# Invasive Plant Management Plan for 79 Penny Lane (Lyons Property), Town of Williston

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## Table of Contents

Summary……pg.2

General Site Overview……..pg.3

Land Management Goals……pg.3

Current Invasive Plant Inventory of Property……..pg.3

Invasive Species Management Prioritization……pg.9

Early Detection and Rapid Response……..pg.10

Estimated Cost of Management……pg. 11

Tips for Management/Additional Resources……..pg. 12

Future Monitoring……pg. 12

Map 1. Lyons Property Invasive Plant Polygon Map……..pg.14

Map 2. Lyons Property Invasive Plant Point Map……pg.15

Appendix A-USDA Plant Codes……pg. 16

Appendix B-Invasive Plant Fact Sheets ……pg.17

Appendix C-Methods……..pg.34

Appendix D-Invasive Management Contractors/Additional Resources……pg.38

Appendix E-Cost Estimates……pg.42

# Summary

The town of Williston owns a few different properties that have multiple purposes for recreation and renewable energy but also have great ecological value that needs to be monitored to preserve its stability. The Lyons property, although highly disturbed by invasive plants, has the potential for being restored to wet meadow or eventually to an alder swamp and northern hardwood forest with time and proper management techniques. The Lyons property has 5 invasive plant species present including wild parsnip, spotted knapweed, common buckthorn, multiflora rose, and shrub honeysuckle. Unfortunately, most of the property is covered in spotted knapweed and wild parsnip with pockets of other invasive plants, however, this site can be restored and managed properly to a point where very few invasive plants could be found. The soil types found here show that a third of this area was a northern hardwood forest and the other portion was a speckled alder swamp. With much time, restoration effort and management, this area could be restored to what it once was or made into a town park that gets more use out of the local residents in the area.

# General Site Overview

Site Description:

The Lyons parcel is a 24-acre meadow/wetland/forest edge is located on Penny Lane in Williston, VT and is owned by the town of Williston. It is slightly used for recreation and has 25 solar panels on the property. It is mowed annually because the town hopes to install stormwater ponds on the site. A slightly used trail runs around the perimeter of the property starting behind the town offices located on the southern border of the property. It is bordered by I-89 to the south, the Williston town offices to the north, and forested edges on its eastern and western portions. In the eastern portion of the property, a private landowner chose to not mow that area of the property and this area is referred to as an experimental area because it isn't mowed annually and shows many different species than the rest of the property since it is being managed differently.

Land Use History:

The Lyons property was put under a conservation easement in 1990. Of the 24 acres, 8 acres was supposed to be developed, possibly into stormwater ponds, but an agreement has not been reached yet by the town. The property is protected through a local historical preservation ordinance that includes design review criteria for all new development. 25 solar panels were put on the property in 2012. The best uses of the property have been identified as: passive recreational use, renewable energy generation, stormwater management, urban forestry.

Natural Resource Value:

Class 2 wetlands exist on the site. This site has a few areas in it that were most likely wetland at one point due to a depression and wetter vegetation.

# Land Management Goals

The town of Williston has named a few management goals for this property, as shown below:

- The invasive plant inventory results will be used to develop an integrated approach to eradication, control, and monitoring over the invasive species found on site
- To monitor non-invaded areas for early detection and implement rapid response
- To assess and identify areas of invasive infestation on the site for future management and treatment
- To assess areas for potential invasive species education/awareness opportunities with the community

# Current Invasive Plant Inventory of Property

Plants that are considered invasive in the state of Vermont were inventoried in this survey (see Appendix C for methods). This inventory was mostly focused on the field/open area of the property because it had the most variety of invasive plants observed and because of the amount of wild parsnip

present. The forested section was not as pertinent because it covered less land area of the property and was almost entirely a strip of solely overgrown common buckthorn.

The Lyons parcel has 5 species of invasive plants: wild/poison parsnip, spotted knapweed, common buckthorn, multiflora rose, and shrub honeysuckle (see Map 1). Wild parsnip was the most dominant invasive plant observed; seen mostly in large, dense thickets throughout the field interspersed with the second most dominant invasive plant observed, spotted knapweed. Most clumps of both species were together or a dense clump of either species (more wild parsnip though) (see Map 1). Common buckthorn was spotted on the forest edges in dense thickets with seedlings growing in the field portion next to the forest edge and in the forested buffer where it was the only large adult tree with the sole understory being sapling common buckthorn and a few natural regen ash trees (see Maps 1 and 2). Multiflora rose was spotted a few times in the annually mowed field portion as small plants that could be easily mechanically removed but in the experimental section that hadn't been mowed in a few years, a larger multiflora rose bush was growing and starting to spread seedlings into the field along with some common buckthorn (see Map 2). Shrub honeysuckle was a very rare sighting in the mowed field and was only found among the forested edges and a few small bushes in the experimental non-mowed section (see Map 2).

A breakdown of mapped species distribution is below:

| **Scientific name** | **Common name** | **Mapped acreage** |
|---|---|---|
| *Centaurea maculosa* | Spotted knapweed | 0.7 |
| *Pastinaca sativa* | Wild parsnip | 0.24 |
| *Centaurea maculosa* and *Pastinaca sativa* | Spotted knapweed and wild parsnip (co-occurring) | 4.3 |
| *Rhamnus cathartica* | Common buckthorn | 0.1 |
| *Rosa multiflora* | Multiflora rose | <0.1 |
| *Lonicera spp.* | Honeysuckle | <0.1 |
| *Populus alba* | White poplar | <0.1 |

## Spotted knapweed *(Centaurea stoebe)*

### Description

Spotted knapweed is a bushy, winter-hardy perennial plant that can live up to 5 years. It is shade intolerant and does well in disturbed dry soil with lots of sunlight. The rosettes are a blueish green that are pubescent and covered with shiny specks. The leaves are alternate, spiraling and jutting out and upward. The basal leaves are deeply divided into elliptic or linear lobes. It flowers from June to November and each flower bud is covered with overlapping rows of dry, fringed green bracts with black tips. The flowers are a pink to purple color that radiate out and up. Spotted knapweed produces fruit from June until February; making tightly packed seed heads of oblong, brownish achenes, topped by short stubby thistles. Up to 1,000 seeds can be produced by one plant.

Threat

Spotted knapweed has a very deep taproot allowing it to establish itself quickly and securely in the soil. This also means that it is very hard to remove once it has been established and its seed bank is hard to get rid of. It displaces native vegetation which reduces that amount of plants that fauna can forage on. Since there are fewer native plants present to hold in soil, they can indirectly cause soil degradation, erosion, and surface runoff. This plant can also disperse itself very easily by wind, water, livestock, wildlife, and human activity which contributes to its spread and invasion of other places so rapidly.

Control

There are many different ways to prevent the spread of spotted knapweed as well as use mechanical and chemical methods to treat existing populations. Preventing seed dispersal to other places not infested with spotted knapweed is the best way to prevent an invasion. This includes cleaning clothing, restricting livestock from grazing in infested areas and using certified weed free hay. Spotted knapweed can be most easily removed in small sizes when the ground is wet. The entire plant must be removed or it will grow back due to its deep taproot. Mowing will reduce that number of flowers but the plant may still grow back. For larger populations, chemical treatment may be the best, most effective option. Spotted knapweed was the second most common invasive plant seen on the Lyon's property and it may be most effective to use chemical treatment due to such a large population in one area.

