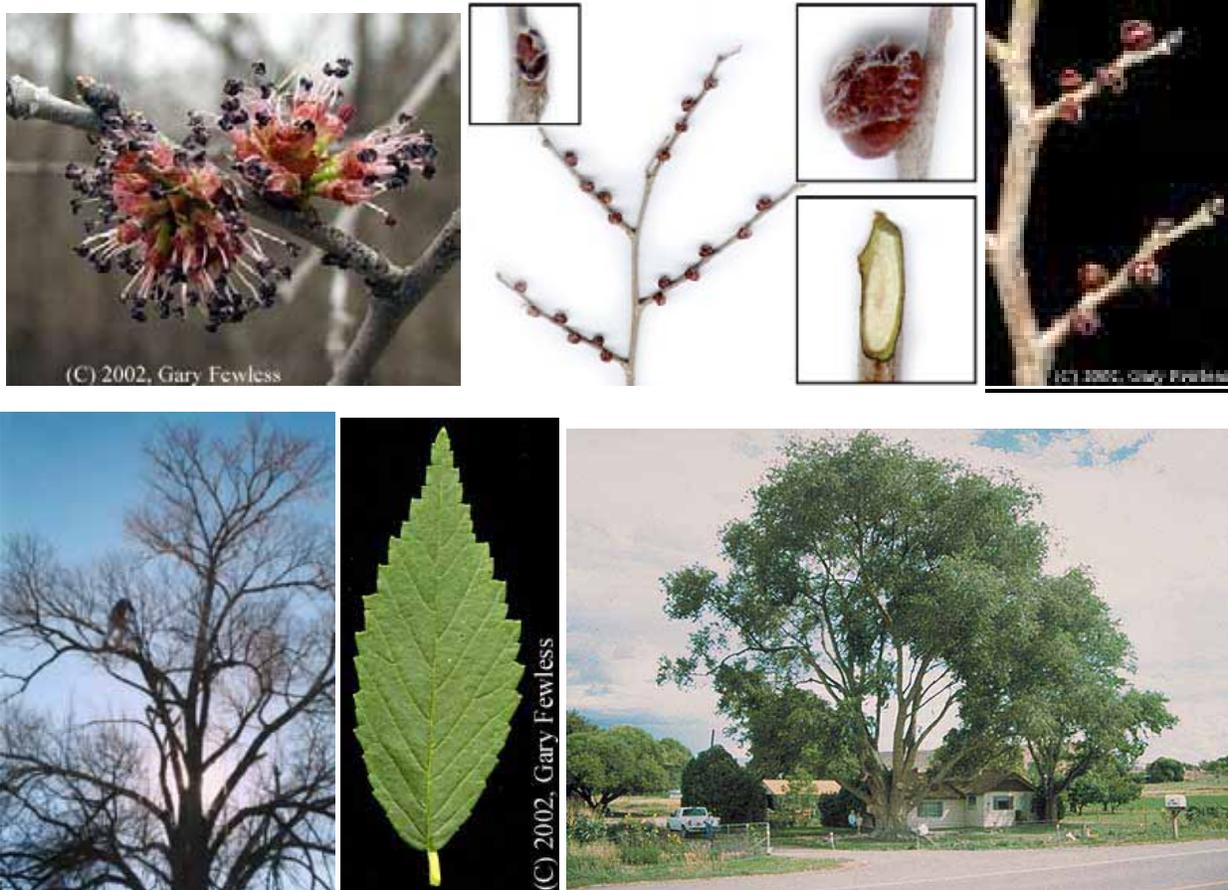
Threats: Thickets of seedlings form around seed-producing trees, bare ground areas, animal and insect mounds, and other disturbed areas. Wind carries seed to distant areas where new colonies can form. This tough exotic survives under conditions not easily tolerated by other species, allowing it to take advantage of open ground and resources otherwise used by native plants. Fast growing seedlings of Siberian elm quickly overtake native vegetation, especially shade-intolerant species. This often leads to invasion by additional weedy species.

Similar Species: Other species of elms (*Ulmus*) and the close relative, *Zelkova*, (especially younger plants) look similar to Siberian elm. Some may even confuse it with choke-cherry (*Prunus serotina*) and hackberry (*Celtis* sp.). The native slippery elm and American elm typically have leaves that are greater than 3 inches long, with unequal heart-shaped leaf bases, and leaf margins with double teeth.

