

INVASIVE SPECIES MANAGEMENT PLAN

Rocky Hill MBTA Community Elm Street City of Amesbury, Massachusetts



SUBMITTED TO:

City of Amesbury
Conservation Commission
39 South Hunt Road
Amesbury, Massachusetts 01913

PREPARED FOR:

Dale Development, LLC
360 Washington Road
Rye, New Hampshire 03870

PREPARED BY:

Lucas Environmental, LLC
500A Washington Street
Quincy, Massachusetts 02169

REPORT DATE: June 19, 2026





500A Washington Street, Quincy, MA 02169

June 19, 2026

City of Amesbury
Conservation Commission
39 South Hunt Road
Amesbury, MA 01913

Re: Invasive Species Management Plan
Rocky Hill MBTA Community at Elm Street
265, 277, 281, 287, and 287½ Elm Street, Amesbury, Massachusetts
MassDEP File #002-1362

Members of the City of Amesbury Conservation Commission,

On behalf of Dale Development, LLC, Lucas Environmental, LLC (LE) has prepared this Invasive Species Management Plan (ISMP) for the proposed Rocky Hill MBTA Community residential development located at 265, 277, 281, 287, and 287½ Elm Street in the City of Amesbury, Massachusetts (Assessor's ID Map 68: Lots, 12, 13, 15, 20 & Map 80: Lots 3, 4).

The ISMP includes plant species to be targeted, proposed treatment methods, potential herbicide applications, seasonal timing of treatments and applications, monitoring, and reporting through completion of construction of the residential development. The ISMP is proposed for the area within the limit of work for the proposed project development.

If you have any questions, please do not hesitate to contact me at 617.405.4140 or cml@lucasenviro.com. Thank you for your consideration in this matter.

Sincerely,
LUCAS ENVIRONMENTAL, LLC

Christopher M. Lucas, PWS, CWS, RPSS
Environmental Consultant/Wetland & Soil Scientist

TABLE OF CONTENTS

SECTION I – ISMP	
1.0 INTRODUCTION.....	1
2.0 SIGNIFICANCE OF THE INVASIVE SPECIES THREAT.....	2
3.0 INVASIVE SPECIES MANAGEMENT OPTIONS.....	3
3.1 Management Techniques Overview	3
4.0 PROPOSED SPECIFIC CONTROL METHODS.....	4
4.1 Glossy & European Buckthorn (<i>Frangula alnus</i> & <i>Rhamnus cathartica</i>)	4
4.1.1 Management Protocol Options.....	4
4.1.2 Recommended Control Methods.....	5
4.2 Tatarian & Morrow’s Honeysuckle (<i>Lonicera tatarica</i> & <i>L. morrowii</i>)	5
4.2.1 Management Protocol Options.....	5
4.2.2 Recommended Control Methods.....	6
4.3 Japanese Barberry (<i>Berberis thunbergii</i>)	6
4.3.1 Management Protocol Options.....	6
4.3.2 Recommended Control Methods.....	7
4.4 Japanese Knotweed (<i>Reynoutria japonica</i>).....	7
4.4.1 Management Protocol Options.....	8
4.4.2 Recommended Control Methods.....	9
4.5 Oriental Bittersweet (<i>Celastrus orbiculatus</i>)	9
4.5.2 Management Protocol Options.....	10
4.5.2 Recommended Control Methods.....	11
4.6 Notes on Herbicide Use	12



TABLE OF CONTENTS

SECTION I – ISMP (CONTINUED).....	
5.0 DISPOSAL	12
6.0 REVEGETATION/RESTORATION.....	13
7.0 SITE MONITORING	13
8.0 REFERENCES.....	13
SECTION II – TABLE 1	
SECTION III – FACT SHEETS.....	



SECTION I – ISMP

INVASIVE SPECIES MANAGEMENT PLAN

1.0 INTRODUCTION

Lucas Environmental, LLC, (LE) has prepared the following invasive species management plan (ISMP) for the proposed Rocky Hill MBTA Community residential development located at 265, 277, 281, 287, and 287½ Elm Street in Amesbury, Massachusetts 01913 (Assessor's ID Map 68: Lots, 12, 13, 15, 20 & Map 80: Lots 3, 4).

This document details measures to control invasive species and prevent their spread and covers a wide range of potential invasive species control measures that could be implemented during construction to effectively remove and control them within the project limit of work. Based upon field observations to date, a set of plant species has been identified which includes target invasive species requiring varying degrees of management. The most effective methods will ultimately be selected from the options outlined herein, by the contractor performing the invasive species removal and control work. Invasive species removal and control work will be performed in accordance with all applicable state regulations and will be monitored throughout the construction phase of the residential development project for effectiveness.