## Wild/Poison Parsnip *(Pastinaca sativa)*

Description

Wild parsnip is a perennial herb that is similar to cultivated parsnip and can grow to be 5 feet tall. It is commonly found in open, disturbed areas and in mowed fields. It has alternate, compound and branched leaves with jagged teeth. Its leaflets are yellow-green, shiny, oblong and diamond shaped. It flowers from May-June and flowers are arranged in an umbel. In July, it produces dry, smooth, slightly winged seeds that are dispersed in the fall. This plant is known to be dangerous to humans; when the stem is broken the phototoxic sap can cause burns, blistering and skin discoloration. If being managed, this species needs to be approached with caution.

Threat

Wild parsnip tends to outcompete other wild plants in fields because it can grow in a large range of growing conditions from wetlands to pastures and in varying soil types. The seeds produced can also be viable in the soil for up to 4 years afterward and its seed bank is hard to eradicate. Once introduced, wild parsnip is known to invade a field and form thick, impenetrable stands that can modify disturbed habitats. Contact with this plant can cause up to third degree burns after exposure to sunlight and can cause severe blistering.

Control

Wild parsnip can be controlled by mechanical and chemical methods depending on the size and severity of the infestation. Wild parsnip can be easily dug out with small populations but for larger populations, a power bush cutter can be used to cut plants at the base of the stem before they flower, although the plants may resprout and flower again following even a low mowing. Trying to burn wild parsnip will not harm the plants and can make them resprout. Chemical control is the most effective way to get rid of wild parsnip by treating its rosettes. Biological control methods can also be used including the parsnip webworm which damages individual plants severely, but not as effectively with large patches. Most of the Lyon's property is covered in thickets of wild parsnip, so the only effective solution may be to use chemical control, or to plant native trees and shrubs that would shade out the parsnip over time.

## Common buckthorn *(Rhamnus cathartica)*

Description

Common buckthorn is a deciduous small, shrubby tree that grows to be about 25 feet tall. It is commonly found in most habitats as an understory and primary to mid-successional tree. It does well in poor soil and is shade intolerant. It has dark gray to black bark that tends to peel in small strips as the bark matures. It has twigs that tend to be a light gray color which stand out against its dark brown to black imbricate buds that are appressed against the stem and look like a "buck" hoof. It also has a 1-2in thorn at the end of some of its branches. It has dark green leaves that are mostly sub-opposite, ovate, and finely serrated edges with arcuate veination. In the fall, it produces small blackish blue berries in small clumps. It produces yellow-green 4 petaled flowers in clusters of 2-6 near the base of the petiole.

Threat

Common buckthorn impacts the ecological stability of any ecosystem they enter since they are a generalist species and can take over ecological niches that numerous other native plants filled. Common buckthorn outcompetes native plants and its berries produce emodin, a natural laxative that prevents mammals and birds from digesting the sugars in the berries. The berries and seeds of common buckthorn also can be easily transported and dispersed in wildlife scat and to new places. This means that seed banks can be easily established and hard to get rid of entirely once introduced. Common buckthorn tends to leaf out earlier and hold onto its leaves longer than native plants, meaning it typically has a better growing season than native plants. Common buckthorn tends to put a large amount of nitrogen in the soil, changing the soil's chemical composition and causing some native species to struggle. Common buckthorn also tends to form dense thickets in the understory, making it difficult to remove. This is apparent in the forested edges of the property, where a larger, older tree is present and almost the entire understory is regeneration of saplings and seedlings.

Control

There are both mechanical and chemical options for treating common buckthorn. Mechanical control consists of hand pulling when the ground is soft and removing the entire root system, or cutting the

stumps and them wrapping burlap over it and cutting back any new growth found. Chemical control can also be applied to stumps in late summer and winter and to leaves in late fall.

## Multiflora rose *(Rosa multiflora)*

### Description

Multiflora rose is a multistemmed, perennial, thorny shrub that can grow to be 15 feet tall and tends to grow in large clumps. It grows best in early successional/disturbed habitats and often appears a few years after a field's mowing regime has ended. The stems are green to red arching canes and have stiff, large thorns. It has pinnately compound serrated leaves with 7-9 oblong leaflets. It has fringed petioles, unlike native rose species, and grows much larger than native rose species so it is easy to tell apart. In mid-June it produces small white-pink flowers and also produces red rose hips that stay on the plant throughout the winter.

### Threat

Multiflora rose poses many threats to the stability of Vermont ecosystems since it is a generalist that outcompetes native species and fills multiple niches, decreasing biodiversity. Multiflora rose's seeds can also be easily dispersed by birds and other wildlife and like common buckthorn, it can establish a seed bank very well (seeds are viable up to 20 years later). Multiflora rose can also make impenetrable thickets that make it impossible for native species to take root.

### Control

Mechanical and chemical methods can be used to eradicate multiflora rose. Young plants are easiest to be pulled by hand and frequent repeated cutting/mowing 3-6 times a growing season for 2-4 years can be effective. All multiflora rose spotted on the Lyons property were small individuals that could be easily mechanically treated if caught soon (within the next two years). However, there was a larger patch in the experimental section that can still be treated with mechanical means, but it needs to be done sooner rather than later. Chemical means could be cutting the stump and spraying in late summer or for denser populations, applying to foliage.

## Shrub honeysuckle *(Lonicera spp.)*

### Description

There are 4 different types of invasive honeysuckle present in Vermont. They include Tartanian honeysuckle (*Lonicera tartarica*), Amur honeysuckle (*Lonicera maackki*), Morrow's honeysuckle (*Lonicera morrowii*) and Bell's honeysuckle (*Lonicera bella*). Honeysuckle is commonly found in mid-successional forest with some shade, clearings, or along hiking trails and can vary in age and size from a small plant to a large bush sometimes encompassing other invasive plants (common buckthorn or multiflora rose). It is shade intolerant but can survive in shadier conditions as well and can adapt to

living in poor soil. All are deciduous shrubby trees that grow to be 15 feet tall and are all can be difficult to distinguish from one another. They have small, opposite, slightly pubescent elliptical-shaped leaves and have very white fragrant flowers in early summer that develop in pairs in the axils of the leaves and produce red to orange berries in late summer. Although all 4 non-native species are very difficult to tell apart from each other, they are easy to distinguish from native honeysuckle because all 4 have a hollow, dark-colored pith where native honeysuckle does not.

Threat

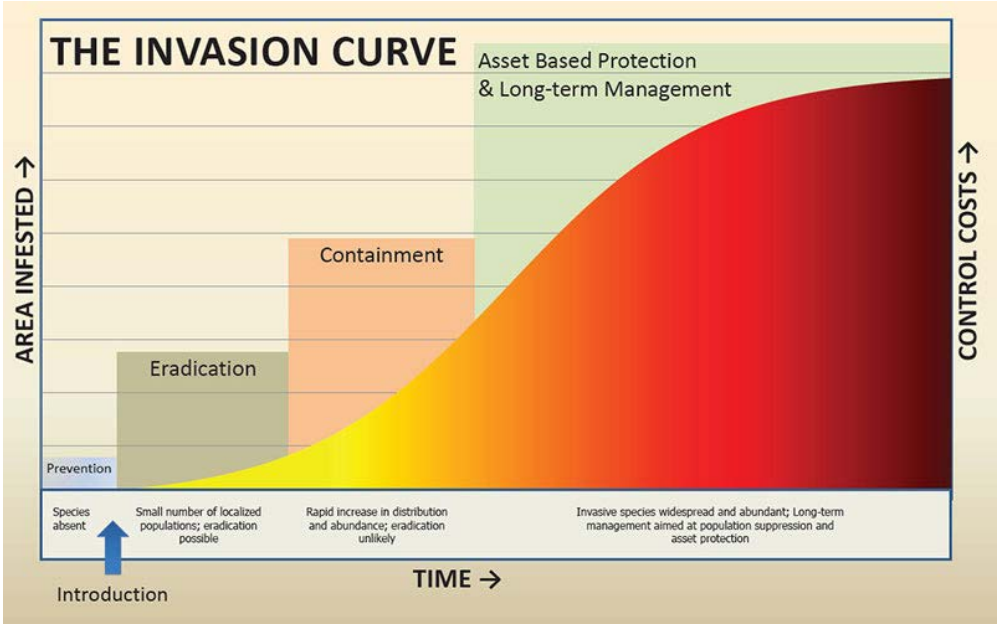
Honeysuckle has many negative ecological impacts on native flora and fauna, outcompeting native plant species and decreasing the stability and biodiversity of the ecosystem it is introduced in. Since honeysuckle has sturdier and lower-lying branches than native species, songbirds build their nest lower to the ground and this results in higher predation of these species. Natural forest regeneration is also severely impacted by honeysuckle since it can form dense thickets and block out any living space/sun for native plants to come in in the understory.

