

Sucker Brook Hollow, Williston, Vermont

Invasive Plant Management Plan



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Table of Contents

Contents	Page
Summary	1
Site Description	2
Land Management Goals	3
Current Invasive Plant Inventory of Property	3
Invasive Species Management Prioritization	11
Early Detection and Rapid Response	13
Cost of Management	13
Appendix A – Maps	15
Appendix B – Methods	18
Appendix C – Invasive Management Contractors/Additional Resources	20
Appendix D – Species Fact Sheets	24
Appendix E – Cost Estimates	43

Summary

The Town of Williston owns a property along Route 2A within the greater Gramma Ridge, a valuable wildlife corridor. The property has great ecological and cultural value. The Sucker Brook flows south directly through the property, which drains entirely into the brook, and empties into the Muddy Brook, a tributary of the Winooski River. The property also offers access to the Sucker Brook Hollow Trail, which through a trail easement held by the Town of Williston, connects to the top of the Five Tree Hill property. Eleven invasive plant species were found to be present within the property, seven of which are on the state watch list and are regulated at the state level (represented by *). The invasive species found include: common buckthorn* (*Rhamnus cathartica*), honeysuckles* (*Lonicera spp.*), garlic mustard* (*Alliaria petiolata*), wild parsnip (*Pastinaca sativa*), multiflora rose (*Rosa multiflora*), common barberry* (*Berberis vulgaris*), Japanese barberry* (*Berberis thunbergii*), black locust (*Rubinia pseudoacacia*), purple loosestrife* (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and common reed* (*Phragmites australis*). While some species such as common buckthorn, honeysuckle locust are well established in fairly large populations, other species such as purple loosestrife, barberry, and multiflora rose are much less established and offer easier control opportunities. Species were prioritized for management based on a system developed by the Nature Conservancy known as the Invasion Curve, based on the balance between the lowest cost and effort for the highest benefit. Garlic mustard is the highest priority because it occurs in small populations in a centralized location and could relatively easily be controlled for a large benefit. Common buckthorn is also of particular concern, however due to the extent of the infestation, would be expensive to effectively manage. Low priority species include species such as black locust and common reed. The management of these low priority species have benefits that would likely not outweigh the costs (financial and ecological) of management.

The property should also be monitored into the future to track current populations as well as for introduction of new invasive species, particularly surrounding the roadsides and parking area.

Site Description

Property Description

The property is comprised of 19.69-acres with 695 feet of frontage on the eastside of Route 2A. The Sucker Brook crosses the property in a north – south direction through a 30 to 50-foot deep ravine. Land east of the brook is heavily wooded, and generally slopes westerly towards the ravine. An unnamed tributary to Sucker Brook has its headwaters in the eastern portion of the property. The majority of stormwater runoff discharges from the property via this tributary and the main stem. Little if any drainage flows onto the property from other adjacent lands. The subject property is located within the greater Winooski River drainage basin. The Sucker Brook and its tributaries discharge into Muddy Brook, which is a first order tributary of the Winooski River.

In 1985, the Sucker Brook jumped its banks during a large rain event, abandoning a 30-foot waterfall and travelling instead on highly erodible sands, silts, and clays, causing thousands pf cubic yards of sediment to wash downstream. In 2003, the Town hired Dubois & King to develop plans to stabilize the bank. From 2004 to 2007 the Town received a number of state and federal grants to pay for the project. The project was completed in 2008 with the construction of an 880-foot stone-lined channel through the ravine, as well as the re-vegetation of floodplain and ravine.

In 2008, the former single-family residence was demolished and removed from the property in accordance with state, local and federal regulations. In 2009, the town hired Engineering Ventures of Burlington, Vermont to design a 57-foot long footbridge across the Sucker Brook, as well as an eight-car parking lot. From 2009 – 2011 the town utilized multiple state and federal grants to fund the construction of the footbridge, parking lot, and trail (which connects to the Five Tree Hill property). The Sucker Brook Hollow Country Park officially opened July 19, 2013.

Natural Resources

The property is located within the Muddy Brook watershed, which is part of the greater Winooski River Watershed, and Sucker Brook discharges into the Muddy Brook. The area to the east of Sucker Brook primarily slopes to the west, draining into Sucker Brook. The area is largely forested with two later successional hemlock stands with little understory; a wet sugar maple and quaking aspen stand with an understory of alder and common buckthorn, and an herbaceous layer of horsetail and sensitive fern; lastly, one stand comprised largely of northern white-cedar. The area to the west of Sucker Brook is earlier successional sugar and red maple, black locust, sumac, and other northern hardwood species. This area is where the highest diversity and concentration of invasive species is located, particularly around the parking area and roadside edge. Within the ravine and floodplain that was re-vegetated in 2008, there is primarily alder along the banks with other common herbaceous species found in wet environments such as horsetail and sensitive fern.

Land Management Goals

The Town of Williston has identified management goals through a public planning process and has outlined the following goals:

- The enhancement of outdoor recreational opportunities
- The preservation of natural and scenic resources
- The restoration and maintenance of the Sucker Brook

In specific relation to invasive species, the introduction of non-native species should be avoided to a reasonable extent. Non-native species found on the property should be documented and the population monitored by the WCC staff. The Vermont ANR and National Invasive Council (www.invasivespecies.gov) should be contacted for technical guidance.

Current Invasive Plant Inventory of Property

Using the ArcGIS Collector application, I inventoried plant species that are currently classified as invasive species by the state of Vermont (www.vtinvasives.org). More information about surveying methods can be found in the Appendix section. While there are a large number of non-native species in Vermont, only those that are likely to cause negative effects on the environment, human health, or economic factors are classified as invasives. This inventory aimed to establish a baseline inventory of invasive plants species within the Sucker Brook Hollow parcel.

Eleven invasive plant species were found to be present within the property, seven of which are on the state watch list and are regulated at the state level (represented by *). The invasive species found include: common buckthorn* (*Rhamnus cathartica*), honeysuckles* (*Lonicera spp.*), garlic mustard* (*Alliaria petiolata*), wild parsnip (*Pastinaca sativa*), multiflora rose (*Rosa multiflora*), common barberry* (*Berberis vulgaris*), Japanese barberry* (*Berberis thunbergii*), black locust (*Rubinia pseudoacacia*), purple loosestrife* (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and common reed* (*Phragmites australis*). Common buckthorn and honeysuckle are the most prominent species, with other fairly large populations of black locust, garlic mustard, and other sporadic species to the west of Sucker Brook. Some of the species found such as the barberries and purple loosestrife are found far less frequently throughout the property.

Common Buckthorn

Description

Common buckthorn is a deciduous shrub or small tree that can grow to about 25 feet tall. The bark is dark gray and peels horizontally as the tree ages, and the inner bark is orange. The leaves are dark green, usually sub-opposite, oval, slightly serrate with three to four pairs of arcuate veins and a somewhat folded tip. Twigs have two lateral buds separated by the characteristic “buckthorn” at the leading tip of each branch. Fruits are small black berries, roughly 0.25 inch in diameter. Common buckthorn is by far the most prominent invasive plant species within the property. Mature buckthorn trees are



found throughout the majority of the property and have propagated to a vast extent, particularly around forest/roadside edge, and within the wet, sugar maple stand (see Map 2).

Threat

Common buckthorn can have negative impacts on both native plants and animals. The berries of buckthorn contain emodin, a natural laxative that prevents mammals from digesting the berries and perpetuates the propagation of buckthorn seed. The plant also has the ability to increase the amount of nitrogen in the soil, impacting the composition of native species capable of growing in the soil. Because the tree is an aggressive competitor, leafing out earlier than native species and retaining leaves longer in the season, buckthorn will often form dense thickets that crowd out native shrubs and understory plants. Buckthorn can readily establish and persist well in forested, edge, and open habitats. While the plant reproduces by seed, they also easily root sprout and re-sprout from cut or burned stumps.

Control

There are both mechanical and chemical control options for common buckthorn. Because of its effectiveness as a competitor, both mechanical and chemical controls are often needed. Mechanical controls of mature plants include, cutting stumps and covering the stumps with burlap or black plastic to prevent re-growth or simply digging up larger plants using a weed wrench. Immature plants can be hand pulled and hung from their roots to prevent re-rooting, or they can be cut down with a brush saw (this has to be done repeatedly to prevent regrowth). Chemicals can also be applied to the cut stumps, or sprayed on the leaves at the end of the growing season, but this must be done by a certified applicator.

Honeysuckle

Description



Both native and non-native species of honeysuckle are present in Vermont. However, there are four invasive species of bush honeysuckle that invade Vermont forests. These include Amur honeysuckle (*Lonicera maackii*), Morrow's honeysuckle (*Lonicera morrowii*), Tartarian honeysuckle (*Lonicera tatarica*), and Bell's honeysuckle (*Lonicera bella*). All of them are deciduous shrubs with opposite, egg-shaped leaves, fragrant flowers, and red or red-orange berries. They can grow to be 15 feet high. The four species are difficult to distinguish from one another but can be distinguished from native honeysuckle because all four invasive species have a hollow pith. Honeysuckle primarily reproduces vegetatively. The majority of honeysuckle was found to the west of Sucker Brook along the steep sloped ravine, along the roadside edge, and in the area where the single-family residence had been located (see Map 3).

Threat

Similar to buckthorn, honeysuckle has negative impacts on both wildlife and plants. Populations tend to develop dense thickets in the understory, shading out and outcompeting native trees, shrubs and herbs. Their rapid growth makes them strong competitors in terms of moisture and nutrients as well as light and space. While birds will eat its berries, the fruit is poorer in fats and nutrients than those of the native plants that are being pushed out, and cannot sustain birds on long migratory flights.

Control

The most effective way to control honeysuckle is to hand pull stems when the soil is wet, and either dispose of plants, or hang by the root system to prevent re-rooting. As with buckthorn, we can also cut stumps and wrap them in plastic or burlap, however, this will likely not be enough and the plant will re-sprout the following season if not the same season. Chemical treatments can also be applied directly to cut stumps or sprayed on foliage in the fall. Chemical treatments should be conducted by a certified professional.

Garlic Mustard

Description

Garlic mustard and is an herbaceous, biennial forb. First year plants are basal rosette which bolt and flower in the second year. Plants can be easily identified by their garlic odor that is present when any part of the plant is crushed. Foliage on first year rosettes is green, heart-shaped long leaves. Leaves become more triangular and strongly toothed as the plant matures in its second year. Flowers exist on second year plants atop a 1-4-foot flowering stalk. Each flower has four small, white pedals in early spring (flowering stalks persist throughout summer). Seeds are shiny black and produces in erect, slender green pods on the flowering stalk, and turn brown when mature. On the property, garlic mustard was found only to the west of Sucker Brook, primarily located around the parking area (see Map 1).