A primary goal of the proposed ISMP is removal, or otherwise effective control, of invasive woody trees and shrubs, herbaceous, and vine plant species in the target areas. To meet this goal, management activities focused on target invasive species performed over several years may be necessary. Due to the presence of invasive species outside the limit of work areas, yearly management beyond this period will likely be required to avoid re-establishment and prove effective. Successful invasive species management will be for the benefit of impacted resource areas and adjacent terrestrial and wetland habitats supporting remaining native plant assemblages and associated faunal communities. Additional species may be added to the target species list as further site investigations warrant during construction and monitoring.

The target species listed below include the following invasive woody trees and shrubs, herbaceous, and vine species that have been observed on the proposed site to date:

- Glossy/European Buckthorn (*Frangula alnus*)
- Honeysuckle (*Lonicera tatarica* & *L. morrowii*.)
- Japanese Barberry (*Berberis thunbergii*)
- Japanese Knotweed (*Reynoutria japonica*)
- Oriental Bittersweet (*Celastrus orbiculatus*)

LE has reviewed available literature on each of these target species and has modeled certain elements of the management protocol after control methods recommended by The Nature Conservancy (TNC), as well as other widely accepted guidelines and agency-recommendations for invasive species management. The management protocols present alternatives for both mechanical and chemical (herbicide) control methods, depending on the particular species, species location in the landscape, and the most effective means of managing the species based upon current knowledge and site conditions.

INVASIVE SPECIES MANAGEMENT PLAN

2.0 SIGNIFICANCE OF THE INVASIVE SPECIES THREAT

Invasive plants are non-native species that have been introduced to areas outside of their native range, where they often thrive and out-compete/overtake endemic plant communities. Non-native plants are characteristically aggressive, have few natural enemies and/or limiting biological factors within their introduced range, and tend to have very effective reproductive abilities. The spread of such plants is a major concern in the United States, as they reduce the functions and ecosystems services of habitat for native flora and fauna within both wetlands and uplands and are a nuisance to manage once they have become established within an area. Adverse economic and environmental impacts are often incurred by the establishment of invasive species.

In Massachusetts, the Massachusetts Invasive Plant Advisory Group (MIPAG), a voluntary collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape, has been charged by the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) to provide recommendations to the Commonwealth regarding which plants are invasive and what steps should be taken to manage these species.

Non-native invasive plants often displace native species over a relatively short period of time, often resulting in monotypic plant communities that lack species richness and diversity. Species richness and diversity are essential to maintaining ecological balance. As is true with most exotic or non-native species, those found at the site are increasingly common throughout eastern North America, where their spread has led to a decline in native richness, diversity, and cover of the local native plant communities.

Most exotic species are adapted to a wide variety of habitats and climatic conditions and are free of known diseases and/or insects or other predators native to the U.S. These plants reproduce either by producing large amounts of seeds that are readily dispersed by birds or small mammals (as with buckthorn or Oriental bittersweet), spread through underground stems or rhizomes (e.g., Japanese knotweed), or both (as with Oriental bittersweet). As such, invasive plants quickly establish within a landscape, grow, and spread rapidly. Non-native species aggressively out-compete native plants and can dominate a plant community within a short period of time. In general, many of the introduced plants were widely cultivated in the past for their ornamental and perceived high wildlife value. Only in more recent years have conservationists and land managers come to realize the importance of preserving native plant communities.

MIPAG was instrumental in developing the Commonwealth's first list of invasive, likely invasive, and potentially invasive plants that have now been prohibited from importation, sale, or trade. As a result, future invasions by non-native species will be more likely due to the spread of naturalized populations, rather than new (accidental) introductions.

MIPAG has also developed a list of early detection species for the Commonwealth. MIPAG has also published its strategic recommendations to prevent, control, and where possible, eradicate invasive plant species in the Commonwealth of Massachusetts. These recommendations complement efforts at both the regional and national levels to establish an early detection and rapid response system for invasive plants. Their recommendations are published in the "Strategic Recommendations for Managing Invasive Plants in Massachusetts" (February 28, 2005). More recently, MIPAG has published both the "Massachusetts Invasive Plant Species: Early Detection Priorities" (March 16, 2011), and the "Guidance for the Effective Management of Invasive Plants, Version 2" (December 2012).