Control

Honeysuckle can be treated using mechanical and chemical methods, although larger infestations are easier to treat with chemicals. Small seedlings or light infestations can be hand removed but in shadier areas, bush clippings to ground level once yearly may be necessary. Chemical control is much more effective on large established stands of honeysuckle by spraying the foliage. Well established stands are best managed by cutting the stems to ground level and painting or spraying the stumps with herbicide. The honeysuckle found on the Lyons property isn't very severe, but it may become more abundant in the experimental area and among forest edges (since it is present on the forest edges/patches of the property) if the field part of the property is no longer mowed and allowed to return to a forest.

For more information on invasive plant management techniques, visit VTinvasives.org or refer to Appendix D. For more information on the invasive species themselves, refer to the invasive species fact sheets in Appendix B.

# Invasive Species Management Prioritization




This management plan was designed around the dominant invasive plant species present that would prioritize the lowest cost/effort for the highest ecological benefit. Highest priority species were ones that it was cost effective, less labor intensive, and very ecologically valuable to treat as soon as possible to prevent the invasion of this species from spreading. This management plan was also designed around the concept of the invasion curve, showing that the most effective way to manage an invasive species is when it is first introduced because it is easiest and most cost effective to eradicate it before the population exponentially grows to the point where it can only be contained or managed from a long term prospective.

The highest priority species (the species easiest to completely eradicate entirely from the property) is multiflora rose. There are a few single small plants of it throughout the property (refer to Map 2), and these could be easily pulled up mechanically and should be done as soon as possible to prevent this small, very manageable population from quickly becoming out of control in future years if these plants are not taken care of. The large patch of it in the experimental section of the property could also be mechanically removed, but since it is a bigger patch, it will require more effort to get rid of. That being said, it can still be removed without herbicides and it will stop the patch from invading other parts of the property.

The longer one waits to treat multiflora rose the harder it is to completely get rid of and it can quickly take over an open field, so it is crucial to treat the multiflora rose as quickly as possible and then go back every year for the next five years to make sure none of it comes back. This will most likely lead to a successful eradication of the plant entirely, and it is highly recommended that management action taken toward multiflora rose happens as soon as possible because of how easy, cost efficient, and ecologically important it is to get rid of It before it becomes a bigger problem.

The next priority species found is honeysuckle. There are a few larger clumps of it scattered throughout the property, mostly in the experimental section and in the forested edges. A few small plants were found in the field area that could be easily mechanically removed and managed if dealt with in the next 2 years (see Map 2). The larger bushes of it that would require more effort to mechanically remove were located in the experimental area, but if managed within the next two years, could be completely eradicated from the property in total, providing the largest ecological value. The larger polygons of it

located in the field of the property and along most forested edges and the large forest clump in the middle of the property (See Map 1) may need to be dealt with using chemical means or some other form of higher treatment since the seed bank and these plants are very large and will be hard to manage in the long run. This population will most likely not be eliminated entirely, just reduced and managed in further management plans, costing a medium amount of time, money, and effort since long term monitoring will have to be put in place. That being said, the highest priority is to get rid of the few small plants pointed out on the property and to ensure they don't reappear because it is the most cost effective, efficient and valuable way to prevent the invasion from becoming much worse.

The next priority species found is common buckthorn. There are a few smaller trees found on the northern border of the property that could be very easy to mechanically remove within the next 2 years (as soon as possible) as well as in the experimental area (see Map 2). The polygon of buckthorn surveyed consisted mostly of young trees that could be removed mechanically with little effort/cost which would benefit the ecological value of the property. The trees are denser in the experimental area, but if treated within the next two years, common buckthorn could be eradicated from the field portion of the property. However, the forested edges along I-89 and the forested clumps are covered in buckthorn. The interior of the forested edges are large adult buckthorn that would have to be chemically treated thoroughly, especially to make sure that all of the natural regeneration of buckthorn found was reduced. To even make a dent in the amount of buckthorn present, a large sum of money, time, and effort will be needed to manage this buckthorn population to stop it from spreading into the field portion of the property. That is why monitoring the forested edges is so important in future years to make sure the infested forest edges that are beyond being able to be efficiently managed do not cause the field to become infested with buckthorn as well.

The least priority species are the wild parsnip and spotted knapweed that were found over most of the field portion of the property simply because they are so well established in the property that it would take many years, a large sum of funding, and many long hours of chemical and mechanical labor to stop the infestation from spreading. Decreasing this population may not be worth the time and money invested into it and may be better spent eradicating some of the other species mentioned above. In most instances, wild parsnip was found in large, dense clumps with interspersed clumps of spotted knapweed or each species was found by itself in large, dense clumps. Due to the invasion and large presence of both of these plants, chemical treatment will most likely be the best option to begin treating both. Many years of monitoring and treatment will need to follow to get the populations of both of these plants to reasonable level (at least 10 years) that will be manageable in the future. The seed bank of both of these plants is very well established so treatment plans and monitoring will take a lot of time and financial resources.

## Early Detection and Rapid Response

There are a few common invasive species found just outside the parcel that may in future years become present in the property and become problematic. For example, since the surrounding forest edges are all older common buckthorn, these forest edges will over time become more and more invaded with buckthorn. Some saplings of common buckthorn were found in these forest edges already among brambles and honeysuckle, and seedlings of common buckthorn were found in the field forested edge

area. These forest edges need to be monitored in future years to keep track of how far common buckthorn is advancing into the field. The experimental area had a few invasive plants that were beginning to establish themselves and this area should be paid particular attention to and monitored in future years for new introductions of invasive species. The experimental area had a few smaller and one large clump of multiflora rose that could be easily managed, but future monitoring is critical to ensure the small population doesn't come back to that area as the field moves into further stages of succession. This is also crucial for the common buckthorn population found in this area. Once it is taken care of, monitoring of the population and looking for signs of the seed bank growing back in future years is very important to ensuring the experimental area doesn't become overtaken by multiflora rose, honeysuckle, and common buckthorn in these early successional stages.

## Estimated Cost of Management

The cost of management for this project will depend on the process chosen to manage the invasive species present on the property. Mechanical and chemical treatment vary in cost in which the upfront cost of chemical may be more than mechanical. Mechanical can be costlier in the long run since more treatments and labor will be required based on the work contracted. Cost also varies on who you have do manual labor. If volunteers are acquired to do invasive removal, they may cost less but may not do as thorough or efficient as a job as hired contractors for mechanical removal. Treatment visits will also vary depending on mechanical or chemical treatment. The first treatment for both methods will be much higher than follow up treatments depending on how bad the invasion is. Spotted knapweed covered .69 acres, spotted knapweed and wild parsnip covered 4.3 acres, wild parsnip covered .24 acres, and common buckthorn covered .11 acres of the property. Mechanical brush management (removing a few woody stems) costs $98.35 an acre and using chemical methods costs $603.80 an acre for an intensely invaded area such as some areas of this property. Herbaceous weed control using chemicals to treat invasive plants on an intensive level is $496.53 an acre and can vary depending on the size and species of the infestation. Wild parsnip tends to cost more money to treat because of how hazardous it is to work with. For more information about cost estimates, refer to Appendix E.