Threat

Garlic mustard is of particular management concern due to the fact that the plant's high shade tolerance allows it to readily invade high quality, mature stands where it can form a dense herb stratum of garlic mustard. Once established, in addition to shading out desired species, garlic mustard produces allelopathic compounds that change the chemical composition of the soil and inhibit seed germination of its competitors.

Control

For small infestations, hand removal of the entire root system is most practical. For larger infestations, cut stems to the ground several times throughout the growing season, preventing seed production. Chemical control can be used for severe infestations, and fire can be used but will often encourage germination of stored seeds. A number of weevil species are known to feed on garlic mustard, however the effectiveness of biocontrol methods is highly debated.

Wild Parsnip

Description

Wild parsnip (a.k.a. poison parsnip) is a biennial/perennial herb that looks and smells similar to cultivated parsnip and can grow up to 4 feet in height. Leaves are alternate, compound and branched with jagged teeth.



Leaflets are green, shiny, oblong, coarsely-toothed, and diamond shaped. Flowers occur from May through late June and are arranged in an umbel of hundreds of small yellow flowers, which develop into seed and disperse in late summer to fall. Wild parsnip is commonly found in sunny, recently disturbed areas such as roadsides and recently disturbed fields. In the Sucker Brook property, they are mostly found along the side of Route 2A and the parking area (see Map 2).

Threat

Wild parsnip is classified as an invasive species primarily due to the fact that the plant contains a phototoxic sap that can cause burns, blistering, and skin discoloration. Once a wild parsnip infestation begins, it can spread across an area to form dense stands. Plants die after producing seed, however, seeds remain viable in the soil for four years.

Control

Contact with this plant can cause skin to become photosensitive; exposure to sunlight can cause severe blistering. Proper protection must be worn (pants, long-sleeves, gloves, etc.), and equipment cared for (cleaned thoroughly before leaving site), when working with wild parsnip. Parsnip is one of the first plants to emerge and may easily be detected and dug out in small populations. In larger populations, a mower or brush cutter can be used to cut stem before flowering, however the plant may re-sprout and need to be cut again. Many general use herbicides can also be used as a chemical control against parsnip.

Multiflora Rose

Description

Multiflora rose is a multi-stemmed perennial shrub that grows up to 1 foot tall. The stems are green to red arching canes and have stiff, curved thorns. The leaves are pinnately compound with 7-9 leaflets. Leaflets are small (~1 in.), oblong and sharply serrate. Fringed petioles help distinguish it from other rose species. Flowers are small, white to pinkish, 5-pedale and occur in abundantly in clusters in spring. Fruit remains through winter. Only four individuals were located with this survey and are loosely dispersed throughout the property (see Map 1).



Threat

Multiflora rose has a number of methods to reproduce extremely quickly including its production of up to 1 million seeds a year, root sprouting, and layering. Through these methods of regeneration, multiflora rose can form impenetrable thickets that exclude native species and impede in both human and wildlife use. The plant also has a wide tolerance for soil, moisture, and light conditions, and can thrive in forested, open, and wet areas. The seedbank can also remain for 10-20 years, creating the need for long term management.

Control

Young plants can be pulled by hand when the ground is soft. Frequent, repeated cutting or mowing throughout 2-4 growing seasons has been shown to cause high mortality, however this requires 3-6 cuttings per season. A combination of cutting at the end of the growing season, and the application of a glyphosate herbicide to the cut stumps is often effective in controlling individuals. However, the location needs to be monitored in the future as seeds within the soil germinate. Low volume chemical foliar sprays can be used on large populations.

Black Locust

Description



Black locust is a large deciduous tree that grows up to 65 feet. Bark is light gray with deep vertical furrows. Leaves are pinnately compound with 10-20 pale green, oval leaflets. Seeds are black, hard coated, in a flat bean-like pod. Flowers are white, sweetly smelling, pea flowers and occur in spring. Within the property, black locust was found only to the west of Sucker Brook, and along the north and west sides of the parking area. Most are mature trees; however, some saplings are located within the large past west of Sucker Brook (see Map 3).

Threat

Once introduced to an area, black locust expands readily into areas where their shade can reduce available light for native competitors. Black locust can root sucker and dense patches of clones can create shaded islands with little ground vegetation. Additionally, their large, fragrant flowers compete with native species for pollinating insects.

Control

Mowing or burning are only effective in reducing the spread of young shoots. Because of its vigor in root sprouting, to stop the spread of an infestation, a chemical application is often needed. Herbicide can be applied to the stem or cut stump of the parent tree, spreading the chemical through all of the clones attached to the root system. Particularly dense areas may require follow up treatment.

Barberry (common and Japanese)

Description

Both Japanese and common barberry are deciduous shrubs with many arching branches, which can produce new plant when they come in contact with the soil. Leaves are oval or paddle shaped and occur in clusters. Each cluster of leaves is subtended two- (Japanese barberry) or three- (common barberry) branched spines. Flowers differ slightly but both are white to yellow and occur in droopy clusters. Fruit is a small red berry that is dispersed by birds and other wildlife.



Barberry is a very shade tolerant species and can form thickets in both understory and full light conditions. Very few individuals were found within the Sucker Brook property (see Map 1).

Threat

Due to its shade tolerance and reproduction through layering, barberry can form dense and impenetrable thickets in both shaded and sunny environments. These sharp thickets can displace native plants, as well as reducing wildlife habitat and forage. Deer will preferentially avoid barberry, putting more grazing pressure on native plants. It has also been found to alter the pH and biological activity of the soil. Not only is barberry a human health risk due to sharp spines, its thickets act as nursery grounds for deer ticks, a carrier of Lyme disease.

Control

Barberry is easiest to identify and treat in the spring because it is one of the first shrubs to leaf out. Using thick gloves, small plants can be hand pulled out of the ground, while larger plants should be dug up to be sure to remove entire root system. Mowing and cutting will often result in re-sprouting, but can be effective in making removal of roots easier. This plant is sensitive to fire; prescribed burns and weed torches can be effective options in controlling barberry. Herbicides can also be used to control barberry and can be applied to cut stumps or sprayed on the foliage. Fire and herbicide applications should be performed by a certified professional.

Purple Loosestrife

Description



Purple loosestrife is a tall, multi-stemmed, perennial forb that can grow up to 5 feet in height. Leaves are dark green, lance-shaped, sessile, round or heart-shaped at the base, and arranged oppositely or whorled. Its most notable characteristic is its flowers; occurring from July to October, pink to purple flowers develop on a 4-16-inch long spike at the top of the stems. Flowers have 5-7 petals and twice as many stamens as petals. Purple loosestrife thrives in a variety of wet habitats and tolerates a variety of moisture, nutrient, and moisture conditions. On the Sucker Brook property, purple

loosestrife is confined to the roadside and field/forest edge between Rout 2A and the southwestern portion of the property, and near the mouth of the culvert on the south side of the property (see Map 1).

Threat

This plant aggressively spreads both vegetatively and by abundant seed dispersal (up to 3 million a year). Through these means, it can form dense stands that completely dominate an area and exclude native vegetation. Purple loosestrife also hybridizes with native loosestrife species, potentially depleting the native species gene pool.

Control

Hand pulling is only effective for seedlings with small roots, and cutting may reduce the amount of seed produce but likely will not kill the plant. Flooding kills seedling; however, established plants need to be

inundated for weeks to kill. This unfortunately kills desirable vegetation as well and the site would need re-vegetation. Glyphosate herbicide is effective at controlling purple loosestrife. Use wetland permitted herbicide and apply directly to cut stems to avoid residual damage. Four species of European beetles are host specific parasites to purple loosestrife and are available as biocontrol. However, biocontrol methods will not eradicate a population, merely reduce the severity of an infestation.

Reed Canary Grass

Description

Reed canary grass is a perennial grass that grows to 6-feet tall. The plant has variable morphology, so characteristics often depend on site. Leaf blades are flat, from 1-4 feet long and less than an inch wide, glabrous and taper gradually. The ligule at the base of the leaf is transparent and long. Flowering occurs from May to July; flowers arise from hairless stems and can be green, purple, or brown in color and are usually 6-6 inches in length. As fruit matures, color changes from green or purple to light tan. Stems do not remain through winter. Within the Sucker brook property, reed canary grass is confined to the roadside drainage ditch between Route 2A and the west side of the property (see Map 2).



Threat

Reed canary grass can form large, homogenous stands that harbor few other plant species, and offer very little use for native wildlife. In sites where water moves slowly, reed canary grass promotes the deposition of silts, potentially constricting waterways. On sites with faster moving water, reed canary grass may encourage erosion of the beneath its dense mat roots. Additionally, reed canary grass is capable of building up an enormous seedbank that will erupt following an invasive species treatment.

Control

Small patches can be effectively dug up, pulled by hand or covered in black plastic for at least one growing season. Larger patches can be mowed at least twice a growing season to weaken an infestation. Disrupting roots with a root rake has also been shown to weaken established plants and deplete the seed bank. However, due to the enormous seed bank, mechanical controls often only work to control the spread of an infestation, not eradicate the infestation. Chemical controls can be directly applied to cut stems in smaller populations. Herbicide is best applied in early spring, before most native species sprout; remove dead leaves to provide precise application to growing shoots. Be sure to use an herbicide that is approved for wetland use.

Common Reed

Description

Common reed is a tall, perennial grass that grows up to 15-feet in height or more on a thick vertical stalk. Leaves are wide (0.5-2.5 inches), 6-26 inches long, flat, pointed and quite glabrous. Flower heads are dense, fluffy, gray or purple in color, occur from July to October, and are between 6 and 16 inches long.



The seeds are brown, light weight and about 0.3 inches long. In the fall, the plant turns brown and persists through winter. The plant favors wet area, and can even survive in brackish conditions. Within the Sucker Brook Property, common reed is limited to the newly created floodplain along Sucker Brook, and is beginning to creep up the walls of the ravine (see Map 3).

Threat

While common reed spreads a large amount of seed, the plant primarily reproduces vegetatively, growing its rhizomes horizontally through the growing season and sending up new shoots in spring. Through these means, it grows tall, dense stands that replace native grasses, sedges and herbaceous plants, and provide poor quality habitat for insects, birds and amphibians. Common reed roots also release allelopathic compounds which can cause mortality in nearby native plants. Additionally, fish populations that reproduce in wetlands inundated with common reed are shown to have higher egg and juvenile mortality.