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Control: Manual: During the growing season, seedlings can be hand pulled and small trees carefully removed by a grub hoe or weed wrench. Trees girdled in mid-May to early July will die over 1-2 years without sprouting if cut properly. Girdling is done by removing a band of bark from the wood, making two parallel cuts 3-4 inches apart, then knocking bark off with a blunt object such as the back of an axe head or dull end of a girdling bar. The xylem must remain intact; if girdled too deeply the tree will respond as if cut down and will resprout. On sites with few seed sources, the large trees can be cut down and resprouts trimmed as needed. **Chemical:** To avoid resprouts after cutting or girdling, cut stumps may be treated with systemic herbicides such as glyphosate (e.g., Roundup) and triclopyr (e.g., Garlon). After spring sap flow ceases and during the growing season, apply 4 parts water to 1 part glyphosate (based on 41% active ingredient glyphosate concentrate) with a hand sprayer to cut stumps. The entire stump should be saturated with the herbicide to achieve the most effective control. Garlon 4 (triclopyr ester formulation) can be applied as a cut stump or basal bark treatment. For basal bark, apply a 20-percent solution in horticultural oil (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray in winter (January to February) or summer-fall (June to October). Cut stems can be immediately treated with glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix) in water with a surfactant. **Other:** A regular regime of prescribed burning in fire-adapted communities will kill seedlings.

LINKS: <http://www.nps.gov/plants/alien/fact/ulpu1.htm>
<http://www.ericstreecare.com/etcintreeo.jpg>
http://plants.usda.gov/cgi_bin/large_image_rpt.cgi?imageID=ulpu_001_avp.tif
<http://www.uib.es/depart/dba/botanica/herbari/generes/Ulmus/pumila/>
http://www.coloradotrees.org/champions/alph_listing/nat_champs/sib_elm.html



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Ampelopsis brevipedunculata -- Porcelain-berry**Watch****Description:** Porcelainberry is a deciduous, woody, perennial vine of the grape family, Vitaceae. It is

related to the North American raccoon-grape and peppervine, and is sometimes referred to as Amur peppervine or porcelain ampelopsis. The simple, heart-shaped leaves of porcelainberry are dark green with coarsely toothed edges, and are shiny underneath with delicate hairs along the veins. The leaves vary from slightly 3-5 lobed to deeply dissected, the latter being distinctively recognizable. The leaves are arranged alternately on vines that grow to heights of 15 to 20 feet. The plant climbs by tendrils that grow opposite the leaves on the stem. Small, greenish-white flowers appear in clusters on porcelainberry in June, July, and August. The colorful berries of porcelainberry, its most distinguishing feature, appear in September-October. The berries, about 0.25 inches in diameter, range in color from white to yellow, to pastel shades of green, lilac and amethyst purple, to

turquoise and sky blue. All colors of the berry are often found growing on the same plant at the same time while the plant is still in full foliage

Habitat: Porcelainberry grows well in most soils, especially in pond margins, stream banks, thickets, and waste places, where there is full sunlight to partial shade, and where it is not permanently wet. Like its relative the grape, porcelainberry appears to be less tolerant of heavily shaded areas, such as that found in mature forest.

Distribution: This plant originated in China, Korea, Japan, Russian Far East and is found in the U.S. from New England to North Carolina and west to Michigan. The colorful berries (carrying 2-4 seeds each) attract birds and other small animals that eat the berries and disperse the seeds in their droppings. Because the plant is often found growing in riparian areas downstream from established plant colonies, it is thought that the seeds may also be dispersed in stream water.

Threats: *Ampelopsis brevipedunculata*, because it is a vine, has the ability to grow up and smother native vegetation. It grows rapidly and is difficult to control. Because of the extra weight caused by the vine on the plant, the plant becomes susceptible to wind and ice damage. The fruit can float, so water can disperse these plants long distances. The seeds are also known to have a high germination rate, aiding the establishment of this plant.

Similar Species: There are several US native species of *Ampelopsis* that could be confused with this exotic.

Control: Since the vines can grow as long as 15 feet in a single growing season, repeated applications in the same growing season and in subsequent years may be necessary to fully eradicate the plant.