INVASIVE SPECIES MANAGEMENT PLAN

3.0 INVASIVE SPECIES MANAGEMENT OPTIONS

LE has reviewed numerous resources from state and regional agencies and private organizations with land management expertise offering plant species-specific information and recommended invasive species removal and control techniques. These groups include MIPAG, the Nature Conservancy, the Massachusetts Trustees of Reservations, the SuAsCo Cisma (Cooperative Invasive Species Management Area), and other local land management experts and consultants. LE has presented much of this information in a summary format provided by Table 1 (Section II) providing information specific to the target invasive species.

The following sections of this management protocol provide species-specific information and control techniques. Because all pesticides, including herbicides, are toxic to some degree, and that even at low levels may cause serious adverse health and environmental effects, LE strongly recommends that qualified, Massachusetts-Licensed Pesticide Applicator contractors follow these or similar protocols during the project's implementation phase. Implementation should only begin once the Applicant has obtained all written approvals and all local and state review agencies have been notified as required per specific permits.

3.1 Management Techniques Overview

Selected management techniques are generally based upon the extent of a given invasive plant species within the plant community and employ a strategy that best controls the target species, while minimizing the potential for adverse impacts to other desirable (i.e., native) species. Invasive species are often difficult to completely eliminate from an area, and a practical management goal is to control, not necessarily eradicate, invasive species while simultaneously encouraging, or even introducing, a native plant community.

Methods for the management of invasive species fall into three basic categories:

- Mechanical (cutting, pulling, grubbing, covering, etc.);
- Chemical (use of herbicides); and
- Biological (using living organisms such as insects or domestic grazing animals).

In general, mechanical controls, such as cutting or pulling, have the least adverse impacts on the adjacent, native communities; however, mechanical methods are often not as effective in the control of certain plant species. When warranted and appropriate, chemical controls (through the application of herbicides) are most effective by modest applications of specific herbicides applied to the surface of freshly cut stems, which is the surface of exposed plants vascular tissue. Selective application of herbicides also functions to reduce adverse impacts on desirable native species from herbicide application. For this same reason, broad foliar spraying of herbicides is generally not recommended because of the potential for negative impacts to non-target plant and animal species, although foliar spraying may be effective in controlling larger, monotypic stands of invasive plants. Biological control, or use of living organisms as a control agent, has also been proven effective on certain species. Upon effective removal or control of invasive species, native plant species are then typically planted or seeded to restore a native plant community. The initial invasive species removal should be conducted concurrently and throughout the construction phase of the project.

INVASIVE SPECIES MANAGEMENT PLAN

4.0 PROPOSED SPECIFIC CONTROL METHODS

4.1 Glossy & European Buckthorn (*Frangula alnus* & *Rhamnus cathartica*)

Glossy and European buckthorn occur in a variety of upland and wetland habitats. Glossy buckthorn generally prefers moist to wetter sites while European buckthorn prefers drier uplands, fields, and forest edges, however the two species can, and often do, overlap in their distribution. They are typically found in forest understories, hedgerows, bogs, stream and lake edges, wetland borders, wet meadows, urban landscapes, roadsides, and other disturbed habitats, often preferring acidic soils. Their growth forms includes large, multi-stemmed understory shrubs, but they can also develop a singular trunk and mature into a small tree, reaching heights of up to 20 to 25 feet. Fruit production is abundant, can extend well into the fall and winter months, with seeds dispersed by birds and small mammals. The berries can ripen at different times often resulting in green, red, and dark purple/black berries all on the same tree. Additionally, these species re-sprout vigorously following cutting and/or top removal. In one study, researchers observed that mature trees cut near the base can send up sprouts nearly six feet in height in the same year (Wyman, 1971; Andreas, 1983; and Brue, 1980; as cited in Converse, 1984). These species are a significant threat to native upland and wetland communities, where they often form dense stands that cause the growth of other species to be suppressed.

4.1.1 Management Protocol Options

Methods to control these species include manual and chemical management. Burning has been demonstrated as ineffective, particularly when burns are done on open land near a buckthorn population, as fire-exposed soils are more vulnerable to seed dispersal.