Control

Because common reed is a grass, cutting several times during a season at the wrong times can cause a population to respond in higher densities. However, mechanically controlling this plant is often the most effect means of control. Cutting by hand or machine at the end of July, when most of the plant's food stores are in above ground biomass, before the plant produces seed, for most effective results. Plants should be cut roughly 6 inches from the ground, and residual mulch can be removed over winter to promote germination of native plants. For this method, cutting will need to be repeated the following year and then every 3-5 years. Cut stems can be covered in black plastic to prevent regrowth, or have herbicide applied directly to the cut stems. When using herbicide, be sure not to damage nearby native plants and use only wetland approved herbicides.

For more information regarding specific invasive species in Vermont, see Appendix D or visit www.vtinvasives.org.

Invasive Species Management Prioritization

As part of this management plan, I have prioritized species for management. Prioritization is based off of cost and effort of management in comparison to the benefit of managing a specific species. Species were also prioritized for management through a method developed by the Nature Conservancy, called the Invasion Curve (see Appendix B). The invasion curve factors in control cost, the area infected and time to determine how to target management. Within these elements, I have factored in the severity of infestation, as well as the relative effects on the surrounding ecosystem. (see Appendix B for more information on prioritization methodology)

Table 1. Management Priority Ratings

Management Priority	Description
1	Lowest effort, highest feasibility (lowest cost), highest benefit
2	Medium effort, moderately feasible (medium cost), high or medium benefit
3	High effort, feasible at large cost, medium benefit

Much consideration must be taken when prioritizing where to allocate the town’s resources when dealing with invasive species. The Sucker Brook property has eleven invasive plants species present with varying infestation severity. Of those eleven species, garlic mustard is the highest priority. This species has the ability to drastically affect understory species composition and can quickly form dense stands. While there are a number of patches of garlic mustard on the property, they are centralized around the parking area, providing ease of access to control. The easiest and most cost-effective approach to management is cut stems at least twice a season, following up the next year and continuing to monitor the area for new growth. While this type of mechanical control can be easy, cost in labor may rise above the potential cost of a chemical herbicide, which can be applied to the cut stems following the first cutting. The area will need to be monitored into the future; any new growth can be hand-pulled and disposed of.

Table 2. Invasive Species Management Prioritization

Species	Priority	Species	Priority
Garlic Mustard	1	Wild Parsnip	2
Multiflora Rose	1	Reed Canary Grass	2
Barberry spp.	1	Honeysuckle	3
Purple Loosestrife	1	Black Locust	3
Common Buckthorn	2	Common Reed	3

Other high priority species include multiflora rose, both barberry species, and purple loosestrife. Each of these species exist on the property in very small populations, and could inexpensively be located and hand-pulled when the soil is damp. The locations of each individual were recorded in this survey, and after treatment can be revisited to monitor for regrowth. When dealing with multiflora rose and barberry, be sure to wear thick gloves; these plants have a number of sharp spines along the entire length of stems.

The next priority species are common buckthorn, wild parsnip and reed canary grass. These species fall into the second level of prioritization for differing reasons. The common buckthorn infestation on this property is moderately severe and management would be expensive. However, the benefits of controlling this infestation would be great; providing growing room and resources for competing native vegetation. Due to the extent of the infestation, management would likely have to utilize both mechanical and chemical control methods, as well as repeated treatments and population monitoring. Wild parsnip and reed canary grass are medium priority for a similar reason; their population is limited to a largely accessible area, and would be inexpensive to control. Reed canary grass populations are confined to sunny drainage areas along the side of Route 2A and the adjacent property line. These areas are already mowed during the summer by the Williston Public Works department; mowing the area

twice a growing season, as well as loosening the roots with a pitch fork, can weaken these populations without costing much. While most of the wild parsnip on the property falls in this same mowed strip, some individuals are found along the forest/property edge south from the driveway. Plants that are not mowed in the greenway can be hand pulled before going to flower (wear protective gear; this plant contains a phototoxic sap that can cause burns, blistering, and skin discoloration), and their population monitored into the future.

Lowest priority species are honeysuckle, common reed and black locust. Honeysuckle being the highest priority of the three, a large portion of the population has taken root in the newly created floodplain, and along the steep banks of the ravine. While they are invasive and removing them would allow for native species to fill in the gap, their location within a highly sensitive wetland ecosystem and bank stabilizing roots would make removal difficult and potentially more harmful to the ecosystem. Instead, basic mechanical control methods, such as pruning, which create growing space for healthy native plants without compromising the stability of the soil, should be utilized. Chemical control methods can be used to kill well established plants, but should be applied only when needed in such close proximity to surface water. Common reed, while neither in large or dense populations, is providing a service by acting as a bank stabilizer on the steep walls that had once eroded so rapidly. Care should be taken to avoid further spread of the infestation, however. Control should be taken with care, hand-pulling plants, not exposing too much bare soil, and encouraging growth of desired natives where treatment is applied. Black locust makes up a large portion of the overstory in the forest on the northwest portion of the property. Removing the overstory black locust would likely foster the growth of a new cohort of black locust saplings, as well as releasing other invasive species present, such as common buckthorn and honeysuckle, for growth. The wood of black locust trees is particularly hard and difficult to cut through with conventional equipment, additionally, its ability to root sucker creates a need for chemical herbicides when managing established populations.

Early Detection and Rapid Response

While there are a number of invasive species present on the Sucker Brook Hollow property, this does not mean that new species cannot arrive or current populations shift and expand. Invasive species can spread by many means and many other invasive species are present in the town of Williston that could be introduced to the property. In order to prevent the establishment and spread of invasive species, to preserve natural and scenic resources, and foster a healthy ecosystem, it is recommended that the Sucker Brook Hollow parcel be monitored periodically for invasive species. Current populations should be assessed each year, and any new species should be cataloged and removed. Particular attention should be given to monitoring the area surrounding the parking lot. This area is likely to see the introduction of invasive species due to the current dynamics of the forest here, as well as the potential for seed to be introduced anthropogenically on cars, clothes or equipment.

Cost of Management

The potential cost of management of the invasive plant species on the Sucker Brook Property is highly variable depending on which species are targeted, to what extent, and the control methods implemented. Large, widespread populations, such as common buckthorn, will be costlier to manage

regardless of the method used because of the extent of the infestation. Where as small populations, such as those of barberry are significantly less expensive to manage and completely eradicate from the property. Mechanical and chemical control methods can also differ in cost for the same infestations. Chemical control methods tend to be more expensive up front due to the cost of chemical herbicides and licensed applicators, but less costly in the long run. While mechanical treatments are often less costly for a single treatment, the need for repeated treatments can increase the cost above that of chemical control methods. For more information about cost estimates, see Appendix E.

There are a number of ways to reduce the cost of managing invasive plants including grant funding opportunities and community engagement. The Environmental Reserve Fund has typically been used to fund conservation acquisitions, however, can also be utilized to fund stewardship activities such as invasive species control. Using volunteer labor can reduce the cost of management. While community volunteers may not work as efficiently as a certified contractor, they will be less expensive, with the added benefit of providing community members the educational opportunity to learn about the threat of invasive species and methods of control. During the summer, youth groups such as the Boy Scouts of America, 4H clubs, school groups, and other service groups can be utilized during volunteer work days to mechanically control invasive species. Having the local community, especially children, out to help manage invasive species on their favorite town trail will educate them on the importance of controlling invasive species on their own land. For a list of licensed invasive management contractors, see Appendix C.

Appendix A - Maps

Map 1: Priority 1 Species



Map 2: Priority 2 Species



Map 3: Priority 3 Species



Appendix B – Methods

Field Methods

To prioritize areas on the property to focus my survey, I used aerial imagery to identify locations where invasive species would likely establish (i.e. roadsides, forest edge, wetlands, disturbed areas). I then followed up with a preliminary site visit to guide my surveying method. I began my survey at targeted areas: the trail, along the banks of Sucker Brook, parking area, and the forest edge along Route 2A. I then surveyed along north-south subjective transects, beginning in the west end of the property and moving east. Adjustments of the path of each transect was made in the field depending on patch sizes and densities of invasive plants within the forest.

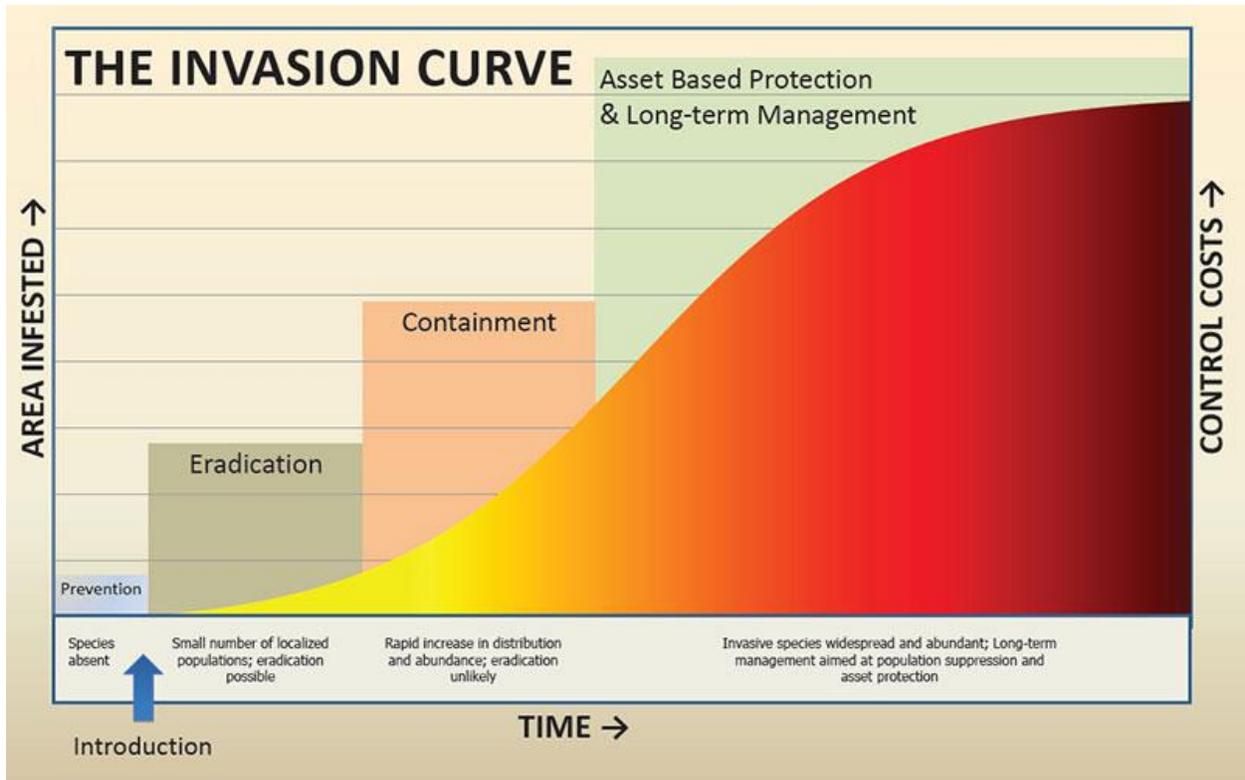
The main objective of this survey was to observe and establish a record of invasive plant species on the property, with a focus on preserving the native viewshed. As we walked the transects and target areas, we marked individual occurrences of invasive plants or created shapes to encompass larger patches. Data was collected using the GPS capabilities of a smartphone and ERSI ArcGIS Collector application that allows you to download a map to the phone and create data points and shapes on the map. We deviated from transects in areas to accurately map locations of infestations. For each data point, we noted the species, maturity, habitat type, took any additional notes that may be useful, and took at least one photo of the infestation. From this field inventory, I used ArcGIS to create maps showing the locations and priority status of the invasive plants on the property. This inventory allows us to create site specific management strategies as well as provide opportunity to monitor invasive plant populations dynamics into the future.