There are many ways to reduce the cost of managing the invasive plants present on the site as well as engaging the community in invasive species awareness and removal. For monitoring purposes, using volunteers is a great way to save money for long term monitoring or have large one-time or annual community invasive removal events to remove some of the denser areas on the property. During the growing season especially, volunteers and youth groups can be recruited such as boys/girls scouts, 4H clubs, schools, or other service groups. Volunteer days can also be a great way to do invasive species outreach for the local community. Having local people who care about their town land who go out and take care of it themselves and learn about why their town land needs to be restored will be more inclined to help and help effectively since they have a connection to the land they use. Many opportunities can be made for engaging the local community to fight invasive plants and in return, their help can lower management and monitoring costs.

For a list of licensed invasive management contractors, please see Appendix D.

## Tips for Management/Additional Resources

This management plan's primary use is for invasive plant inventory and management and this inventory is only a brief snapshot of these invasive plants. Future monitoring must be done to control the population. Although a best effort was made to identify and find all invasive plants on the property, there may have been some that were missed when conducting transects.

Implementing an invasive management plan for this given parcel of land will vary widely on where and at what stage the invasive plants are in. It is very important to note that most of the time there is not solely one method that will be completely successful in managing each species present. The best way to manage it is by an integrated approach using a variety of different methods (chemical and mechanical). Managing invasive plants is also an ongoing effort and most often management must continue year after year in monitoring to make sure nothing comes back. It is recommended that management prioritization focuses on areas that have the greatest ecological value for the least amount of cost to manage them. Some of the invasive plant management can be done inexpensively and by hand, being accomplished by individuals. Most of the property however is a large infestation of invasive plants where control is going to be difficult, and hiring a professional to go out and treat the large patches that will eliminate 90% of the plants will work best. Sources of funding and other invasive species management information is provided in Appendix D for those interested in invasive management. It is very important (especially since this is town land) to engage the local community about the monitoring and control of invasive plants on this property because the people who use this land frequently will be great aspects in monitoring invasive plant populations because they will be using this land most and will want to keep their land healthy.

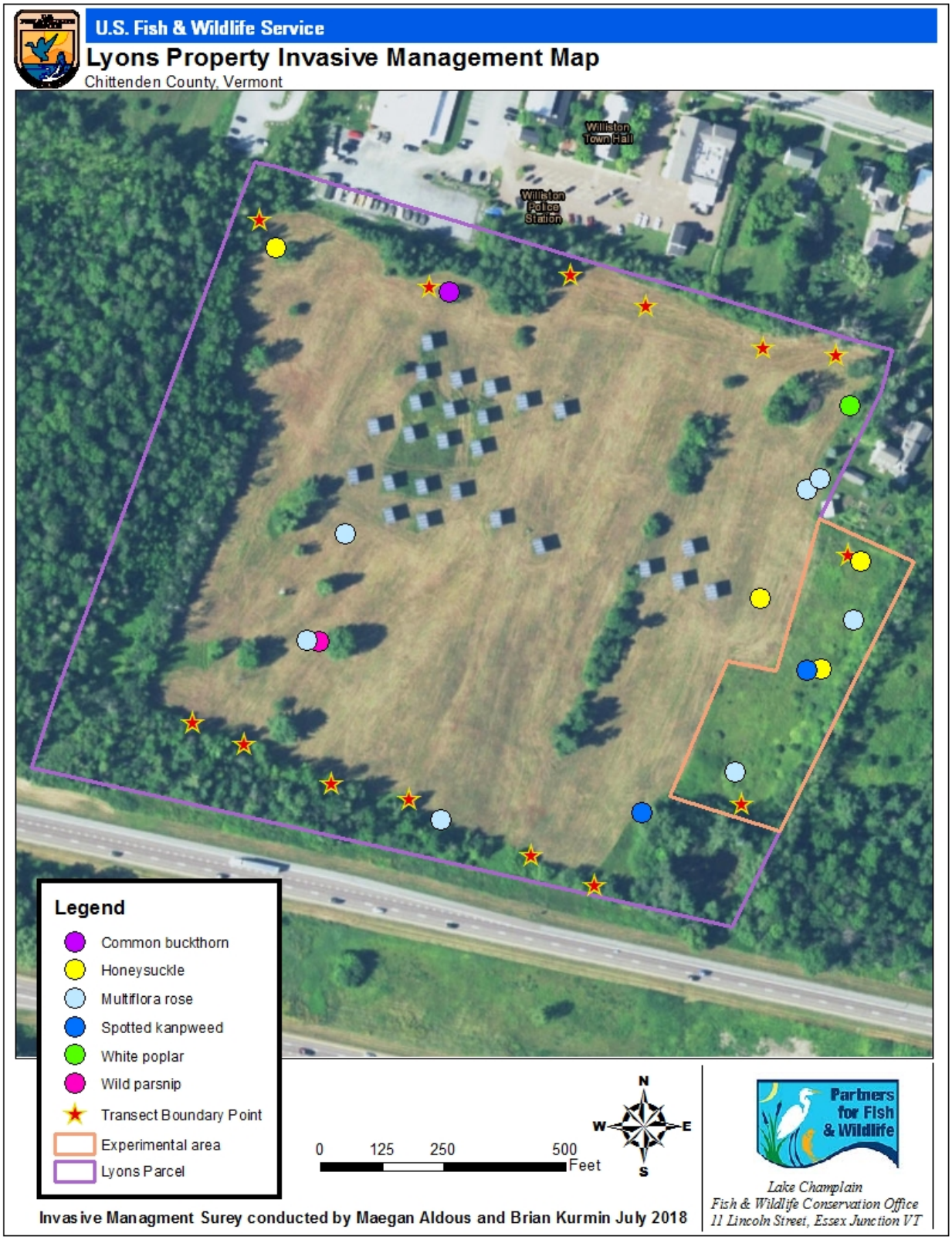
## Future Monitoring

The forested edges of the property solely consist of older common buckthorn in the overstory with sapling common buckthorns and ash as natural regen in the understory. This is very concerning for future forest composition because when Emerald Ash Borer reaches Williston, these small ash trees that may otherwise outlive the common buckthorn will die, allowing common buckthorn to be the only dominant understory and overstory tree, creating a very unstable and unhealthy ecosystem. Native pioneer species such as paper birch, eastern white pine, and quaking aspen can be planted; these species could possibly shade out the common buckthorn saplings while creating some temporary mid-successional habitat before the area is restored fully with native plants. Areas that have multiflora rose in it should be continuously monitored at least once every year to ensure the small population is completely eradicated from the property. Even if the population is no longer present on the property after management has been established, a monitoring protocol should encourage workers to keep an eye out for it while managing for buckthorn and honeysuckle since it could easily work itself back on to the property without anyone noticing. It is best if the small pockets of invasive plants (multiflora rose, honeysuckle) are eradicated as quickly as possible to avoid a costlier invasion in the future. The larger areas of invasive plants (spotted knapweed and wild parsnip) should be continually monitored and their populations should be managed to ensure that they don't expand into new areas. It is recommended that the property is walked through biannually, in the spring and autumn, to look for invasive species or

at least once a year. Staying on top of what species are coming into the area and removing new problem plants as soon as they arrive will ensure that the property returns to a healthy and stable ecosystem while providing habitat for wildlife.