Manual: Because flowers are produced on the current season's growth, hand-pruning in the fall or spring will prevent flower buds from forming the following season. Where feasible, plants should be pulled up by hand before fruiting to prevent the spread of seeds. If the plants are pulled while in fruit, the fruits should be bagged and burned before they ripen. This method can be difficult in areas where the plant is well established since pulling up the plant often pulls out native plants with intermingled roots. Cut above-ground vines and, if possible, pull from trees to allow the trees to recover and recut repeatedly as needed.

Chemical: The herbicides triclopyr (e.g., Garlon 3a and Garlon 4) and glyphosate (Roundup and Rodeo) have been used with varying success to battle infestations of porcelainberry. **Foliar applications:** Smaller infestations of porcelainberry can be controlled to some extent with spot applications of glyphosphate to leaves, used sparingly to avoid contact of desirable plants with spray. Cut vines back during the summer and allow to resprout before applying herbicide, or apply glyphosate to leaves in early autumn, just prior to senescence. More effective control has been achieved using triclopyr formulations. From summer to fall, apply a water-based solution of 2.5% Garlon 3A (triclopyr amine) to foliage or cut first, allow to

regrow, and then apply triclopyr to new growth. *Basal bark applications:* Apply a mixture of 20-30% Garlon 4 (triclopyr ester) with an equal volume of commercially available basal oil, diesel fuel, No. 1 or 2 fuel oil, or kerosene. Other oils, such as horticultural oil can be substituted if the label for the oil recommends it for basal bark application. Application should be during any season when temperatures are around 60 degrees Fahrenheit or more for several days, around the basal portions of vines.

Alternatives: The following vines are good alternates: trumpet honeysuckle (*Lonicera sempervirens*), with red or yellow flowers and berries that can be eaten by birds; native wisteria* (*Wisteria frutescens*), a woody vine with abundant clusters of purple flowers; Virginia creeper (*Parthenocissus quinquefolia*), which can be aggressive but offers extraordinary fall color; trumpet creeper (*Campsis radicans*) and goldflame honeysuckle (*Lonicera heckrottii*), both attractive to hummingbirds; and jackman clematis (*Clematis jackmanii*), a hardy climber with showy purple flowers.

* If you wish to plant wisteria, make certain that it is the native species. Two commonly planted ornamental wisterias, Chinese wisteria (*Wisteria sinensis*) and Japanese wisteria (*Wisteria floribunda*), are exotic and aggressive invaders. Please consult the native plant society in your state for more information on species native to your particular area.

<http://www.nps.gov/plants/alien/fact/ambr1.htm>

<http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=38>

[http://www.muweb.cz/www/dendrologie/Obrazky19/Ampelopsis%20brevipedunculata%20Elegans%20\(10\).jpg](http://www.muweb.cz/www/dendrologie/Obrazky19/Ampelopsis%20brevipedunculata%20Elegans%20(10).jpg)

<http://plants.chebucto.biz/fleurs/F1492.JPG>





Elements of a Comprehensive Invasives Control Program

Management plans must provide a rationale for controlling invasives,

1. Identify the management objectives of the site to be treated.
2. Determine whether site characteristics and adjacent land uses are compatible with the management objectives.
3. Evaluate the site for potential regrowth of invasives following treatment.
4. Evaluate the site to determine if invasives control by itself is adequate to achieve the desired management objectives (i.e., are other restoration efforts, such as replanting native plants, necessary?).
5. Determine whether site characteristics and adjacent land uses are compatible with the measures to be applied.
6. Conduct an on-site evaluation of resident biota and identify ecological functions of the wetland.
7. Identify all permits and reviews which must be obtained.
8. Define all activities needed to meet project objectives.
9. Establish a time line for these activities.
10. Secure all funding, permits and cooperative agreements necessary to complete the project.