Manual and Mechanical Control

- Studies have shown that cutting back larger trees twice in a single growing season for two to three consecutive growing seasons results in fewer and shorter stems and reduced plant vigor. This is best done twice a season (in June and in August). Trees with stem bases less than two inches in diameter can be successfully girdled (a one inch-wide cut) during the winter months. Girdling does not disrupt soils and does not disrupt sensitive wetland habitats.
- Individual seedlings and smaller trees/shrubs can be hand pulled or removed with a grubbing tool; however, this technique is only effective in areas of low buckthorn density where the root system can also be effectively removed.

Chemical Control

- Using glyphosate without a surfactant has been reported to have the greatest control with little or no harm to non-target vegetation. Herbicide application of glyphosate has also been shown to be effective on cut stumps, or along girdled stems.

INVASIVE SPECIES MANAGEMENT PLAN

4.1.2 Recommended Control Methods

The recommended method for control of these species is mechanical by pulling/grubbing the tree/shrub/seedling and removing the root system of smaller individuals where feasible or by cutting back larger trees and girdling of large-stemmed individuals. While the use of herbicide (Rodeo®) (without surfactants) has proven effective, it is not recommended where glossy/European buckthorn plants are located within or immediately adjacent to wetlands if it is not absolutely necessary for removal/control.

4.2 Tatarian & Morrow's Honeysuckle (*Lonicera tatarica* & *L. morrowii*)

Morrow's honeysuckle and the closely related Tatarian honeysuckle (i.e., "exotic bush honeysuckles") are deciduous, oppositely branched, hollow stemmed shrubs in the Family Caprifoliaceae. These honeysuckles are adapted to a wide variety of habitats, although disturbance of some kind usually precedes invasion. Fruit production of the bush honeysuckles is abundant, and reproduction is almost entirely by seeds that are typically dispersed by birds and possibly small mammals. These honeysuckles are typically among the earliest deciduous plants to leaf-out during the growing season, with leaf break generally beginning two weeks earlier than co-occurring trees and shrubs. These honeysuckles contribute to reduced richness, diversity, and cover of native shrub and herb communities and reduce tree regeneration in early to mid-successional forests.

4.2.1 Management Protocol Options

Land managers have used both mechanical and chemical methods, as well as prescribed burning, to control exotic bush honeysuckles. There are no known biological controls of *Lonicera* spp.

Manual and Mechanical Control

- Mechanical controls include grubbing or pulling seedlings and mature shrubs, and repeated clipping of larger shrubs.
- Effective mechanical management requires a commitment to cut or pull plants at least once a year and may require more than one year of treatment. Winter clipping should be avoided as it encourages vigorous re-sprouting.
- Repeated annual prescribed burns during the growing season will top-kill shrubs and inhibit new shoot production.

Chemical Control

- Most managers report that treatment with herbicides may be necessary for all large bush honeysuckle populations.
- Formulations of both glyphosate and Triclopyr have been used as foliar sprays or cut stump sprays and paints with varying degrees of success.
- A survey of The Nature Conservancy land managers undertaken in 1998 found that most used glyphosate, and used it as a cut stump treatment, to control *L. tatarica*.

INVASIVE SPECIES MANAGEMENT PLAN

4.2.2 Recommended Control Methods

Mechanical removal methods are most appropriate for this site for the initial treatment where and when feasible. Depending upon the results of seasonal monitoring and the size, density of plants, and location a program involving herbicide application (cut stump or foliar spray) to individual plants may also be appropriate as necessary for effective elimination/control.

4.3 Japanese Barberry (*Berberis thunbergii*)

Japanese barberry is a small to medium, dense shrub in the Family Berberidaceae. This species was often planted as hedges for landscaping but has spread to native habitats. Japanese barberry is capable of changing soil characteristics (i.e. allelopathic) to out compete native plants and also has early spring leaf emergence that allows it to shade out nearby competitors.

European barberry (*Berberis vulgaris*), another invasive species, resembles Japanese barberry closely with the major exception being Japanese barberry has single spines whereas European barberry produces three-pronged spines. Japanese barberry twigs are ridged with spines. Plants are two to four feet high. Newer twigs and stems turn reddish in the winter and become gray as they age and the inner bark is bright yellow on the branches and roots.

This plant can colonize most sites, displacing a wide range of native species, especially herbaceous spring ephemerals. Highly adaptive, it can grow in sites from full sun to deep shade. Japanese barberry tolerates drought but has also been found growing in wet areas. Given enough individuals in an area, their leaf litter shifts the pH of the soil, making it more basic, thus further excluding many native plant species. It commonly grows in woodlands, trails, roadsides, fencerows, pastures, bottomlands, and highly disturbed areas. Japanese barberry spreads by both seed and vegetative means. In addition to spreading through seed dispersal, Japanese barberry is able to form rhizomes and spread via roots so it is necessary to remove all connecting roots when digging the plant up. Individual plants can spread horizontally by a process called layering, in which roots form when branches are in contact with the ground. New plants created in this way will survive being severed from the parent plant.