# Map 1. Lyons Property Invasive Plant Polygon

# Map 2. Lyons Property Invasive Plant Point



# Appendix A-USDA Plant Codes

The following are the USDA plant codes for common invasive plants found on the property and were used in the data collection process.

| Species | Code |
|---|---|
| Norway maple | ACPL |
| Garlic mustard | ALPE4 |
| Barberry | BETH |
| Oriental bittersweet | CEOR7 |
| Spotted knapweed | CEST8 |
| Autumn olive | ELUM |
| Glossy buckthorn | FRAL4 |
| Honeysuckle | LONIC |
| Wild parsnip | PASA2 |
| Common buckthorn | RHCA3 |
| Multiflora rose | ROMU |

# Appendix B-Invasive Plant Fact Sheets

# Fact Sheet: Spotted Knapweed

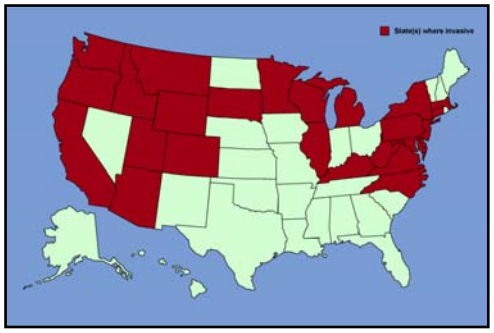
## Spotted Knapweed
*Centaurea biebersteinii* DC.
Sunflower family (Asteraceae)

### NATIVE RANGE
Central Europe, east to central Russia, Caucasia, and western Siberia

### DESCRIPTION
Spotted knapweed is a biennial or short-lived perennial. Its name is derived from the spots formed by black margins on the flower bract tips. Spotted knapweed typically forms a basal rosette of leaves in its first year and flowers in subsequent years. Rosette leaves are approximately 8 inches long by 2 inches wide, borne on short stalks, and deeply lobed once or twice on both sides of the center vein, with lobes oblong and wider toward the tip. The taproot is stout and deep. Flowering stems are erect, 8 to 50 inches tall, branched above the middle, and sparsely to densely hairy. Stem leaves alternate along the stem, are unstalked, and may be slightly lobed, or linear and unlobed. Leaf size decreases towards the tip of the stem.

Flowers are purple to pink, rarely white, with 25 to 35 flowers per head. Plants bloom from June to October, and flower heads usually remain on the plant. Flower heads are oblong or oval shaped, ¼ inch wide and ½ inch across, and are single or borne in clusters of two or three at the branch ends. Leaf like bracts surrounding the base of the flower head are oval and yellow green, becoming brown near the base. The margins of these bracts have a soft spine like fringe, with the center spine being shorter than the lateral spines. The brown, oval seeds are 1/16 to 1/8 inch long, with pale longitudinal lines and a short fringe on one end.

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




### DISTRIBUTION IN THE UNITED STATES
Spotted knapweed is a widely distributed species reported to occur throughout Canada and in every state in the U.S. except Alaska, Georgia, Mississippi, Oklahoma and Texas. It has been designated as a noxious weed in Arizona, California, Colorado, Idaho, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

It has been identified as invasive in natural areas by eighteen organizations in twenty-six states (Arizona, California, Colorado, Connecticut, Delaware, Kentucky, Idaho, Illinois, Massachusetts, Maryland, Michigan, Minnesota, Montana, North Carolina, New Jersey, New York, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Washington, Wisconsin, West Virginia, and Wyoming). Fifteen national parks also identify spotted knapweed as an invasive plant and a threat to natural habitats.

### HABITAT IN THE UNITED STATES
Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving 8 to 80 inches of rain annually. Spotted knapweed prefers well-drained, light-textured soils that receive summer rainfall, including open forests dominated by ponderosa pine and Douglas fir, and prairie habitats dominated by Idaho fescue, bluebunch

wheatgrass, and needle-and-thread grass. Disturbance allows for rapid establishment and spread; however, spotted knapweed is capable of invading well managed rangelands. Spotted knapweed does not compete well with vigorously growing grass in moist areas. In seasonally dry areas, spotted knapweed's taproot allows it to access water from deep in the soil, beyond the reach of more shallowly rooted species.

**BACKGROUND**

Spotted knapweed was introduced to North America from Eurasia as a contaminant in alfalfa and possibly clover seed, and through discarded soil used as ship ballast. It was first recorded in Victoria, British Columbia in 1883 and spread further in domestic alfalfa seeds and hay before it was recognized as a serious problem.

**BIOLOGY & SPREAD**

Spotted knapweed plants in North America generally live 3 to 7 years but can live up to nine years or longer. Plants regrow from buds on the root crown. Reproduction is by seed, and plants are capable of producing 500- 4,000 seeds per square foot per year. About 90% of the seeds are viable at the time of dispersal, and they can remain viable in the soil for 5-8 years. Most seeds are dispersed near the parent plant but can be transported by people, wildlife, livestock, vehicles, and in soil, crop seed, and contaminated hay. Gravel pits, soil stockpiles, powerlines, grain elevators, railroad and equipment yards are important seed distribution points.

**MANAGEMENT OPTIONS**

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

***Manual and Mechanical***

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

***Biological***

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

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

***Chemical***

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

***Other***

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

**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 spotted knapweed, please contact:

- Michael Carpinelli, USDA-ARS, Burns, OR (541-573-8911, michael.carpinelli at oregonstate.edu)
- Steve Dewey's Weed Web (http://www.ext.usu.edu/ag/weeds/index.htm)
- Peter Rice, Montana Noxious Weed Trust (http://invader.dbs.umt.edu/)

**OTHER LINKS**
- http://www.invasive.org/search/action.cfm?q=Centaurea%20biebersteinii
- http://www.lib.uconn.edu/webapps/ipane/browsing.cfm?descriptionid=45

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Washington State Noxious Weed Control Board

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# WILD PARSNIP

*Pastinaca sativa*

## Caution: Do not touch this plant!

*Wild parsnip infestation*

## 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.

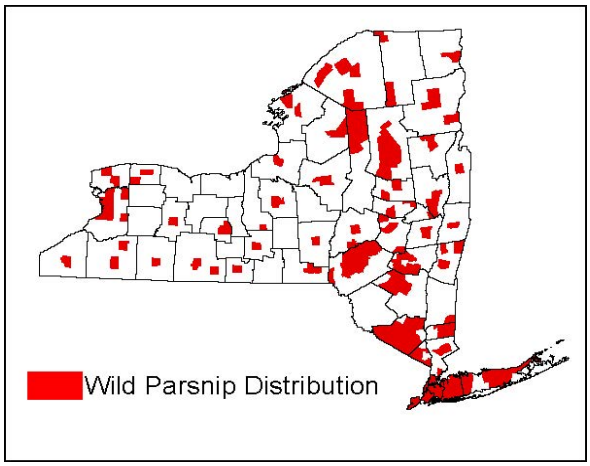
*Wild parsnip stem*

*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).



## 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.

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

### 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.

## 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

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# BUCKTHORN

invasive fact sheet

© Leslie Mehrhoff/IPANE

**Buckthorn** replaces native trees and shrubs in Vermont's forests and fields. It is **easy to see in the fall** when its dark blue berries cover the tree's branches.