Control of Invasive Plant Species

An exotic plant invasion can move through an area with the speed of an epidemic. Like a disease, eliminating it right away, or preventing its introduction, is the best management practice. Pulling or killing a few stems, saplings or seedlings when they first appear may prevent an insurmountable problem later. Make sure you've correctly identify the plant first; don't destroy native species by mistake

Attacking the problem by hand with the aid of a few gardening tools is least destructive to the habitat; plants can be pulled, mowed or cut. Keep in mind that each species will respond differently to each control method. Some plants may sprout prolifically when cut and may require multiple cuttings for several years before their roots will finally die. Manual removal methods alone, especially when used repeatedly over a period of time, have been extremely successful. Find out what works for the species you are dealing with, and what methods may make matter worse. Treating invasive plants with herbicides is often an effective control method, but it should be used cautiously and with discretion and only after other alternatives are considered first. Consulting the NH Department of Agriculture's Division of Pesticide Control prior to applying any chemical control method is advised.

General Herbicide Directions

Safety issues: If you are considering using herbicide to control invasives, the best way to avoid damaging the lands you want to protect and risking injury to yourself, pets, wildlife or others is by knowing the facts. In wetland areas in New Hampshire, only a licensed pesticide specialist with a permit for the specific infested area can apply herbicides. In fact, no herbicides suitable for wetland applications are available for sale to the general public. Outside of wetlands, a property owner may personally apply an herbicide without a license on his or her own property. We suggest you study and follow all safety precautions for the recommended herbicide for the plant you are trying to eradicate. Contact the manufacturer and/or the NH Department of Agriculture's Division of Pesticide Control with questions about the legalities of working in a specific area and/or about a particular herbicide.

Protective gear should be worn to apply herbicide, including very thick, non-absorbent nitrite gloves and protective eye goggles. Wash your hands when done and dispose of used gloves, bottles, and brushes in a separate trash bag. Make sure this disposal bag is well marked so that it cannot be mistaken for something else and accidentally opened by someone who is not wearing protective gear. Keep herbicides out of reach of children and pets.

Please Note: The control options listed in this documentation were all found by doing internet searches on the particular invasive plants. The author of this documentation is not a licensed herbologist and has no direct experience with control methods for most of these invaders. The listed methods are only suggestions – better control methods may be available. Further research

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by the applicant is suggested. The Nashua Conservation Commission is not responsible for the use or misuse of any chemical product and does not guarantee the success of any method or product. Mention of any particular product does not imply endorsement by the Nashua Conservation Commission.

Herbicides: *While the fact sheets give specific control options for particular invasives, the following is information about some of the described herbicides*

Application to Terrestrial Plants: See fact sheets for the specific invasive you want to terminate, as the wrong technique could actually encourage growth of certain invasives, while killing off desirable natives. Different plants may require different strengths of the same herbicide.

1. For many invasives, this technique is affective: Directly apply the herbicide to stems cut a few inches from the ground immediately after they are clipped.
2. Fall application works best in most cases, as the plant stores energy in its roots for the winter. The ideal time to spray is after surrounding native vegetation has become dormant (October-November) to avoid affecting non-target species.
3. For some hollow stemmed plants (e.g., Phragmites), place a drop of diluted herbicide into the hollow stem of the plant immediately after clipping.
4. Several herbicides should be applied during daylight and when ambient air temperature is above 65°F (although some are still effective until the ground freezes) and when there is no chance of precipitation for the next eight hours.
5. Herbicide may also be sprayed carefully to the leaves of uncut plants. This method is most often used when there is a dense thicket of invasive plants or when the invasive plant in question is the very first species to put out growth in the spring, or the last with remaining foliage in the fall. It may be necessary to precede foliar applications with stump treatments to reduce the risk of damaging non-target species.
6. Do not apply herbicide so heavily that the herbicide drips off the leaf surface.
7. Including a dye with a herbicide will help you see where the compound has been applied.
8. Most invasives require subsequent applications to kill seedlings that germinate the following year.
9. For more on invasives: <http://www.cyberonic.com/~gwlt/invasive.html>