Prioritization Rational

A general cost/benefit assessment was done for each invasive species present on the property, in order to prioritize management strategies. The relative cost of management (high, medium, or low) was determined for each plant by assessing the abundance and distribution of the plant, the effort and cost required to manage such an infestation, and the potential environmental ramifications of mechanical and chemical treatment methods. Potential benefits (high or medium) of managing a species is based on the threat of the plant to the management objective for the parcel and the extent of the infestation.

The Invasion Curve (shown below), developed by the Nature Conservancy, assesses the time, area and control cost of an infestation in order to target management strategies: prevention, eradication, containment, and/or asset-based, long-term management. Small, localized populations (such as barberry and purple loosestrife in Sucker Brook Hollow) may be successfully eradicated at low cost and with minimal control efforts. However, as invasive plant populations begin to rapidly expand (such as garlic mustard in this case), efforts must be redirected to controlling the spread of the plant, with a goal of weakening the population enough over a number of years in order to eventually achieve eradication. For large, well established populations (most notably common buckthorn in Sucker Brook Hollow), efforts must be focused on long-term, asset-based management.

By factoring in the Invasion Curve as well as land management goals set forth by the town, I have prioritized management of invasive plant species on the Sucker Brook Hollow Property. While management of the invasive species currently present on the property is the main objective, the town must also allocate efforts to preventing other invasive species from establishing on the property.



Appendix C - Invasive Management Contractors/Additional Resources

Invasive Plant Information

Vermont Invasives (from fact sheets to eradication methods): <https://vtinvasives.org/>

Invasive Plant management Techniques: <https://vtinvasives.org/land/management>

Best Management Practices for the Prevention and Treatment of terrestrial Invasive Plants in Vermont Woodlands: <http://www.vermontwoodlands.org/documents/FinalBMPinvasivesmanual.pdf>

Invasive Plant Treatment Methods:

<https://vtinvorg.w3.uvm.edu/sites/default/files/Tool%204%20Invasive%20Plant%20Treatment%20Methods.pdf>

Chittenden County Forester

Ethan Tapper

111 West Street

Essex Junction, VT 05452-4695

Work Phone: 802-585-9099

Email: ethan.tapper@vermont.gov

Potential Funding Opportunities

USDA Natural Resource Conservation Science Conservation Stewardship Program:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/>

Dept. of the Interior Land and Water Conservation Fund: <https://www.doi.gov/lwcf>

National Invasive Species Council: <https://www.doi.gov/invasivespecies/management-plan-and-executive-order>

Town of Williston Environmental Reserve Fund

Other Resources

Land Management Guide Against EAB for Land Managers:

https://vtinvasives.org/sites/default/files/documents/pests/AshManagementGuidanceforForestManagers_041513.pdf

Invasive Plant Removal Contractors

This is a list of contractors that are certified or have been certified in the past 5 years to apply herbicides to control invasive plants. Before selecting a contractor, check with Linda Boccuzzo (802-828-6417, Linda.Boccuzzo@state.vt.us) of the Vermont Agency of Agriculture to be sure that the specific contractor you are considering has the current commercial license and the appropriate categories for

the job. This will ensure that herbicides are legally applied on your land. For any and all herbicide or pesticide questions contact the Vermont Agency of Agriculture. Listed order of contractor is not preferential and is only in order as added to the list.

Fred Glanzberg

3995 Royalton Hill Rd.
South Royalton VT 05068
(802)763-7800 or (802)299-7960
fredg@sover.net
Work Area: Statewide

Got Weeds?

Michael Bald (manual and non-chemical control methods)
Royalton, VT
(802) 345 8299
choosewiselyvt@gmail.com
<https://choosewiselyvt.wordpress.com/>
Work Area: Statewide

Habitat Restoration Solutions

Robert Hyams
438 Partridge Hill
Hinesburg, VT 05461
Tel: (802) 734-5630
robert@gmavt.net
habitatrestorationvt@gmail.com
www.habitatrestorationvt.com
Work Area: Statewide

Hardt Forestry

Luke Hardt
4719 Bridgman Hill Rd
Hardwick, Vermont 05843
(802) 673-7769
luke@hardtforestry.com
<http://www.hardtforestry.com/>
Work Area: Addison, Caledonia, Chittenden, Essex, Franklin, Grand Isle, Lamoille, Orange, Orleans, and Washington Counties

Land Stewardship, Inc.

Chris Polatin

PO Box 511 Turner Falls, MA 01376
(Mailing) 334 Mountain Road Gill, MA 01354 (headquarters)
Phone: 413-367-5292 Fax: 732-474-9757
Email: chris@landstewardshipinc.com
www.landstewardshipinc.com
Work Area: Statewide

Lewis Tree Service, Inc.

Walter Dodge 300 Lucius Gordon Drive
West Henrietta, NY 14586
Office: 413-245-6166
Mobile: 413-237-9878
Email: walter.dodge@lewistree.com
Work Area: Statewide

New England Forestry Consultants, Inc.

Tony Lamberton, President
P.O. Box 1192
Middletown Springs, VT 05757
(802) 235-1042
tlamberton@vermontel.net
www.cforesters.com
Work Area: Statewide

Redstart Forestry Consulting

Markus Bradley, Drew Harding, Tyler Mousley, Dana Hazen
P.O. Box 475 Corinth, VT 05039
(802) 439-5252
markus@redstartconsulting.com
<http://redstartconsulting.com/index.htm>
Work Area: Statewide

Vegetation Control Service, Inc.

Andrew Powers
Sales/Vegetation Management Specialist
2342 Main St. Athol, MA 01331
Cell: 508-868-3994
Fax: 978-249-4784
Toll Free: 800-323-7706
apowers@vegetationcontrol.com
<http://www.vegetationcontrol.com/Default.aspx>
Work Area: Statewide

Vermont Invasive Management

William Dunkley
1362 Old Stage Road
Westford, VT, 05494
802-324-7112

E-mail: wdunkley65@gmail.com

Work Area: Addison, Caledonia, Chittenden, Grand Isle, Franklin, Lamoille, Orleans, and Washington Counties

Backyard Biomes, LLC

Zach Merson
84 Buell Street
Burlington, VT 05401
781-408-1768

info@backyardbiomesvt.com

backyardbiomesvt.com

Work Area: Addison, Chittenden, Grand Isle, Franklin, Lamoille, and Washington Counties

Appendix D – Invasive Species Fact Sheets

STOP THE INVASION
PROTECT NEW YORK FROM INVASIVE SPECIES



Department of
Environmental
Conservation

WILD PARSNIP

Pastinaca sativa

Caution: Do not touch this plant!

What is wild parsnip?

Wild parsnip is an invasive plant from Europe and Asia that has become naturalized in North America. It is well suited for colonizing disturbed areas but can also be found in open fields and lawns. Wild parsnip sap can cause painful, localized burning and blistering of the skin.

Identification

Wild parsnip can grow up to 5' tall and has hollow, grooved stems that are hairless. Leaves resemble large celery leaves. They are yellow-green, coarsely toothed and compound, with 3-5 leaflets. Small, yellow flowers are clustered together in a flat-topped array approximately 3-8" across. Flowering usually occurs during the second year of growth, starting in May or June and lasting for 1-2 months. Seeds are flat, brown, and slightly winged to facilitate wind dispersal in the fall.



Wild parsnip infestation



Wild parsnip stem



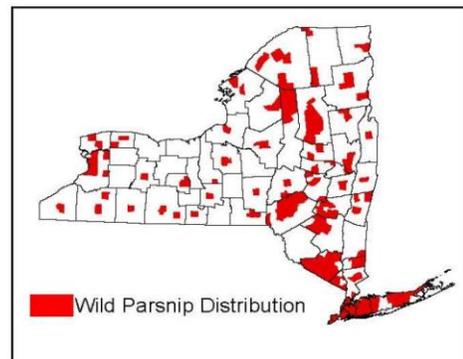
Wild parsnip leaf



Wild parsnip flower cluster and seeds
Seed Photo: Bruce Ackley, Bugwood.org

Where is wild parsnip located?

Wild parsnip can be found growing in a broad range of habitats, especially along roadsides, in fields and in pastures. It is common in the United States and Canada and is widespread in New York. The map on the right reflects only what has been positively identified and reported; it significantly under represents the presence of wild parsnip in the state. DEC encourages the public to report sightings of this invasive plant to iMapInvasives (see below).



For more information, or to sign-up for email updates from NYSDEC, visit our website:

www.dec.ny.gov

Why is wild parsnip dangerous?

Wild parsnip sap contains chemicals called furanocoumarins which can make skin more vulnerable to ultraviolet radiation. Brushing against or breaking the plant releases sap that, combined with sunlight, can cause a severe burn within 24 to 48 hours. This reaction, known as phytophotodermatitis, can also cause discoloration of the skin and increased sensitivity to sunlight that may last for years.

How to protect yourself from wild parsnip:

- Learn to identify wild parsnip at different life stages.
- Do not touch any parts of the plant with bare skin.
- Wear gloves, long-sleeved shirts, pants, boots and eye protection if working near wild parsnip to prevent skin contact with the sap. Synthetic, water-resistant materials are recommended.

If contact with sap occurs...

- Wash the affected area thoroughly with soap and water, and keep it covered for at least 48 hours to prevent a reaction.
- If a reaction occurs, keep the affected area out of sunlight to prevent further burning or discoloration, and see a physician.



Burns from wild parsnip
Photo: Andrew Link, Lacrosse Tribune 2013

What can be done about wild parsnip?