## Recognize

common buckthorn
glossy buckthorn

### common buckthorn (*Rhamnus cathartica*)

orange tissue

opposite, toothed leaves with "u" vein

### glossy buckthorn (*Rhamnus frangula*)

alternate glossy leaves

unripe red berries

Photos © John Randall/The Nature Conservancy

© 2006 Jenn Forman Orth

## The Problem

- Birds and mammals feed on buckthorn berries during the winter, aiding in the dispersal of seeds. While buckthorn may benefit from this behavior, the feeding animals do not. Buckthorn berries contain emodin, a natural laxative, that prevents mammals from digesting sugars found in the berries, like this Eastern chipmunk shown above.
- Like many other invasive trees and shrubs, buckthorn leafs out early and retains its leaves into late fall, giving it a much longer advantageous growing season than native plants.
- Buckthorn can increase the amount of nitrogen in the soil, impacting the composition of native species that can grow in the area.

# BUCKTHORN

Remove

## Integrated Invasive Plant Management

*Most landowners have more than one invasive plant species on their property. Before you head for the clippers, develop a management plan. A well-developed plan that is specific to your property will help you save time and money, increase long-term effectiveness, and reduce the spread of invasives.*

- √ ***Create land management goals.*** Determine what natural features you are most interested in protecting and what wildlife management, forestry activities or trail building goals you have for the next 5—20 years, and what you want the land to be like in 200 years.
- √ ***Map the invasive species on your property and the surrounding area.*** Look for invasive plants along logging roads and trails, and other openings in the forest canopy. Roughly map the species that you find, and convey a sense of the size and density of the populations.
- √ ***Practice Early Detection and Rapid Response (EDRR).*** Each year, walk your entire property. Look for and remove new occurrences of invasive species. Stay up to date on what invasive species are coming into your area.
- √ ***Consider available resources and develop a timeline.*** Be realistic with the time and money you have and set goals accordingly. Based on what resources you have available, time your work accordingly.
- √ ***Determine a weed- or site-led management approach.*** *Site-led management* is designed for the landowner interested in protecting a particular resource or natural feature from encroachment. *Weed-led management* approaches the problem from a single-species perspective. Your approach may change from one part of your property to another, depending upon the species present, natural features, vegetation types, and land management goals.
- √ ***Integrate invasive species prevention and management into all of your land management activities.*** Certain land management activities may spread invasive species. Predict what activities (e.g. logging, construction of trails, roads or buildings) will cause future problems and take necessary precautions. For example, after spending time in an area that has invasive plants, check clothing for seeds and remove soil from shoe soles. Require that any logging, mowing or excavation equipment that comes on your property is weed-free. Monitor new plantings, whether within designed landscapes or natural settings, for invasives that may have been present in imported soil. Before doing a cut in a timber stand, remove all invasives. Ask your forester to incorporate invasive plant management into your land management plan.

### *Mechanical removal:*

**Hand pull:** Any time of year when the ground is soft, especially after a rain, hand pull small plants by the base of the stem. Be sure to pull up the entire root system. Hang from a branch to prevent re-rooting. For larger plants, use a Weed Wrench™. Continue to monitor the area every year for new seedlings.

**Cut stump:** Cut plants back any time of year. Wrap a few layers of burlap or thick plastic over the stump and tie tightly with twine. You will need to check stumps periodically and cut back any new growth.

### *Chemical removal:*

**Cut stump:** Cut the plant 4 inches above the ground. Use a drip bottle to apply a 18-21% glyphosate solution to the stump within one hour of cutting. This is best done in late summer through winter when plants are transporting resources to their root systems.

**Low volume foliar spray:** This method is used for dense populations and best left to a contractor. In the fall, when native plants are losing their leaves, spray a 2% glyphosate or triclopyr solution on the entire leaf surface of the plant. In order to avoid

### Safe Chemical Application

- √ ***The label found on the herbicide container is the law.*** Read this label in its entirety. It will teach 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 good contractor will have the knowledge to help create an effective management plan. For a list of certified contractors, contact the Department of Agriculture at 802-828-3482.
- √ ***Develop an Integrated Plant Management approach.*** Use chemical control as only ONE piece of your prevention and management strategy.

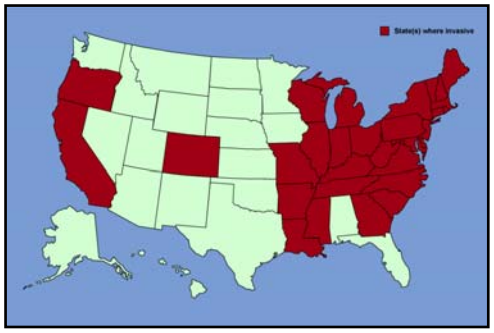
# Fact Sheet: Multiflora Rose

## Multiflora Rose
*Rosa multiflora* Thunb.
Rose family (Rosaceae)

### NATIVE RANGE
Japan, Korea, and eastern China

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

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




### DISTRIBUTION IN THE UNITED STATES
Multiflora rose occurs throughout the U.S., with the exception of the Rocky Mountains, the southeastern Coastal Plain and the deserts of California and Nevada.

### HABITAT IN THE UNITED STATES
Multiflora rose has a wide tolerance for various soil, moisture, and light conditions. It occurs in dense woods, prairies, along stream banks and roadsides and in open fields and pastures.

### BACKGROUND
Multiflora rose was introduced to the East Coast from Japan in 1866 as rootstock for ornamental roses. Beginning in the 1930s, the U.S. Soil Conservation Service promoted it for use in erosion control and as "living fences" to confine livestock. State conservation departments soon discovered value in multiflora rose as wildlife cover for pheasant, bobwhite quail, and cottontail rabbit and as food for songbirds and encouraged its use by distributing rooted cuttings to landowners free of charge. More recently, multiflora rose has been planted in highway median strips to serve as crash barriers and to reduce automobile headlight glare. Its tenacious and unstoppable growth habit was eventually recognized as a problem on pastures and unplowed lands, where it disrupted cattle grazing. For these reasons, multiflora rose is classified as a noxious weed in several states, including Iowa, Ohio, West Virginia, and New Jersey.

### BIOLOGY & SPREAD
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.

## MANAGEMENT OPTIONS

Mechanical and chemical methods are currently the most widely used methods for managing multiflora rose. Frequent, repeated cutting or mowing at the rate of three to six times per growing season, for two to four years, has been shown to be effective in achieving high mortality of multiflora rose. In high 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. Application of systemic herbicides (e.g., glyphosate) to freshly cut stumps or to regrowth may be the most effective methods, especially if conducted late in the growing season. Plant growth regulators have been used to control the spread of multiflora rose by preventing fruit set.

### *Biological*

Biological control is not yet available for management of multiflora rose. However, researchers are investigating several options, including a native viral pathogen (rose-rosette disease), which is spread by a tiny native mite, and a seed-infesting wasp, the European rose chalcid. Rose-rosette disease, native to the western U.S., has been spreading easterwardly at a slow pace and is thought to hold the potential for eliminating multiflora rose in areas where it grows in dense patches. An important drawback to both the rose rosette fungus and the European rose chalcid is their potential impact to other rose species and cultivars.

**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 multiflora rose management, please contact:

- Robert J. Richardson, Aquatic and Noncropland Weed Management, Crop Science Department, Box 7620, North Carolina State University, Raleigh, NC 27695-7620, (919) 515-5653, Rob_Richardson at ncsu.edu

## SUGGESTED ALTERNATIVE PLANTS

Using native shrubs and trees for land restoration and landscaping purposes is one way to prevent invasions by multiflora rose.

## OTHER LINKS

- http://www.invasive.org/search/action.cfm?q=Rosa%20multiflora
- http://www.lib.uconn.edu/webapps/ipane/browsing.cfm?descriptionid=29

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# BUSH HONEYSUCKLE

invasive fact sheet

© Leslie Mehrhoff/IPANE

**Bush honeysuckle** invades Vermont's forests and fields. It is **easy to see in May and June** when its yellow, white or pink flowers are in bloom.