Rodeo is a wetland-specific product formulation of the herbicide glyphosate which has been approved by the EPA for controlling many species of undesirable plants growing in or near sensitive aquatic environments. Glyphosate (N- (phosphonomethyl) glycine) is a non-selective systemic herbicide that kills or injures actively growing plants when applied to green tissue. The compound is rapidly translocated throughout the plant body where it interferes with the biosynthesis of aromatic compounds at points of growth. Since the specific enzyme inhibited by the action of glyphosate is localized in plastids, only organisms having this pathway and plastids are affected. All plants have plastids and the shikimate pathway; animals do not. Thus, the mode of action of glyphosate is specific to plants. Abundant toxicological data exists showing glyphosate to be safe when used according to label instructions. In brief, the compound does not bioaccumulate in aquatic food chains and exhibits very low toxicity to achlorophyllous organisms including bacteria, fungi, and animals. Glyphosate is non-volatile, immobilized in most soils, and is rapidly removed from the environment by chemical bonding with soil particles and microbial degradation. The herbicide glyphosate is the active ingredient of several commercial products including Rodeo, Roundup, Roundup Pro, Roundup Ultra, and Accord.

The product Roundup in concentrated form contains 41% of the herbicide glyphosate and 7% surfactant. The product Rodeo contains 53.8% glyphosate and no surfactant; however, the label's mixing instructions require the addition of nonionic surfactant, total concentration 0.5% in the spray mixture. Since it is the surfactant, and not glyphosate, that can potentially harm some aquatic organisms, the lower surfactant concentration of Rodeo is responsible for the reduced toxicity to non-target organisms in aquatic systems, hence its registry for use. Please note, Rodeo must be used with surfactant according to the manufacturer's label instructions. To do otherwise is a violation of the federal label law. Triclopyr is selective to broadleaf plants and is a better choice if native or other desirable grasses are present.

One common problem in using aquatic herbicides is determining area and/or volume of the pond or area to be treated. Following are descriptions of some of the more commonly used aquatic herbicides.

Aquashade is a non-toxic dye or colorant which prevents or reduces aquatic plant growth by limiting sunlight penetration, similar to fertilization. However, Aquashade does not enhance the natural food chain and may suppress the natural food chain of the pond.

Reward is a contact herbicide in the form of liquid a diquat formulation that can be more effective on certain types of aquatics if mixed with a copper compound. Contact herbicides act quickly and kill all plants cells that they contact.

Citrine Plus, K-Tea, Captain, Algae Pro, Clearigate are all chelated or compound copper herbicides and can be used in a mixture with Reward or Aquathol K. Other chelated or compound copper formulations are also available.

Aquathol, Aquathol K, and Aquathol Super K are contact herbicides made from dipotassium salts of endothall and comes in both liquid and granular formulations. They can be mixed with copper compounds for additional effectiveness.

Hydrothol 191 is an alkylamine salt of endothall and comes in both liquid and granular formulations. It is a contact herbicide which can be toxic to fish.

Sonar and **Avast** are broad spectrum, systemic herbicides which are fluridone compounds packaged in liquid and granular formulations. Systemic herbicides are absorbed and move within the plant to the site of action. Systemic herbicides tend to act more slowly than contact herbicides.

One danger with any aquatic chemical control method is the chance of an oxygen depletion after the treatment caused by the decomposition of the dead plant material. Oxygen depletions can kill fish in the pond. If the pond is heavily infested with weeds it may be possible (depending on the herbicide chosen) to treat the pond in sections and let each section decompose for about two weeks before treating another section. Aeration, particularly at night, for several days after treatment may help control the oxygen depletion.

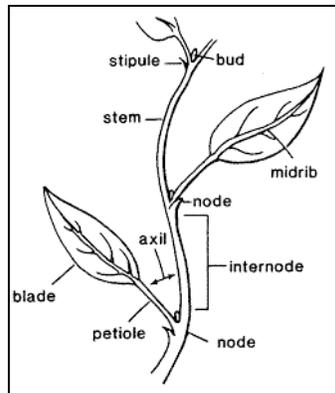
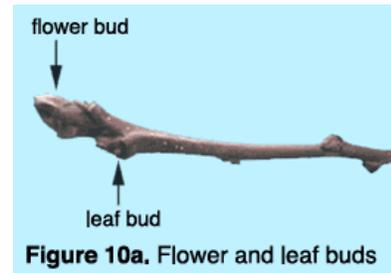
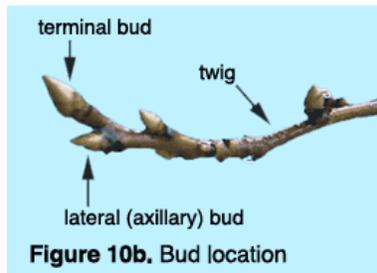
Disposal