Once large plants are removed, regular mowing where possible can be effective in management. Spring prescribed fire can also be used for control. Even after plants have been removed, treatment may have to be continued for several years as seeds sprout.

4.3.1 Management Protocol Options

Manual and Mechanical Control

- Mechanical controls include grubbing or pulling seedlings and mature shrubs, and repeated clipping of shrubs. When pulling barberry by hand, extreme care should be taken because the tips of barberry spines are finer than the point of a hypodermic needle and their silicate composition decomposes very slowly under the skin.

INVASIVE SPECIES MANAGEMENT PLAN

- The plant has relatively shallow roots, but re-sprouting can occur if the entire root system is not removed. Manual removals are best suited to areas with only small barberry populations or areas of special ecological sensitivity.
- Mechanical mowing or top removal alone will not successfully control the plants since they vigorously re-sprout. However, mowing can serve as a step prior to herbicide applications to reduce plant size, allowing more efficient applications of herbicide in smaller quantities and with better coverage.
- A relatively new method being explored for removing Japanese barberry is flame weeding. This is the application of a directed flame, usually using a propane torch, to the base of individual plants. This differs from a broadcast prescribed burn, where all surrounding vegetation would also be burned. While this method is very effective in reducing the size of the shrub, it has not exceeded 40 percent mortality, compared with 93 percent mortality for foliar-applied Triclopyr.

Chemical Control

- Foliar treatment with a backpack sprayer is the most effective means to treat sites with low to moderate target density. A useful treatment for barberry suppression is a mixture of glyphosate and Triclopyr at a 2:1 ratio. Other formulations containing glyphosate or Triclopyr can also be used according to the application specifications on the label.
- Stem treatments are effective against Japanese barberry and can be implemented throughout the year, which provides scheduling flexibility. Treatment options include basal bark and cut-stem treatments.
- Basal bark treatments use a concentrated mixture of the herbicide Triclopyr in oil applied to the entire circumference of the lower 12–18 inches of the intact stem, depending on its size.
- If top growth removal is preferred, cut the stems close to the soil line and treat the cut surfaces. Oil-based Triclopyr products can be applied any time after cutting, while water-based glyphosate treatments must be applied immediately after the stems are cut.

4.3.2 Recommended Control Methods

Mechanical removal methods may be most appropriate for this site for the initial treatment. Depending on the results of seasonal monitoring, a program involving herbicide application to plants may be appropriate.

4.4 Japanese Knotweed (*Reynoutria japonica*)

Japanese knotweed is an upright, herbaceous, shrub-like perennial in the Family Polygonaceae native to eastern Asia. Its stout stems are hollow, smooth, and swollen at the joints. The alternate leaves are broad and oval, triangular, or heart-shaped with a pointed tip and may become six inches long and three to four inches wide. It has greenish white flowers and can spread by seed as well as growth by rhizome, runners, and stems (vegetative growth). Damaged stem segments are able to re-grow if the buds at the nodes are viable.

INVASIVE SPECIES MANAGEMENT PLAN

This exotic invasive plant can be found in fields, roadsides, waste areas, forest edges, and river shores and banks. Once a population of knotweed becomes established, it spreads primarily by growth along its large rhizomes, which can grow to a length of 30 feet. Japanese knotweed flowers in August and September, with seeds emerging two weeks following flowering. Japanese knotweed requires high amounts of sunlight and normally does not establish well within forest understories.

4.4.1 Management Protocol Options

Japanese knotweed is present, but not widespread, at the site. Different control methods are recommended for the control of Japanese knotweed, depending upon the location of the plant population, and are described below. It is generally acknowledged by land managers, however, that the use of herbicides is necessary to effectively control this particular species.

Manual and Mechanical Control

Manual and mechanical management techniques are most appropriate for smaller stands of knotweed and young plants. These techniques are also more feasible in environmentally sensitive areas where limitations on herbicide application exist.