## Recognize bush honeysuckle

© John Randall/The Nature Conservancy

thin-petaled flowers

red fall berries

hollow stem pith

© Gary Fewless/University of Wisconsin-Green Bay

opposite, oval leaves

© John Randall/The Nature Conservancy

## The Problem

© James Leupoll/USF&WS

- When songbirds build nests in non-native honeysuckle they suffer a higher predation rate than when their nests are built in native shrubs such as arrowwood (*Viburnum dentatum*). This is because honeysuckle stems are sturdier and closer to the ground — raccoons, skunks and other predators can easily scramble up the stems.
- Forest regeneration is severely impacted by honeysuckle infestations. The shrubs form dense colonies in the understory, outcompeting native shrubs and trees.
- Sunlight can no longer reach the forest floor, reducing the diversity and abundance of native wildflower and fern populations.

# BUSH HONEYSUCKLE

Remove

### *Mechanical removal:*

**Hand pull:** Any time of year when the ground is soft, especially after a rain, hand pull small plants by the base of the stem. Be sure to pull up the entire root system. Hang from a branch to prevent re-rooting. For larger plants, use a Weed Wrench™. Continue to monitor the area every year for new seedlings.

**Cut stump:** Cut plants back in the fall or winter. Wrap a few layers of burlap or thick plastic over the stump and tie tightly with twine or rope. Check covered stumps periodically and cut back any new growth.

### *Chemical removal:*

**Cut stump:** Cut the plant 4 inches above the ground. Use a drip bottle to apply a 18-21% glyphosate solution to the stump within one hour of cutting. This is best done in late summer through winter when plants are transporting resources to their root systems.

**Low volume foliar spray:** This method is used for dense populations and best left to a contractor. In the fall, when native plants are losing their leaves, spray a 2% glyphosate or triclopyr solution on the entire leaf surface of the plant. In order to avoid drift to native plants, spray only on calm days.

### Safe Chemical Application

- √ ***Develop an Integrated Plant Management approach.*** Use chemical control as only ONE piece of your prevention and management strategy.
- √ ***The label found on the herbicide container is the law.*** It indicates the 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.
- √ ***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 good contractor will have the knowledge to help create an effective management plan. For a list of certified contractors, contact the VT Department of Agriculture at 802-828-3482.

Replant

## Non-invasive Alternatives

© Mrs. W.D. Barnsford/Lady Bird Johnson Wildflower Center

ninebark
*Physocarpus opulifolius*

© Stefan Bloodworth/Lady Bird Johnson Wildflower Center

winterberry
*Ilex verticillata*

black chokeberry
*Aronia melanocarpa*

© David G. Smith/delawarewildflower.org

Virginia rose
*Rosa virginiana*

© Albert F.W. Vick, Jr./Lady Bird Johnson Wildflower Center

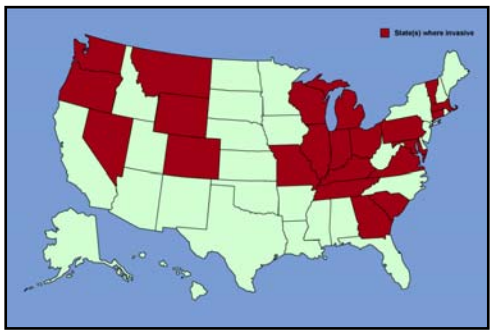
# Fact Sheet: White Poplar

## White Poplar
*Populus alba* L.
Willow family (Salicaceae)

### NATIVE RANGE
Central and southern Europe to western Siberia and central Asia

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

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




### DISTRIBUTION IN THE UNITED STATES
White poplar is found in forty-three states throughout the contiguous U.S.

### HABITAT IN THE UNITED STATES
White poplar seems to grow best in full sun habitats such as fields, forest edges and wetland fringes.

### BACKGROUND
White poplar was first introduced to North America in 1748 and has a long history in cultivation. It is chiefly planted as an ornamental for its attractive leaves of contrasting color (i.e., green above, white below). It has escaped and spread widely from many original planting sites. Because it is susceptible to a wide variety of pest insects and diseases, and is easily damaged by storms and wind, the ornamental value of white poplar is low.

### BIOLOGY & SPREAD
Local spread of white poplar is primarily by vegetative means, through root suckers. Root suckers arise from adventitious buds on the extensive lateral root system. Large numbers of suckers from a single tree can quickly develop into a dense colony. Suckering can occur naturally or as a result of damage or other disturbance to the parent plant. Mature white poplar trees produce thousands of wind-dispersed seeds that may be carried long distances. However, seed germination of white poplar appears to be very low in the U.S.

### MANAGEMENT OPTIONS
White poplar can be controlled using a variety of physical and chemical controls. Removal of seedlings and young plants by hand will help prevent further spread or establishment. Plants should be pulled as soon as they are large enough to grasp. The entire root system, or as much of it as possible, should be removed to prevent resprout from fragments. Hand removal of plants is best achieved after a rain, when the soil is loose.

Trees of any size may be felled by cutting at ground level with power or manual saws. Because resprouts are common after cutting, this process may need to be repeated many times until the reserves of the tree are exhausted. Girdling, which kills the tree by severing tissues that conduct water and sugars, also may be effective for large trees, especially if accompanied by application of a systemic herbicide to the cut area. A hatchet or saw is used to make a cut through the bark encircling the base of the tree, approximately six inches above the ground and deep into the bark. Girdling will kill the parent tree but may require follow-up cutting or treatment of sprouts with an herbicide.

***Chemical***

Chemical control of white poplar seedlings and small trees has been achieved by applying a 2% solution of glyphosate (e.g., Roundup®) or triclopyr (e.g., Garlon® 3) and water plus a 0.5% non-ionic surfactant to the foliage until the leaves are thoroughly wet. Use of low pressure and a coarse spray with large droplet size will reduce spray drift and damage to non-target plants.

**NOTE: Because glyphosate is a non-selective systemic herbicide, it may kill other grasses, broad-leaved herbaceous and woody plants that it contacts. Triclopyr kills broadleaf (dicotyledonous) plants but causes little or no damage to grasses and is useful for areas where desirable grasses are to be maintained.**

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

**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.**

## CONTACT

For more information on the management of White Poplar, please contact:

- Kris Johnson, Great Smoky Mountains National Park, Gatlinburg, TN

## SUGGESTED ALTERNATIVE PLANTS

Hundreds of native tree species are available that can be used in place of white poplar. A few examples, for parts of the eastern U.S. only, include white oak (*Quercus alba*), red maple (*Acer rubrum*), American holly (*Ilex opaca*), persimmon (*Diospyros virginiana*), and sweetgum (*Liquidambar styraciflua*). Check with your local native plant society for further suggestions on trees native to your area and where you can purchase them.

## OTHER LINKS

- http://www.invasive.org/search/action.cfm?q=Populus%20alba
- http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=87

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**PHOTOGRAPHS**
Tom Remaley, Great Smoky Mountains National Park, Gatlinburg, TN

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# Appendix C-Methods

Aerial imagery was used to map and assess possible locations of invasive plants (forest edges, roadsides, etc.) and invasive plants were surveyed by walking transects from the north to the south borders of the property; collecting data on each invasive patch seen and taking a photo point at each transect end. Adjustments were made to transects depending on the location/size of an invasive plant clump.

The main objective was to record where invasive plants were on the property and their abundance and distribution throughout the property.