Prevent establishment and spread

It is important to remove new infestations while they are still small and not well established. When using equipment where wild parsnip is present, make sure to clean it thoroughly before using it again in an area that is parsnip-free. Avoid areas where seed is present to prevent its accidental spread on clothing and equipment.

Control and management

Manual removal of plants can be effective for small areas. Cutting roots 1-2" below the soil or pulling plants by hand should be done before they have gone to seed. If removing plants after seeds have already developed, cut off the seed heads and put them in plastic bags. Leave the bags out in the sun for one week to kill the seed heads before disposal. Mowing wild parsnip after flowers have bloomed but before seeds have developed can kill the plants. Some plants may re-sprout, making it necessary to mow the area again. General herbicides can be applied as spot treatments to new shoots.

Report an infestation

If you believe you have found wild parsnip...

- Take a picture of the entire plant and close-ups of the leaf, flower and/or seed.
- Note the location (intersecting roads, landmarks or GPS coordinates).
- Report the infestation to iMapInvasives at www.NYiMapInvasives.org.

For more information, contact DEC Forest Health (see below) or your local Partnership for Regional Invasive Species Management (PRISM) by visiting www.nyis.info.

CONTACT INFORMATION

Forest Health

Division of Lands and Forests

New York State Department of Environmental Conservation

21 South Putt Corners Road, New Paltz, NY 12561

P: 845-256-3111 | F: 845-255-3414 | ghogweed@dec.ny.gov

www.dec.ny.gov



Department of
Environmental
Conservation



This institution is an equal opportunity provider.

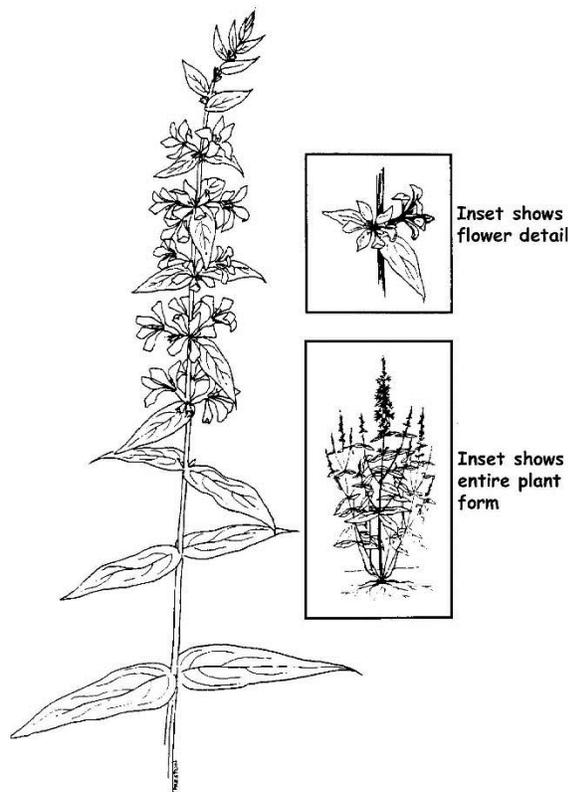
Vermont Invasive Exotic Plant Fact Sheet

Purple Loosestrife *Lythrum salicaria* L. Loosestrife Family Vermont Class B Noxious Weed

Description: Purple loosestrife is an erect, hardy perennial most easily identified by its showy magenta flowers that appear from July to September. Flowers are 5 to 6-petaled and are borne close to the stem on terminal spikes. Flowers from a mature plant can produce more than 2 million seeds annually. Purple loosestrife leaves are long and narrow. Opposite leaf arrangement is typical but leaves may also be found in whorls of 3 or 4, and sometimes are alternate on the stem. Stems are stiff, 4 to six-sided, and angular. Mature plants grow from 1.5 to 8 feet (.5-2 meters) tall. As many as 30 to 50 stems may arise from one root system, forming a large bushy cluster. Purple loosestrife spreads primarily from seed but also from the underground shoots and roots of established plants. Loosestrife's tiny flat seeds can live in soil and water for many years, and can be transported great distances by humans, animals, water, and wind.

Habitat: Purple loosestrife invades ditches, streams, rivers, lakes, wetlands, and other moist, shallow freshwater sites. It is tolerant of a wide variety of moisture and nutrient conditions as well as variations in climate. Plants are most successful on slightly acid or neutral soils. Purple loosestrife will especially take advantage of sites where there are human disturbances to the landscape, such as dredging, draining, or filling.

Threats: In spite of its spectacular beauty, purple loosestrife is a particularly troublesome plant. It quickly replaces native species such as cattails, grasses, sedges, and vulnerable rare plants. The impact of this plant on native wetland vegetation has been disastrous, with monotypic purple loosestrife stands virtually eliminating all other plants. It is not a desirable food or habitat for wildlife, provides poor spawning habitat, and may clog drainage ditches. Despite these impacts, purple loosestrife is still sold commercially as a landscape plant for perennial



(Illustration by Judy Preston - The Nature Conservancy of CT)

Threats continued: gardens in some states. More than 20 different cultivars have been developed, many of which are believed to be sterile. However, these plants become fertile when crossed with wild populations of purple loosestrife and therefore continue to promote its spread. Purple loosestrife is considered to be such a noxious weed that in many states, including Vermont, it is illegal to purchase and plant it.

This fact sheet is one in a series on invasive exotic plants in Vermont and is a cooperative project between the Departments of Environmental Conservation, Fish and Wildlife, and Forests, Parks and Recreation of the Vermont Agency of Natural Resources, and The Nature Conservancy of Vermont. Spring 1998; revised Winter 2003

Vermont Invasive Exotic Plant Fact Sheet

Purple Loosestrife Loosestrife Family (*Lythraceae*)

Distribution: Purple loosestrife originates from the temperate regions of Europe and Asia where it is a minor component of wetland vegetation. It is believed to have been introduced to northeastern North America in the 1800s, probably because of seeds inadvertently transported in the ballast of ships. Because of purple loosestrife's popularity as a garden plant as well as a honey plant, intentional introduction has continued. Purple loosestrife currently occurs in nearly every state in the U.S. and all Canadian provinces. The heaviest infestations are in the northern half of the U.S. and in southern Canada. In Vermont, purple loosestrife covers thousands of acres and can be found in all counties.

Control: Control methods have included hand-pulling, cutting, burning, water level manipulation, and herbicide treatments. Most have been tried with varying degrees of success. Most of these methods will kill plants but not the large seed banks in the soil that allow rapid reestablishment. Current management efforts have focused on biological control agents, specifically four species of host specific, plant-eating insects from Europe. In Vermont, work has begun to evaluate the effects of two leaf-eating beetles (*Galerucella pusilla* and *G. calmariensis*) on purple loosestrife and to investigate rearing of these insects for future purple loosestrife management.

References:

- Anderson, Neil O., and Peter D. Ascher. 1993. "Sterile" Purple Loosestrife Cultivars Are Not Sterile. *Jour. Amer. Hort. Sci.* 118: 851-858.
- Florida Department of Natural Resources. February, 1990. *Florida Prohibited Aquatic Plants.*
- Hight, Stephen D., Bernd Blossey, John Laing, and Rosemarie Declerck-Floate. 1995. *Establishment of Insect Biological Control Agents from Europe Against *Lythrum salicaria* in North America.* *Environmental Entomology* 24(4).
- LaFluer, Anne. 1995. *Invasive Plant Information Sheet: Purple Loosestrife.* The Nature Conservancy of Connecticut. Middletown, Connecticut. Revised February 1996.
- Luke Skinner. 1996. *Biological Control of Purple Loosestrife - A New Control Method for a Tough Wetland Invader.* *Aquatic Nuisance Species Digest.* Volume 1, No. 4.
- Skinner, Luke C., William J. Rendall, and Ellen L. Fuge. 1994. *Minnesota's Purple Loosestrife Program: History, Findings and Management Recommendations.* Minnesota Department of Natural Resources. Special publication 145.
- Thompson, Daniel Q., Ronald L. Stuckey, and Edith B. Thompson. 1987. *Spread, Impact, and Control of Purple Loosestrife (*Lythrum salicaria*) in North American Wetlands.* U.S. Fish Wildlife Service, Fish and Wildlife Research 2.



For more information about Vermont's invasive exotic plant species or if you would like to know how you can help, please contact:

The Nature Conservancy of Vermont, 27 State Street, Montpelier, VT 05602
Tel: 802-229-4425

Vermont Department of Environmental Conservation, 103 S. Main St., Bldg. 10 North,
Waterbury, VT 05671-0408 Tel. 802-241-3777

Vermont Department of Fish and Wildlife, 103 S. Main St., Bldg. 10 South, Waterbury, VT
05671-0501 Tel. 802-241-3715

Vermont Department of Forests, Parks and Recreation, 103 S. Main St., Bldg. 10 South,
Waterbury, VT 05671-0601 Tel. 802-241-3678

Brush Management – Invasive Plant Control Multiflora Rose – *Rosa Multiflora*

Conservation Practice Job Sheet

VT-314



Multiflora Rose (*Rosa Multiflora*)

Multiflora Rose

Multiflora rose has a wide tolerance for various soil, moisture, and light conditions. It can grow in dense woods, prairies, along stream banks and roadsides and in open fields and pastures. Its tenacious and unstoppable growth habit was eventually recognized as a problem on pastures and unplowed lands, where it disrupted cattle grazing. For these reasons, multiflora rose is classified as a noxious weed.

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. Germination of multiflora rose seeds is enhanced by passing through the digestive tract of birds.

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.

Job Sheet – Brush Management (314)



Multiflora Rose, Flower

Small bright red fruits, or rose hips, develop during the summer, becoming leathery, and remain on the plant through the winter. Conscience

Similar Natives

Rosa setigera is a similar native that is on the edge of its range in New Hampshire. Multiflora rose though similar, exhibits a more trailing or arching habit, with mostly white flowers in a pyramid inflorescence, a glabrous style and smaller fruit.

Control

Mechanical and chemical methods are currently the most widely used methods for managing multiflora rose. In high quality natural communities, cutting of individual plants is preferred to site mowing to minimize habitat disturbance. Various herbicides have been used successfully in controlling multiflora rose but, because of the long-lived stores of seed in the soil, follow-up treatments are likely to be necessary. Plant growth regulators have been used to control the spread of multiflora rose by preventing fruit set.

Biological Control

Biological control is not yet available for management of multiflora rose. However, researchers are

Page 1 of 2

investigating several options, including a viral pathogen (rose-rosette disease), which is spread by a tiny native mite, and a seed infesting wasp, the European rose chalcid.

Mechanical Control

Pulling or removing individual plants by hand is effective when plants are small. Special care should be taken to ensure that all roots are removed to prevent resprouting. If plants develop from severed roots these should be removed as well.