- Pulling is considered effective for removing and controlling juvenile Japanese knotweed.
- Digging may be used to control growth of very small populations of young plants. This technique is incredibly labor intensive and generally ineffective when applied to large stands and mature plants. If this technique is utilized, the entire plant, including the roots and runners, must be removed. This is generally done with a mechanical excavator.
- Cutting is another viable mechanical control technique for this species. Shoots are cut as close to the ground as possible, reducing the viability of the rhizomes. Cutting may be done at any point during the growing season before senescence. Cutting is most successful when conducted three times or more per growing season. All cut plant parts must be bagged and sealed and disposed of properly in a landfill to prevent spread. Any stem fragments left behind have potential to re-sprout.
- Repeated cutting can also be used in conjunction with covering this plant with heavy-gauge black plastic for two to three growing seasons to essentially smother the plant.

Chemical Control Alternatives

- A “weed glove” is recommended as an option for applying the herbicide solution in dense areas with desirable neighboring vegetation to avoid herbicide application on non-target plants.
- Cut-stem herbicide application should be utilized when the knotweed is in close proximity to non-target desirable vegetation. The method is effective even in colder temperatures, as long as the ground has not frozen. Prior to applying herbicide, stems should be cut down to about two inches above the ground, between the lowest nodes along the stem. Five milliliters (5 ml) of undiluted herbicide may then be poured into the hollow stem. Foliar applications may be required as follow-up treatment for continued management. This method may not be ideal for large stands with high stem density.

INVASIVE SPECIES MANAGEMENT PLAN

- Stem injection applications are another successful management technique, albeit laborious. Herbicide is injected into the stem in the lower portion of the knotweed in the first few internodes above the ground level. An injector tool that delivers about five milliliters of solution is required for this method. The needle is inserted perpendicular to the stem, midway between the nodes (internodes), whereupon the predetermined amount of herbicide will be delivered to the plant. Knotweed generally takes up the chemical within 20 minutes of treatment. This technique causes minimal harm to nearby plants and is generally not affected by weather conditions, as the herbicide is inside of the plant. This method also eliminates the need for cutting prior to herbicide application and may be conducted at any point during the growing season. Early June is the best time for this method. Stem injection does take multiple seasons to achieve success, and becomes difficult once the knotweed stems become too small for needle insertion.
- Foliar spraying is an effective control strategy for large populations of Japanese knotweed. Glyphosate (two percent solution) and Triclopyr (three to four percent solution) are most commonly used in foliar spraying. Foliage should be sprayed generously until wet without dripping. A low-pressure sprayer and coarse spray pattern should be used when foliar spraying. Foliar spraying should be performed when knotweed shoots are three to six feet tall during non-windy conditions when the two-to three-day extended weather forecast does not call for precipitation. If larger plants exist, they must be cut to a height of approximately five feet prior to applying foliar herbicides.

Of note, a monotypic stand of this species may require anywhere from three to five years of repeated chemical treatment before the Japanese knotweed population is effectively controlled. Quickly establishing native plant vegetation in place of eradicated knotweed will help prevent the reestablishment of the invasive.

4.4.2 Recommended Control Methods

Control by herbicide application is the most effective method for management of this species within the construction limit of work for the Rocky Hill MBTA Community.

4.5 Oriental Bittersweet (*Celastrus orbiculatus*)

Oriental or Asian bittersweet is a perennial vine in the Family Caryophyllaceae occurring in all regions of Massachusetts mainly in upland habitats including forests and forest edges, roadsides, clearings, and open rights-of-way. It was introduced to the United States in the mid-1800s. This vine often climbs to heights of 60 feet and stems may reach four to five inches in diameter. The leaves are opposite, round or elliptical, glossy, and finely toothed. Flowers appear in May. Mature fruit have bright yellow valves with one to three red seeds.

This exotic species is wide-spread and produces abundant seeds, which are spread by birds and possibly small mammals, and by humans (for instance, through the use of this plant in decorating). The stems of this woody vine wrap around and girdle trees, shrubs, and other woody vines, or may cause physical damage from the immense weight of its rapidly growing shoots. Oriental bittersweet may also spread laterally along the ground, forming an impenetrable tangled mass that smothers out all other vegetation.

INVASIVE SPECIES MANAGEMENT PLAN

It is widely recognized that management of Oriental bittersweet is difficult due to its high reproductive rate, long range dispersal, ability to root sucker, and rapid growth rates. Mechanical and chemical management techniques are described below. Management of this species requires extensive monitoring and often a multi-year commitment.

While many mechanical and chemical methods are available, manual and mechanical methods are normally considered as temporary management strategies rather than a means for eradication. Due to the persistence of the seed bank and the ability to spread by root suckering, mechanical control of this species will require a long-term commitment. Chemical control methods are generally considered to be more effective than manual techniques and are the preferred strategy for management of bittersweet in certain locations. The preferred manual/chemical controls are as follows.