## Invasive Plant Management Protocol

a. ***Walking Transect Sweep Protocol***
   i. **Site Name:** Lyon Property, Williston Conservation Commission
   ii. **Date:** The date the transect was conducted in the field.
   iii. **Surveyor Initials:** Enter the initials for the people doing the survey that day.
   iv. **GPS Receiver:** Record the names of any GPS or GIS files associated with the site as well as the individual unit used for data collection. This information will be important if somehow data gets lost or corrupted later on.
   v. **Item ID:** A unique identifier for the start photo point and end photo point of each transect. For the start photo point, write the transect number and then an "S" and for the end photo point, write the transect number and an "E" (ex: transect 1 start photo point would be T1S).
   vi. **Start Photo Point**: At the beginning of each walking transect, take a waypoint with the GPS unit as well as a picture facing toward the end photo point of the transect. This photo point will be used to monitor invasive species occurrence as treatment is initiated in future years. Every time this site is monitored, a new photo will be taken to compare to past years.
   vii. **End Photo Point:** At the end of each walking transect, take a waypoint with the GPS unit as well as a picture facing toward the start photo point of the transect. This photo point will be used to monitor invasive species occurrence as treatment is initiated in future years. Every time this site is monitored, a new photo will be taken to compare to past years.
   ***viii.*** **Overall Species Distribution/General Overview Observations**: This should be conducted at the end photo point. After going through the transect, take a few notes on the general major concerns of the transect. If there was a large amount of invasive species in a transect take note of that and a possible explanation of why that might be. Also describe the general habitat type that was apparent in the transect and the two most dominant invasive plants found in the transect, using species distribution phrases as listed below. (Ex: Transect 1: Densely throughout BETH, localized patches LONIC, wetland meadow, large patches of LONIC near beginning of transect. Possible bobolink habitat? Un ID plant with deep lobes and yellow flowers dominant.).

b. ***Polygon Sighting Protocol (done for over 5 individuals of a species found together)***
   i. **Site Name**: Lyon Property, Williston Conservation Commission
   ii. **Date**: The date the species was observed in the field.
   iii. **Surveyor Initials**: Enter the initials for the people doing the survey that day.

iv. **GPS Receiver:** Record the names of any GPS or GIS files associated with the site as well as the individual unit used for data collection. This information will be important if somehow data gets lost or corrupted later on.

v. **Item ID:** A unique identifier for each polygon. For invasive plant sighting along each transect, name each polygon with the transect number and the polygon number (ex: transect 1's first polygon would be T1P1, the next would be T1P2, etc.). For significant findings outside of a polygon (like a large patch of native species with no invasive plants or something of habitat significance) make a polygon and name it with the number of the transect that you are on and then an abbreviation of what it is (ex: if a patch of native species were found, it would be called T1N1, for native patch).

vi. **Invasive Species (1-3):** Record the USDA Plant code for the species observed. See Appendix BLANK for a list of common invasive species found on the site. If a plant code is missing, refer to the USDA Plant code database. If the species cannot be identified in the field, bring a specimen back to the office for definitive identification. If the species still cannot be identified, write "unknown" in this box, or make the best educated guess (ex: A unidentified grass was found, it would be entered as unknown grass). If more than one invasive species is found, record data in second/third dataset.

vii. **Invasive Species (1-3) Life Stage:** This refers to the phenological state the plant is found in. Life stage will be classified as vegetative, flowering or fruiting.

   1. *Vegetative:* The plant has or hasn't flowered/fruited already and is showing no other reproductive structure other than its leaves/buds.
   2. *Flowering:* The plant is either about to flower, is currently flowering, or has just flowered but hasn't started producing seeds yet.
   3. *Fruiting:* the plant is either about to fruit, is currently fruiting, or has just let go of its fruit but hasn't become vegetative again yet.

viii. **Invasive Species (1-3) Abundance:** This is an estimate of the number of plants you have encountered within a polygon. This information combined with the distribution will provide and idea of the extent of the infestation of the species.

ix. **Invasive Species (1-3) Distribution:** refers to what the specific species population looks like on the site at the time of the sighting. Only one phrase will be chosen to describe the species distribution. Distribution phrase definitions:

   1. *Evenly throughout:* Individual plants occur at fairly regular intervals and may be separated by anywhere from 25 feet to 50 meters. This special arrangement can occur on even small parcels. There often appears to be a pattern to distribution.
   2. *Localized patches:* These are isolated clumps of a species. 1-5 patches can be present; there are never many. The patches can be large in size. The patches may or may not be in close proximity to each other however when widely spaced, they usually occur together. Patches can be 10-20 meters apart.
   3. *Frequent Stands:* Similar to localized patches, only occurring with more frequency and in large numbers. 5-10+ patches can be present. Typically, large clumps of plants occurring close together, but not touching (5-10 meters apart). Many stands are usually in view at once. The key here is many patches, occurring frequently, close together.

4. *Densely throughout:* Many plants growing singly or in clumps close together or touching one another or monoculture. An individual cannot walk through a site without stepping on or touching the target species at all times. Small gaps in coverage are acceptable, large ones aren't.

x. **Native Species Present:** List at least 2 native species that you see either within the invasive species present or within a 10-meter diameter of the infested polygon.

xi. **Native Species Distribution:** Similar to Invasive Species Distribution above and using the same definitions, just looking at the native plant population with one phrase being chosen only.

xii. **Additional Comments:** Note any other pertinent information concerning on the infestation site, any notable habitat characteristics or species identification clarification, etc.

xiii. **Photo:** Take a photo of the polygon you surveyed for future monitoring and comparing population growth in future years.

***c. Waypoint Sighting Protocol (only done for 1-5 individuals of a species found together)***

i. **Site Name:** Lyon Property, Williston Conservation Commission

ii. **Date:** The date the transect was conducted in the field.

iii. **Surveyor Initials:** Enter the initials for the people doing the survey that day.

iv. **GPS Receiver:** Record the names of any GPS or GIS files associated with the site as well as the individual unit used for data collection. This information will be important if somehow data gets lost or corrupted later on.

v. **Item ID:** A unique identifier for each waypoint. For invasive plant sighting along each transect, name each waypoint with the transect number and the waypoint number (ex: transect 1's first waypoint would be T1W1, the next would be T1W2, etc.). For significant findings near the waypoint (like a large patch of native species with no invasive plants or something of habitat significance) mark a waypoint and name it with the number of the transect that you are on and then an abbreviation of what it is (ex: if a patch of native species were found, it would be called T1N1, for native patch).

**vi.** **Invasive Species (1-3):** Record the USDA Plant code for the species observed. See Appendix BLANK for a list of common invasive species found on the site. If a plant code is missing, refer to the USDA Plant code database. If the species cannot be identified in the field, bring a specimen back to the office for definitive identification. If the species still cannot be identified, write "unknown" in this box, or make the best educated guess (ex: A unidentified grass was found, it would be entered as unknown grass). If more than one invasive species is found, record data in second/third dataset.

**vii.** **Invasive Species (1-3) Life Stage:** This refers to the state the plant is found in. Life stage will be classified as vegetative, flowering or fruiting.

**1.** *Vegetative:* The plant has or hasn't flowered/fruited already and is showing no other reproductive structure other than its leaves/buds.

**2.** *Flowering:* The plant is either about to flower, is currently flowering, or has just flowered but hasn't started producing seeds yet.

**3.** *Fruiting:* the plant is either about to fruit, is currently fruiting, or has just let go of its fruit but hasn't become vegetative again yet.

viii. **Native Species Present:** List at least 2 native species that you see either within the invasive species present or within a 10-meter diameter of the infested waypoint.

ix. **Additional Comments:** Note any other pertinent information concerning on the infestation site, any notable habitat characteristics or species identification clarification, etc.

x. **Photo:** Take a photo of the polygon you surveyed for future monitoring and comparing population growth in future years.

# Appendix D-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

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

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 E-Cost Estimates

| 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 |