Cutting is appropriate for small initial populations and for environmentally sensitive areas where herbicides cannot be used. Repeated cutting will control the spread, but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible.

For disturbed areas containing large populations of multiflora rose, mowing can provide partial control, by restricting top growth and spread. Research indicates that mowing three to six times a year can be effective. The objective of a mowing program is to clear the existing vegetation and reduce the reproductive capacity of the below ground portions of the plant. Repeatedly mowing the perimeter of a site to block this type of expansion can be somewhat effective in preventing the spread of multiflora rose.

Prescribed Burning

Prescribed burning has not been tried for multiflora rose.

Chemical Control

Various herbicides have been tested and found effective for control of multiflora rose. Cut-stem treatments are effective but difficult due to dense growth and thorns. Foliar applications are the most common and are very effective. It is important to note that multiflora rose has the typical regenerative powers of the rose family, and control programs must be monitored and followed up if necessary by repeated herbicide application or used in conjunction with other control methods such as mowing^{1,2}.

Refer to the pesticide label for complete instructions on the use and application of a given herbicide. Some applications, by rule, may only be done by a certified pesticide applicator, and/or might require the applicator hold a special permit. Private landowners can apply anything purchased at your local garden store with out having a permit so long as it is not near

a water body or known public aquifer. You should contact the Vermont Agency of Agriculture Agrichemical Management Section if there are any concerns before applying any pesticides.

¹- Lynn, L.B., R.A. Rogers, and J.C. Graham. 1979. "Response of woody species to glyphosate in northeastern states." Proc. Northeastern Weed Sci. Soc.

²- Ahrens, J.F. 1979. "Chemical control of multiflora rose." Proceedings NE Weed Science Society.

Disposal

There are a few general rules of thumb that will ensure proper disposal. Be sure the plant is dead before placing in a mulch or compost pile. Either dry it out in the sun, or bag it in a heavy duty black plastic bag. If you have flowers and/or seeds on the plant, put the flowers and seed heads into the bag head first so that there is minimal risk in dispersing seed.

Information and Recommendations compiled from:

- Ahrens, J.F. 1979. "Chemical control of multiflora rose." Proceedings NE Weed Science Society.
- Alien Plant Invaders of Natural Areas (NPS)
- Invasive Plant Atlas of New England (IPANE)
- "Invasive Plant Management Guide." Stewardship Subcommittee of the Connecticut Invasive Plant Working Group. http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm
- Lynn, L.B., R.A. Rogers, and J.C. Graham. 1979. "Response of woody species to glyphosate in northeastern states." Proc. Northeastern Weed Sci. Soc.
- The Nature Conservancy - Element Stewardship Abstract (and references therein)

CAUTION: The VT Agency of Agriculture Division of Agricultural Resource Management and Environmental Stewardship, Agrichemical Management Section regulates the sale and use of pesticides in Vermont. Many labels and registrations change from year to year, so applicators will want to be sure they are using a currently, registered product. Contact the Agrichemical Section (802-828-6531) for information on pesticide registration, how to acquire a special permit, lists of currently-licensed pesticide applicators, and other information pertaining to the rules and regulations governing pesticide application in this state.

U.S. National Early Detection and Rapid Response System for Invasive Plants EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Garlic Mustard

Scientific Name: *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Brassicaceae)

Family: Brassicaceae

Synonyms: *Alliaria alharia* (L.) Britton, *Alliaria officinalis* Andrzej ex M. Bieb., *Erysimum alliarum* L., *Sisymbrium alliarum* (L.) Scop.

Description: A cool season, biennial herb. **First year plants** are basal rosettes with heart-shaped, evergreen leaves, 1-6" long. **Second year plants** produce a flowering stalk, 1-4' tall. **Leaves** strongly toothed, triangular in shape, alternately arranged on the flowering stalk. **Flowers** white, with four petals in the shape of a cross, 6 mm in diameter, in button-like clusters. **Fruit** a slender pod (silique) with oblong, black, shiny seeds. The plants are easily recognized by a garlic odor that is present when any part of the plant is crushed, and by the toothed, triangular leaves.

Habitat: Natural forests, planted forests, riparian zones, and urban areas. Invasion is more likely in moist shaded soil of river floodplains, forest edges, and other disturbed areas, such as along trails and roadways. It prefers moist, rich soil, but is found in sand, loam, clay, limestone, and sandstone substrates. It is less common on acidic soils.

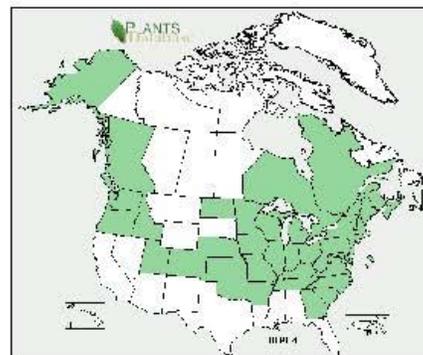
Native Range: Europe.

Pathways of Introduction and Spread: Garlic mustard was introduced to North America for cooking purposes. It can be used as a garlic flavored herb, and is high in vitamins A and C. The seeds are transported by water, animals, and humans.

U.S. and Canada Distribution:

Ecological and Economic Impacts:

Garlic mustard poses a severe threat to native plants and animals in forest ecosystems. A high shade tolerance allows Garlic mustard to form dense stands in mature woodlands. Once established in an area, it degrades habitat for wildlife by outcompeting native plants for light, moisture, nutrients, and space. The plants also produce allelopathic compounds that inhibit seed germination of other species.



Manual Control: Manual removal of the plant, including the entire root system, is effective for eliminating small infestations of Garlic Mustard. Larger infestations should be cut at ground level to prevent seed production.

Chemical Control: Glyphosate (Roundup) is effective in controlling Garlic mustard. One method is to spot treat Garlic mustard plants in the rosette stage during the dormant season. This will minimize damage to desirable native species. Fire can also be used to stimulate the seeds in the soil to germinate. Once they have germinated, they can be controlled with the chemical.

Regulatory Status: Garlic Mustard is regulated as a state noxious weed in [Alabama](#), [Connecticut](#), [Massachusetts](#), [Minnesota](#), [New Hampshire](#), [Oregon](#), [Vermont](#), and [Washington](#).

Online Resources:

Garlic Mustard Fact Sheet - Canadian Wildlife Service.

URL: http://www.cws-scf.ec.gc.ca/publications/inv/p8_e.cfm

Garlic Mustard Fact sheet – USDA Forest Service – Weed of the Week Series.

URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/garlic_mustard.pdf

Garlic Mustard Images - U-GA Bugwood Image Gallery.

URL: <http://www.invasive.org/species/subject.cfm?sub=3005>

Garlic Mustard Profile – ISSG Global Invasive Species Database.

URL: <http://www.issg.org/database/species/ecology.asp?si=406&fr=1&sts=sss&lang=EN>

Garlic Mustard Profile - USDA Plants Database.

URL: <http://plants.usda.gov/java/profile?symbol=ALPE4>

COMMON REED

invasive
fact sheet



© Nava Tabek/IPANE

Common reed grows in Vermont's wetlands and marshes, and along river and lake shores. This plant is **easy to see in August** when its flower stalks are in bloom.



common reed



broad, flat green leaves

purple flowers in tassels on top of stems



tall grass, reaching 13 feet in height

© Stacey Leicht/IPANE

The Problem

Common reed (*Phragmites australis*) replaces native grasses, sedges and herbaceous plants. It provides poor quality habitat for insects, birds and amphibians. Fish populations that reproduce in wetlands and marshes inundated with phragmites suffer higher egg and juvenile mortality. The plant also exudes allelopathic compounds from its roots, causing root death of nearby native plants.



© Berndt Blossay/Cornell University

Wise On Weeds!

The Nature Conservancy, Montpelier, Vermont
802-229-4425 x120
www.vtinvasives.org

The Nature Conservancy
Protecting nature. Preserving life.

COMMON REED



Mechanical control

- ✓ Caution!! Since common reed is a grass, cutting several times during a season at the wrong times may increase stand density.
- ✓ Hand-cut individual stems at the end of July when most of the plant's food reserves are in the aerial portion of the plant, before the flowers produce seed. Plants should be cut below the lowest leaf, leaving a 6 inch or shorter stump. Hand-held cutters, gas-powered hedge trimmers and weed whackers with a circular blade are particularly efficient. You can also cut and mulch dead stems in winter to remove them and promote germination of other species. Repeat in second year and then every three to five years.
- ✓ Cut stems can be composted or allowed to decay in a dry area.
- ✓ Some patches may be too large to cut by hand, but repeated cutting of the perimeter of a stand can prevent vegetative expansion. Mow large stands of common reed annually between June and July to reduce plant vigor and stem density. Common reed will spread by seed or root pieces, so be sure to thoroughly clean all mowing equipment after its use to prevent the reed's spread.
- ✓ After cutting, lay a sheet of black plastic over the area. Use sand bags or bricks to secure the edges and keep covered for a year. Check for new growth around the plastic.



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R. A. Howard @ USDA-NRCS PLANTS Database

Chemical control

- ✓ **For small infestations:** Cut the plants back in the winter. In late summer, cut stems of common reed and drip an 18-21% glyphosate solution into the stem.
- ✓ **For larger infestations:** Cut the plants back in the winter. In late July or early August, when the plants are flowering, use a car wash mitt to wipe a 2% glyphosate solution onto the entire plant. Repeat in following years as necessary.

Safe Chemical Application

- ✓ ***The label found on the herbicide container is the law.*** Read this label in its entirety. It will tell you what concentrations to use, what protective clothing to wear, how to apply the product, and what environmental and human health hazards are associated with the chemical. Improperly used herbicides can cause both short- and long-term health and environmental problems. More is not better! Pesticide labels can be found at <http://www.msds.com/>.
- ✓ ***Use aquatic formulations within 10 feet of water.*** You need a permit to apply herbicides in wetlands. You cannot apply herbicides within 100 feet of a wellhead. Contact VT DEC at 802-241-3761 for more information.
- ✓ ***You need to be certified to apply herbicides on land that you do not own.***
- ✓ ***Hire a contractor to manage large infestations.*** A knowledgeable contractor will help create an effective management plan. For a list of certified contractors, contact the Department of Agriculture at 802-828-3482.



The Nature Conservancy, Montpelier, Vermont
802-229-4425 x120
www.vtinvaders.org





Common Buckthorn

Rhamnus cathartica L.

Buckthorn family (Rhamnaceae)

NATIVE RANGE

Eurasia

DESCRIPTION

Common buckthorn is a shrub or small tree 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 ¼ inch 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.