4.5.2 Management Protocol Options

Manual and Mechanical Control

- Cutting over several growing seasons may help to control a population to a certain extent. Small shoots may be mowed or cut weekly for at least a year, although less frequent mowing (two to three times a year) can stimulate re-sprouting from the roots. Larger shoots must be cut down to the ground every two weeks. It is important to cut vines as close to the root collar as possible. Cutting will eventually deplete the stored energy within the root stock, leaving only the seed bank to manage. Cutting can also result in vigorous re-sprouting from below-ground stems (rhizomes).
- Pulling or grubbing of larger plants including all roots and runners using a “Pulaski” or similar digging tool may also reduce a population, although re-sprouting is inevitable if not all the root material is removed. Even if all root material is removed, germination of seeds present in the seed bank will occur for several growing seasons. All plant parts (including fruits) should be sealed in bags and disposed of in a landfill to prevent re-establishment on a given site.

Mechanical control is most practical in small plots, or in areas where chemical control is not an option. Ultimately, manual and mechanical control is a means of restricting growth until the roots and seeds are no longer viable.

Chemical Control

Chemical control methods are preferred for management of Oriental bittersweet and are more effective than manual techniques. While both glyphosate and Triclopyr have been used to control bittersweet, most of the literature cites more effective control with Triclopyr. Triclopyr specifically targets broadleaf plants, reducing the chances of impacting nearby monocots. Triclopyr may be applied using several techniques.

- Cut-stump (or cut-stem) applications are effective and are preferred in environmentally sensitive areas. This method is also more appropriate for tall vines that have reached the tree canopy. The stems should be cut to approximately two inches above ground level, and then the cut surface should be immediately painted with concentrated herbicide (eight to twenty five percent active ingredient for Triclopyr). It is sometimes necessary to follow the cut-stump application with a foliar spray about two weeks after treatment.

INVASIVE SPECIES MANAGEMENT PLAN

- Basal bark application is another viable technique for controlling Oriental bittersweet. The foliage should be stripped from the stem in a band at a comfortable working height. A 20 percent Triclopyr solution in a commercial basal oil should be applied to the stripped area, while avoiding contact with any trees or plants the bittersweet is entwining. This technique may be conducted year round as long as the temperature remains above 50 degrees Fahrenheit (F) for several days.
- Foliar spraying may be very effective in areas where it is permitted. Low, monocultures of bittersweet may be sprayed directly. Triclopyr has been effective at concentrations as low as two to five percent active ingredient. A one half-percent concentration of a state-approved non-ionic surfactant is recommended in addition to the Triclopyr so that the herbicide penetrates the leaf cuticle. While foliar spraying may be conducted at any point during growing season, it is preferable to spray in late fall while other non-target species are dormant. In addition, temperatures should be well above 40 degrees F, and rain should not be forecast within 24 hours of treatment. Both sides of the leaf should be sprayed liberally, but not to the point of dripping. A second application is often required after two weeks. For particularly large, dense stands, it may be more effective to cut the shoots before the foliar spraying. The stand may be cut to ground level in the spring then the new shoots may be spraying in the summer, prior to fruiting.

4.5.2 Recommended Control Methods

Mechanical Methods

Smaller plants and vines should be pulled or grubbed including all roots and runners using a “Pulaski” tool or similar digging tool. This should occur during the months of March and April. Some regrowth should be anticipated if not all of the root material is removed. Regrowth may also occur from germination of seeds present in the seed bank. Pulling or grubbing of larger plants including all roots and runners may also reduce a population, although re-sprouting is inevitable if not all parts are removed.

For larger plants, it is recommended that the stems be cut every two weeks down to the ground and as close to the root collar as possible. Stems should be cut frequently (weekly or bi-weekly) throughout the year (from April through October), as cutting less frequently can stimulate vigorous re-sprouting from below ground stems.

All plant parts, including fruits, should be bagged and disposed of in a landfill to prevent reestablishment on a given site.

Chemical Methods

Smaller populations have been successfully controlled by cutting and applying an herbicide (Triclopyr) to the regrowth about a month later. Research has also demonstrated effective control by applying Triclopyr to cut stems at the time of the first killing frost. Where warranted, and where mechanical methods have proven ineffective after several attempts, the use of herbicides is recommended. Large, dense populations (i.e., the most difficult to manage plants) will be cut down and then treated with Triclopyr one month following the cutting. This technique may occur during April and May as well as during September to October.