If improperly disposed of, invasives can again invade. Birds can carry seeds from a composting or drying site -- roots may continue to grow even when no longer in the ground. Burning may be the most thorough method for destroying culled invasives – check with your city hall for local restrictions on burning. Chucking invasives cut to fit in thick trash bags, or double-bagging is a good method for small amounts of vegetation. Composting to dry the plants (again, consider the seed/wildlife issue) is a better alternative for large vegetative amounts. The ground should be protected from stray roots, and the plants must dry until inert. A product like Solvita (<http://www.woodsend.org/aaa/solvita.html>) should be used to test the vegetation before redistributing the composted material. Plants killed off with a herbicide before going into seed production should be safe for any disposal. Under no circumstances should any of these plants be placed in or near wetlands or wetland buffers after removal.

Additional References:

- Connecticut Invasive Plant Working Group <http://www.hort.uconn.edu/cipwg/>
- New Hampshire (laws, rules, list): http://www.state.nh.us/agric/topics/plants_insects.htm
- Images from the University of Georgia, Bugwood Network and USDA Forest Service: Invasive and Exotic Species of North: <http://www.invasive.org/> and <http://www.forestryimages.org/>
- The Nature Conservancy <http://tncweeds.ucdavis.edu>
- The Invasive Plant Atlas of New England: <http://invasives.eeb.uconn.edu/ipane/>
- The Northeast Aquatic Nuisance Species Panel: www.northeastans.org/imagelinks.htm

PLANT PART IDENTIFICATION



Flowers – Structure: The **stamen** is the male reproductive organ. It consists of a pollen sac (**anther**) and a long supporting filament. This filament holds the anther in position, making the pollen available for dispersment by wind, insects, or birds. The **pistil** is a plant's female part. It generally is shaped like a bowling pin and is located in the flower's center. It consists of a stigma, style, and ovary. The **stigma** is located at the top and is connected by the **style** to the ovary. The **ovary** contains eggs, which reside in ovules. If an egg is fertilized, the ovule develops into a seed. **Sepals** are small, green, leaflike structures located at the base of a flower. They protect the flower bud. Collectively, the sepals are called a **calyx**. **Petals** generally are the highly colored portions of a flower. Like nectar glands, petals may contain perfume. Collectively, the petals are called a **corolla**. The number of petals on a flower often is used to help identify plant families and genera. Flowers of **dicots** typically have four or five sepals and/or petals, or multiples thereof. **Monocots** have floral parts typically in threes or multiples of three.

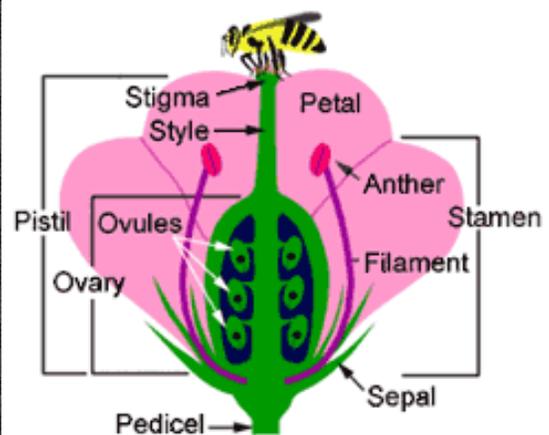
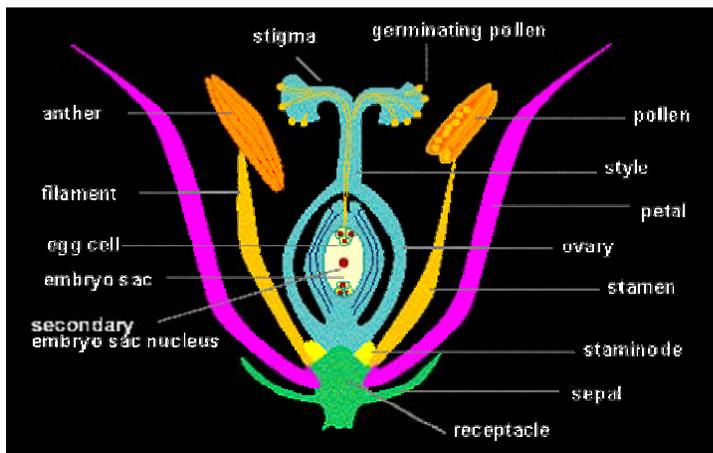


Figure 19. Complete flower structure

<http://www.biologie.uni-hamburg.de/b-online/e02/02d.htm>
<http://extension.oregonstate.edu/mg/botany/flowers.html>

Plant Terminology Glossary

Achene: Small one-seeded, thin walled, indehiscent fruit smaller than a nut.