A similar problem exotic species is *Rhamnus frangula*, glossy buckthorn. Glossy buckthorn does not have a spine at twig tips, leaves are not toothed, and the undersides of the leaves are hairy.

NOTE: Several native American buckthorns that occur in the eastern U.S. that could be confused with the exotic species. If in doubt, consult with a knowledgeable botanist to get an accurate identification. Carolina buckthorn (*Rhamnus caroliniana*), is a lovely native shrub that has 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*), is a low-growing shrub that may grow to a maximum of 3 feet in height, and has leaves with 6-7 pairs of veins.

ECOLOGICAL THREAT

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. In fire-adapted ecosystems such as savannas and prairies, the lack of vegetation under buckthorn prohibits fires. 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.



DISTRIBUTION IN THE UNITED STATES

Common buckthorn has become naturalized from Nova Scotia to Saskatchewan, south to Missouri, and east to New England.

HABITAT IN THE UNITED STATES

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 prairies and open fields. It is tolerant of many soil types, well drained sand, clay, poorly drained calcareous, neutral or alkaline, wet or dry.

BACKGROUND

Common buckthorn was introduced to North America as an ornamental shrub, for fence rows, and wildlife habitat. Introduction of buckthorn was based on its hardiness and ability to thrive in a variety of soil and light conditions.

BIOLOGY & SPREAD

Common buckthorn 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. Buckthorn often establishes beneath trees at the edges of forests and fields.

MANAGEMENT OPTIONS

Mechanical, physical and chemical methods are available for control of common buckthorn and glossy buckthorn (*Rhamnus frangula*), also an invasive exotic plant. Prescribed fire is one method proposed for controlling buckthorn seedlings in fire-adapted natural areas, from late March to early May, most recently by Boudreau and Willson. In the upper Midwest conduct burns as soon as leaf litter is dry; resprouts will be less vigorous due to low carbohydrate levels. Burning every year or every other year in established stands 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. Buckthorn seedlings appear vulnerable to fire, perhaps due to their poorly established root structure. Fire will top kill a mature plant, but resprouting does occur. Uprooting of ½ inch diameter seedlings by hand or up to 1 ½ 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

Careful application of herbicides has been found to effectively control buckthorn in Illinois. The McHenry County, Illinois, Conservation District (MCICD) reports excellent results using 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. The product label suggests avoiding treatment during the spring sap flow. To extend the work season, the use of a triclopyr herbicide was also applied to cut stumps during winter and was reported to be effective by MCICD and the Minnesota Region V State Parks.

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. Experiments at the University of Wisconsin Arboretum report good results using a mixture of 1 part triclopyr herbicide to 7 parts oil on cut stumps, or a 1 part triclopyr herbicide to 16 parts oil mixture applied as a basal bark treatment to stems less than 3 inches across. For fall applications, the Minnesota Department of Natural Resources, Region V State Parks Resource Management has used a 1 part glyphosate herbicide to 5 parts water mixture applied immediately to cut stumps using a hand sprayer. Initial checks indicated over 85 percent control at the test site.

USE PESTICIDES WISELY: Always read the entire pesticide label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact your state department of agriculture for any additional pesticide use requirements, restrictions or recommendations.

NOTICE: mention of pesticide products on this page does not constitute endorsement of any material.

SUGGESTED ALTERNATIVE PLANTS

For home landscaping and wildlife plantings many native low trees and shrubs are available from commercial nurseries. Examples include American elder (*Sambucus canadensis*), Black chokeberry (*Aronia melanocarpa*), and Juneberry (*Amelanchier alnifolia*). Please contact your local native plant society for recommendations of plants native to your particular area.

OTHER LINKS

- <http://www.invasive.org/search/action.cfm?q=Rhamnus%20cathartica>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=24>

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Exotic Bush Honeysuckles

Lonicera fragrantissima (fragrant honeysuckle), *L. maackii* (Amur honeysuckle), *L. morrowii* (Morrow's honeysuckle), *L. standishii* (Standish's honeysuckle), *L. tatarica* (Tartarian honeysuckle), *L. xylosteum* (European fly honeysuckle), *L. X bella* (hybrid, pretty honeysuckle) and possibly others
Honeysuckle family (Caprifoliaceae)



NATIVE RANGE

Eurasia (Japan, China, Korea, Manchuria, Turkey and southern Russia)

DESCRIPTION

Exotic bush honeysuckles are upright, generally deciduous shrubs that range from 6 to 15 feet in height. The 1-2 1/2 inch, egg-shaped leaves are opposite along the stem and short-stalked. Older stems are often hollow. Pairs of fragrant, tubular flowers less than an inch long are borne along the stem in the leaf axils. Flower color varies from creamy white to pink or crimson in some varieties of Tartarian honeysuckle. Flowering generally occurs from early to late spring, but varies for each species and cultivar. The fruits are red to orange, many-seeded berries. Native bush honeysuckles may be confused with these exotic species and cultivars, so proper identification is necessary. Unlike the exotics, most of our native bush honeysuckles have solid stems.

ECOLOGICAL THREAT

Exotic bush honeysuckles can rapidly invade and overtake a site, forming a dense shrub layer that crowds and shades out native plant species. They alter habitats by decreasing light availability, by depleting soil moisture and nutrients, and possibly by releasing toxic chemicals that prevent other plant species from growing in the vicinity. Exotic bush honeysuckles may compete with native bush honeysuckles for pollinators, resulting in reduced seed set for native species. In addition, the fruits of exotic bush honeysuckles, 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.

DISTRIBUTION IN THE UNITED STATES

Amur, Tartarian, Morrow's, and pretty honeysuckle generally range from the central Great Plains to southern New England and south to Tennessee and North Carolina. The remaining species are sporadically distributed. The maps below from left to right are: *Lonicera fragrantissima*, *L. maackii*, *L. morrowii*, *L. standishii*, *L. tatarica*, *L. xylosteum*, *L. X bella*



HABITAT IN THE UNITED STATES

Exotic bush honeysuckles are relatively shade-intolerant and most often occur in forest edge, abandoned field, pasture, roadsides and other open, upland habitats. Woodlands, especially those that have been grazed or otherwise disturbed, may also be invaded by exotic bush honeysuckles. Morrow's honeysuckle and pretty honeysuckle have the greatest habitat breadth and are capable of invading bogs, fens, lakeshores, sandplains and other uncommon habitat types.

BACKGROUND

Exotic bush honeysuckles have been introduced for use as ornamentals, for wildlife cover and for soil erosion control.

BIOLOGY & SPREAD

Open-grown exotic bush honeysuckles fruit prolifically and are highly attractive to birds. In the eastern United States, over twenty species of birds feed on the persistent fruits and widely disseminate seeds across the landscape. In established populations, vegetative sprouting also aids in the persistence of these exotic shrubs.

23 May 2005

Page 1 of 3

Plant Conservation Alliance's Alien Plant Working Group

W eeds C rone W ild: Alien Plant Invaders of Natural Areas

<http://www.nps.gov/plants/alien/>

MANAGEMENT OPTIONS

Mechanical and chemical methods are the primary means of control of exotic bush honeysuckles. No biological control agents are currently available for these plants and any potential agents that might be considered would have to be specific to the exotic species, for obvious reasons. Hand removal of seedlings or small plants may be useful for light infestations, but care should be taken not to disturb the soil any more than necessary. 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.

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%).

Prescribed burning has shown some promise for exotic bush honeysuckles growing in open habitats. In all instances, control should be initiated prior to the seed dispersal period (late summer to early autumn) to minimize reinvasion of treated habitats.

USE PESTICIDES WISELY: Always read the entire pesticide label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact your state department of agriculture for any additional pesticide use requirements, restrictions or recommendations.

NOTICE: mention of pesticide products on this page does not constitute endorsement of any material.

CONTACTS

For more information on the management of exotic bush honeysuckles, please contact:

- Tennessee Exotic Pest Plant Council, <http://www.tneppc.org/>
- The Nature Conservancy - Pest Plant Abstracts, <http://www.imapinvasives.org/GIST/ESA/>
- Virginia Natural Heritage Program - Bush honeysuckles, http://www.dcr.virginia.gov/natural_heritage/documents/fslobe.pdf

SUGGESTED ALTERNATIVE PLANTS

Many 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*). These species are readily available through commercial nurseries.

OTHER LINKS

- <http://www.invasive.org/search/action.cfm?q=Lonicera%20fragrantissima>
- <http://www.invasive.org/search/action.cfm?q=Lonicera%20maackii>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specield=66>
- <http://www.invasive.org/search/action.cfm?q=Lonicera%20morrowii>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specield=67>
- <http://www.invasive.org/search/action.cfm?q=Lonicera%20tatarica>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specield=68>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specield=70>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specield=69>

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Brush Management – Invasive Plant Control Barberries - VT Watch List

Conservation Practice Job Sheet

VT-314



Japanese Barberry (*Berberis thunbergii*)



Common Barberry (*Berberis vulgaris*)

Barberries

Japanese and common barberries are native to Eurasia. Japanese barberry, the more common species, poses a significant threat to natural areas due to its popularity as a landscape shrub, ability to tolerate full shade, and the dispersal of its prolific seeds by birds. Common barberry is found sporadically in New England, usually establishing in pastures, open-canopied forests, and sometimes along roads.

Japanese barberry forms dense stands in natural habitats including woodlands, wetlands, and pastures, and alters soil pH, nitrogen levels, and biological activity in the soil. Reproduction is primarily through prolific seeds (high germination rate) although there are also reports of sprouting from roots as well as vegetative layering. Seeds are spread by birds and mammals.

The barberries are compact, spiny shrubs that commonly grow from two to three feet tall but may reach eight feet with yellow-colored inner bark. Japanese barberry has alternate and entire (smooth margins) leaves with small (<1/2" wide, 6 petals) yellow flowers growing alone or in umbels (flower stems growing from single point) with single spines.

Job Sheet –Brush Management (314)

Common barberry has alternate leaves with bristle-toothed margins and spines are typically in groups of three. It has small yellow flowers in a raceme (branching off a main flower stalk). See pictures. The bright red berries persist after leaf off into winter.

Barberries generally leaf-out earlier and retain their leaves longer than many native shrubs. This trait, shared by many invasive shrubs, gives them a competitive advantage over native plants but also allows landowners to easily locate the invasive shrubs and determine their extent on a property.

Similar Natives

There are no native barberries in New England.

Control

As with all invasive species, barberry is most effectively controlled by recognizing their appearance early and removing isolated plants before they begin to produce seed.

Manual, mechanical and chemical methods are all useful to varying degrees in controlling barberry. Removing or killing plants will provide increased light at the site which may lead to a surge of seedlings

Revised March 2011
Page 1 of 3

in the following year. Prepare to monitor and control these outbreaks.

Biological Control

There are no known biological controls of barberry.

Mechanical Control

Mechanical controls include grubbing or pulling seedlings and mature shrubs, and repeated clipping of shrubs. Repeated mowing or cutting will control the spread of Japanese barberry but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible. Hand-cutting of established clumps is difficult and time consuming due to the long arching stems and prolific thorns. Grubbing or pulling by hand (using a Weed Wrench or a similar tool) is appropriate for small populations or where herbicides cannot be used. Barberry has shallow roots so small plants may be pulled relatively easily when the soil is moist. Because barberry can re-sprout from root fragments remaining in soil, thorough removal of root portions is important. Manual control works well but may need to be combined with chemical in large or persistent infestations.

Because disturbed, open soil can support rapid re-invasion, managers must monitor their efforts at least once per year and repeat control measures as needed. Limit soil disturbance whenever possible. Winter clipping should be avoided as it encourages vigorous re-sprouting.

Prescribed Burning

There is little information about the efficacy of burns.

Chemical Control

Chemical control methods are best done during the fall when most native plants are dormant yet invasive plants are still actively growing. This lessens the risk of affecting non-target plants. The barberry's green leaves will provide easy recognition and allow for a thorough treatment at this time. Winter application of chemicals has proven to be successful as well, and further lessens the risk of damaging non-target species.

Glyphosate (brand names Roundup, and for use near waterbodies, Rodeo¹) is a nonselective herbicide which kills both grasses and broad-leaved plants while triclopyr³ (brand names Garlon¹, Pathfinder¹, and others) is a selective herbicide that kills broad-leaved plants but does little or no harm to grasses.

Job Sheet –Brush Management (314)

Cut Stump Treatments: For 'cut stump' treatments, horizontally cut the stem near the ground. Leaving some stem will allow another cut and application if there is sprouting. Apply a 20-25% solution of glyphosate or triclopyr³ and water to the stump being sure to cover the outer, top 20% of the cut stem^{2, 4, 5}. Herbicide must be applied immediately following the cutting. Add dye or food coloring to the mixture to track treated stumps. This treatment is best applied late in the growing season when the plant is transporting nutrients to its root system (August-October).

Foliar Treatment: For foliar treatments a 2% solutions of glyphosate and water can be used^{2, 5}. The treatment should be applied to the foliage late in the growing season but can be applied early in the season to minimize non-target impacts. Do not cut down treated plants for at least a full growing season.

Basal Bark Method: This method is effective throughout the year as long as snow cover does not prevent spraying to the ground level. Apply a mixture of 25% triclopyr³ and 75% horticultural oil to the basal parts of the shrub to a height of 12-15 inches from the ground^{2, 5}. Be sure to treat entire circumference of the stem in a band at least 12 inches wide. Thorough wetting is necessary for good control; spray until run-off is noticeable at the ground line. Do not apply to bark that's wet from heavy dews and rain.

¹ – Class A Restricted Use Herbicides

² – From TNC ESA – Buckthorns

³ – Greater than 2% Triclopyr herbicide is Class A - restricted use in Vermont.

⁴ - Wisconsin DNR Control Manual

⁵ – Alien Plant Invaders Fact Sheets

Important Note

Mention of specific pesticide products in this document does not constitute an endorsement. These products are mentioned specifically in control literature used to create this document.

Disposal

Small, pulled shrubs should be hung in trees to prevent re-rooting. Larger, pulled shrubs may be piled or piled and burned, roots up, to prevent re-establishment. Cut stems may be piled or piled and burned. If chipping, do not remove material from the site as barberry will spread by seeds.

*Revised March 2011
Page 2 of 3*

Information and Recommendations compiled from:

- The Nature Conservancy - Fact Sheets (and references therein)
- Invasive Plant Atlas of New England (IPANE)
- CT NRCS Invasive Species ID Sheets
- Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants (DNR)
- Tennessee Exotic Plant Management Manual
- Alien Plant Invaders of Natural Areas (NPS)

Appendix E – Cost Estimates

The following tables outline cost estimates for a number of treatment options as a \$/acre value for the highlighted value.

Code	Practice	Component	Units	Unit Cost	Cost Share	Cost Type
313	Waste Storage Facility	Concrete Liner up to 16K Square Feet	sq ft	\$4.10	100%	PR
313	Waste Storage Facility	HU-Concrete Liner up to 16K Square Feet	sq ft	\$4.92	100%	PR
313	Waste Storage Facility	Concrete Stacking Slab with Curb	sq ft	\$6.75	100%	PR
313	Waste Storage Facility	HU-Concrete Stacking Slab with Curb	sq ft	\$8.10	100%	PR
313	Waste Storage Facility	Concrete Stacking Slab without Curb	sq ft	\$4.75	100%	PR
313	Waste Storage Facility	HU-Concrete Stacking Slab without Curb	sq ft	\$5.70	100%	PR
313	Waste Storage Facility	Concrete, Rectangular, With Concrete Top	cu ft	\$5.95	100%	PR
313	Waste Storage Facility	HU-Concrete, Rectangular, With Concrete Top	cu ft	\$7.14	100%	PR
313	Waste Storage Facility	Concrete, Rectangular, with Roof	cu ft	\$2.71	100%	PR
313	Waste Storage Facility	HU-Concrete, Rectangular, with Roof	cu ft	\$3.25	100%	PR
313	Waste Storage Facility	Concrete, Rectangular, Without Roof over 35K ft3 Storage	cu ft	\$1.81	100%	PR
313	Waste Storage Facility	HU-Concrete, Rectangular, Without Roof over 35K ft3 Storage	cu ft	\$2.17	100%	PR
313	Waste Storage Facility	Concrete, Rectangular, Without Roof upto 35K ft3 Storage	cu ft	\$2.38	100%	PR
313	Waste Storage Facility	HU-Concrete, Rectangular, Without Roof upto 35K ft3 Storage	cu ft	\$2.86	100%	PR
313	Waste Storage Facility	Earthen Storage Facility over 50K ft3 Storage	cu ft	\$0.22	100%	PR
313	Waste Storage Facility	HU-Earthen Storage Facility over 50K ft3 Storage	cu ft	\$0.26	100%	PR
313	Waste Storage Facility	Earthen Storage Facility upto 50K ft3 Storage	cu ft	\$0.26	100%	PR
313	Waste Storage Facility	HU-Earthen Storage Facility upto 50K ft3 Storage	cu ft	\$0.32	100%	PR
314	Brush Management	Brush Hog	ac	\$98.35	100%	PR
314	Brush Management	HU-Brush Hog	ac	\$126.45	100%	PR
314	Brush Management	Chemical Difficult Control	ac	\$603.80	100%	PR
314	Brush Management	HU-Chemical Difficult Control	ac	\$724.56	100%	PR
314	Brush Management	Chemical Moderate	ac	\$314.20	100%	PR
314	Brush Management	HU-Chemical Moderate	ac	\$377.04	100%	PR
314	Brush Management	Heavy Mechanical	ac	\$603.54	100%	PR
314	Brush Management	HU-Heavy Mechanical	ac	\$724.24	100%	PR
314	Brush Management	Light Mechanical	ac	\$287.10	100%	PR
314	Brush Management	HU-Light Mechanical	ac	\$344.52	100%	PR
314	Brush Management	Manual, Hand tools	ac	\$56.11	100%	PR
314	Brush Management	HU-Manual, Hand tools	ac	\$67.34	100%	PR
314	Brush Management	Medium Mechanical	ac	\$475.32	100%	PR

Code	Practice	Component	Units	Unit Cost	Cost Share	Cost Type
314	Brush Management	HU-Medium Mechanical	ac	\$570.38	100%	PR
315	Herbaceous Weed Control	Intensive	ac	\$496.53	100%	PR
315	Herbaceous Weed Control	HU-Intensive	ac	\$595.84	100%	PR
315	Herbaceous Weed Control	Low Density	ac	\$54.16	100%	PR
315	Herbaceous Weed Control	HU-Low Density	ac	\$64.99	100%	PR
315	Herbaceous Weed Control	Moderate Density	ac	\$230.92	100%	PR
315	Herbaceous Weed Control	HU-Moderate Density	ac	\$277.11	100%	PR
316	Animal Mortality Facility	Static pile, Concrete Pad	sq ft	\$4.27	100%	PR
316	Animal Mortality Facility	HU-Static pile, Concrete Pad	sq ft	\$5.13	100%	PR
316	Animal Mortality Facility	Static pile, Gravel pad	sq ft	\$1.67	100%	PR
316	Animal Mortality Facility	HU-Static pile, Gravel pad	sq ft	\$2.00	100%	PR
317	Composting Facility	Composter, gravel pad	sq ft	\$1.59	100%	PR
317	Composting Facility	HU-Composter, gravel pad	sq ft	\$1.91	100%	PR
317	Composting Facility	Composter, windrow, concrete	sq ft	\$4.38	100%	PR
317	Composting Facility	HU-Composter, windrow, concrete	sq ft	\$5.26	100%	PR
319	On-Farm Secondary Containment Facility	Concrete Containment with Roof over 150 SF	sq ft	\$26.92	100%	PR
319	On-Farm Secondary Containment Facility	HU-Concrete Containment with Roof over 150 SF	sq ft	\$32.31	100%	PR
319	On-Farm Secondary Containment Facility	Concrete Containment with Roof upto 150 SF	sq ft	\$35.55	100%	PR
319	On-Farm Secondary Containment Facility	HU-Concrete Containment with Roof upto 150 SF	sq ft	\$42.66	100%	PR
319	On-Farm Secondary Containment Facility	Double Wall Tank	gal	\$0.97	100%	PR
319	On-Farm Secondary Containment Facility	HU-Double Wall Tank	gal	\$1.16	100%	PR
325	High Tunnel System	Contiguous US Snow	sq ft	\$3.80	100%	PR
325	High Tunnel System	HU-Contiguous US Snow	sq ft	\$4.56	100%	PR
327	Conservation Cover	Introduced Species	ac	\$126.98	100%	PR
327	Conservation Cover	HU-Introduced Species	ac	\$152.38	100%	PR
327	Conservation Cover	Introduced with Forgone Income	ac	\$474.87	100%	PR
327	Conservation Cover	HU-Introduced with Forgone Income	ac	\$494.62	100%	PR
327	Conservation Cover	Monarch Species Mix	ac	\$671.63	100%	PR
327	Conservation Cover	HU-Monarch Species Mix	ac	\$805.96	100%	PR
327	Conservation Cover	Native Species	ac	\$140.66	100%	PR
327	Conservation Cover	HU-Native Species	ac	\$168.79	100%	PR