Acuminate: A leaf tip that narrows at the end to a tapering point.

Acute: A leaf tip which tapers evenly to a point.

Alluvial: Deposited by water as in soil (alluvial soil) or areas of such soil.

Annual: Completing a life cycle in one season or year. Annual plants produce seed in one season of growth then die. See; [perennial](#), [biennial](#), [monocarpic](#)

Anther: The pollen bearing parts of a [stamen](#).

Berry: All fruits with fleshy walls and multiple seeds.

Biennial: Somewhat of a misnomer seeming to mean a plant that completes a life cycle in two years. It actually is often applied to plants that generally take more than one season or yearly cycle to complete a life cycle. Basically the term applies to plants that die at the end of a life cycle (they die after they produce seeds) but don't complete that cycle in one season. Many plants take an indeterminate number of years to complete the growth necessary to reproduce. See; [perennial](#), [annual](#), [monocarpic](#)

Bract: Small leaf, particularly those at the base of flowers or [pedicels](#).

Bulb: A rounded, usually underground structure with thick, fleshy concentric layers or scales merging into the stem at the top and roots at the bottom. See [corm](#).

Calyx: The [sepals](#). The outer set of flower parts. They sometimes look like leaves and in some plants like petals and sometimes form a tube.

Capsule: A dehiscent fruit with more than one [carpel](#).

Carpel: A simple pistil (modified leaf) or a single section of a compound pistil.

Clasping: Enclosing the stem at least partly.

Cordate: Heart shaped.

Corm: An enlarged underground structure consisting of stem tissue and thin scales. Similar to a [bulb](#).

Corolla: The petals (or petal) that make up the flower. These may be united into a tube or other structure.

Corona: Literally a crown with structures present in some flowers between the petals and stamens.

Corymb: A flat topped or rounded inflorescence with the outer most flowers on the longest stalks.

Crenate: Edge with rounded teeth.

Crepuscular: Active at dawn or dusk. See [nocturnal](#), [diurnal](#).

Cyme: A flower cluster of limited size in which the terminal flower blooms first.

Dehiscent: Opening to release contents as a seed pod or anther.

Deltoid: Shaped like a triangle.

Dioecious: Male and female flowers borne on separate plants.

Disk: The center of composite flowers (the Asteraceae family) made up of a cluster of *disk flowers*, which are the true flowers, and usually surrounded by rays.

Dissected: A division deeper than a lobe but, in the case of a leaf, not enough to make the leaf [divided](#). A somewhat vague term usually referring to a leaf that is has many narrow segments.

Diurnal: Active during the day. See [crepuscular](#), [nocturnal](#).

Divided: Leaves which have separate leaflets or have divisions between lobes that extent to near the leaf stem.

Drupe: A fleshy fruit with a hard center usually containing a single seed such as a peach.

Drupelet: A very small [drupe](#). Usually in a cluster such as the fruit of a raspberry.

Elliptic: Shaped like an ellipse.

Entire: Leaves with smooth edges.

Filament: The part of a [stamen](#) that supports the anther. Commonly a very slender tube.

Glabrous: Lacking hairs or other protuberances.

Glandular: Having glands.

Glaucous: Surface with a fine white coating that rubs off easily.

Habit: The overall appearance of a plant, stem, leaves and so on. Not to be confused with [habitat](#).

Herbaceous: Like a herb. Used here to refer to flowering plants that are not vines, shrubs, trees or succulents. Generally used to refer to plants that die back to the ground every year. Also spelled

Imperfect: Flowers having either stamens (male) or pistils (female) but not both.

Indehiscent: Not opening at maturity.

Indistinguishable: Used here to describe flowers that are too small to distinguish the individual parts (petals or bracts) with the unaided eye.

Inflorescence: A flower or fruit cluster including axis or bracts but not vegetative leaves.

Involucre: The bracts whorled close to the base of a flower or flower cluster.

Irregular: Flowers which are not radially symmetrical. The petals may be unlike each other in shape, size and / or color. Often they have upper and lower parts called lips. Do not confuse this term with the term "Indistinguishable".

Lanceolate: Shaped like a lance blade, i.e., pointed, much longer than wide and widest below the middle.

Linear: Long and narrow. Literally, like a line.

Lip: The upper or lower protruding part part of a irregular flower (corolla or calyx).

Lobed: Leaves which have one or more indentations (deeper than the ones it may have if it is toothed) which divide the leaf into lobes. Lobes only at the base of the leaf do not count.

Monocarpic: Fruiting only once then dying. Usually applied to [perennials](#) that live for years before flowering, setting seed and dying. May describe [annuals](#) or [biennial](#) as well.

Monoecious: Having [imperfect](#) flowers with both male (staminate) and female (pistillate) flowers borne on the same plant.

Monotypic: Having only one taxa.

Nocturnal: Active or blooming during the night. See [diurnal](#), [crepuscular](#).

Obovate: Oval leaf widest near the tip.

Obtuse: A blade tip that is rather blunt.

Opposite: Two leaves per node that emerge from the stem directly oppsite from each other one on either side of the stem.(see [whorled](#))

Ovate: Egg shaped outline with the widest part toward the base.

Panicle: A loose branching flower cluster with at least one branch between the peduncle and the pedicels

Pedicel: The stalk of a single flower or fruit.

Peduncle: The flower stalk or tendril that may support a cluster of flowers or the single flower.

Peltate: A leaf or other structure having a stalk attached not at the margin as in most leaves but toward the center.

Perennial: A plant that doesn't die after one life cycle. Often defined as a plant that lives more than one year. See; [annual](#), [biennial](#)

Petal: A single segment of the [corolla](#).

Petiole: The stalk or stem of a leaf. Completely absent in some leaves.

Pinna: One of the primary divisions of a pinnate leaf.

Pinnate: A leaf shape where leaflets or lobes are arranged on either side of a central axis or [petiole](#).

Pistil: The central organ of a flower containing the ovules. The female part of a flower.

Pod: A [dehiscent](#) fruit.

Puberulent: With soft, short, fine hairs. Slightly [pubescent](#).

Pubescent: With short soft hairs.

Raceme: A flower cluster with the flowers on short [pedicels](#) which are arranged along a central stem.

Recurved: Curved upwards.

Regular: Flowers that are radially symmetrical. That is the petals or rays are all about the same size and shape and are arranged around the center in an even pattern. The petals may be joined into a tube or have separate rays.

Rhizome: Horizontal underground stem. Commonly referred to as roots because they are underground they act functionally as stems and the true roots emerge from the rhizome.

Rhombic: In the shape of a diamond.

Scabrous: Having a coarse surface due to the structure of the surface or short stiff hairs. touch.

Scape: A flowering stem with no leaves.

Sepals: Floral leaf that occurs outside the petals. Often green they sometimes are colorful and mimic petals. Together they form the [calyx](#).

Serrate: Toothed with the teeth pointing away from the stem or base.

Sessile: Having no stalk.

Sporangia: Case containing spores.

Spike: A flower cluster consisting of flowers growing directly from a central stalk.

Stamen: The part of the flower where the pollen is produced. Usually comprised of [filament](#) and an [anther](#). The male part of a flower.

Stigma: The part of the flower that receives the pollen. The tip of the pistil.

Stipule: A leaf-like appendage occurring in pairs, one on each side of the base of a leaf.

Stolon: A branch at the base of a plant that can take root and form a new plant.

Style: The stalk of the pistil. The connection between the stigma and ovary.

Subtend: To be immediately below.

Tendril: Threadlike clinging part of a climbing plant.

Toothed: The margin of the leaf has somewhat regular, shallow indentations. There need not be points

Umbel: A Flower cluster with all the flower stalks radiating from a central point.

Whorled: Three or more leaves arranged in a whorl around the stem.

Winter annual: A plant that dies after producing seed that germinate later the same year and overwinter as immature plants.