INVASIVE SPECIES MANAGEMENT PLAN

4.6 Notes on Herbicide Use

Various groups, including the Nature Conservancy, MIPAG, and the National Park Service (NPS) strongly recommend non-chemical methods of control wherever feasible. However, for large infestations, non-chemical methods are inadequate. Any herbicide use permitted at the site should be applied only by a Massachusetts-Licensed Pesticide Applicator and in accordance with all State regulations pertaining to herbicide application.

The two main herbicide treatments considered in developing this management protocol include glyphosate and Triclopyr. Glyphosate (e.g., Round-up® or Rodeo®) is a non-selective, systemic herbicide that kills both grasses and broad-leaved plants. Triclopyr (e.g., Brush-B-Gone™, Garlon™, Pathfinder™) is a selective herbicide that kills broad-leaved plants, but does little or no harm to grass species. Applied carefully to avoid non-target plants, glyphosate is the least environmentally damaging herbicide in most instances. Round-up® contains a petroleum-based sticker-spreader that allows the herbicide to cling to the target species to ensure its absorption into the plant's tissues. Rodeo®, the glyphosate formulation for use in wetlands, does not contain any sticker-spreader (i.e. surfactants), and thus is considered to be safer for aquatic environments.

Where appropriate and considered necessary for the successful management of the invasive species at this site, specifications for the type of herbicides is provided. As with the timing for mechanical methods for management of invasive species, non-specific use of herbicides or use of a specific herbicide at incorrect times, or in incorrect concentrations, can actually lead to spreading of invasive species.

Other considerations for herbicide use include avoiding inclement weather conditions such as wind, which could result in herbicide application to non-target, possibly native species, or rainy conditions, which could dilute or wash away applied herbicides, rendering them ineffective.

5.0 DISPOSAL

The construction of the Rocky Hill MBTA residential community, in conjunction with this invasive species management protocol, will generate a substantial amount of plant debris and soil that often contains viable root fragments and seed banks. Invasive plant debris may contribute to the introduction or spread of the species at the project site or even at the disposal location if not properly disposed. Invasive plants managed using chemical control methods should be left in place to biodegrade, rather than disposing of the materials off-site. Disposal of invasive plants with flowers or seeds should be minimized to prevent the further spread of target species. Furthermore, plant material should not be composted to prevent regrowth or spread of seeds into the compost sediment. Invasive plant material is to be bagged and allowed to rot within the bags. The bags should be stored in a location with sun for a minimum of three weeks then disposed of in a landfill or incinerated. It is possible to air dry or incinerate herbaceous plants, however, bagging plants and storing before removal off-site may be more successful.

INVASIVE SPECIES MANAGEMENT PLAN

6.0 REVEGETATION/RESTORATION

Following implementation of the initial invasive species management protocols for the target species, native vegetation should be allowed to re-colonize the limit of work area via natural succession, or be established as part of the approved Landscape Plans and Restoration Area Plan that has been specifically developed for the Rocky Hill MBTA Community.

7.0 SITE MONITORING

LE will perform on-site observations throughout the Rocky Hill MBTA Community site construction effort. LE will monitor the mechanical and chemical control efforts to manage existing populations of invasive species as identified. The primary purpose of these observations is to document and assess the effectiveness of the ISMP implementation.

The construction phase assessments will help determine what additional measures will be required by the Applicant and management contractor(s) to attain effective long-term control of the target invasive species. Based upon this monitoring effort, LE can recommend a set of additional control and management measures to help manage the target invasive species identified within the limit of work and help to update this ISMP as needed. The intent of the assessment will also be to observe and document the response of the remaining native plant assemblage to the invasive species removal efforts. If a new invasive species is observed during construction monitoring that has not been previously documented at the site, a monitoring and control plan can be developed for that species and added to the ISMP. Action will likely be taken immediately if new invasive plants are encountered to prevent their spread, and the appropriate agencies notified. Delays may make the problem more difficult to address.

Post ISMP implementation monitoring observations will occur at a minimum during the early and late portions of each growing season during the construction activities. LE would provide the City of Amesbury Conservation Commissions with written reporting on an annual basis, or more frequently if requested/required. Observations can also be performed beyond the site construction monitoring period if requested/required.

8.0 REFERENCES

- Ahrens, J.F. 1987. Herbicides for control of oriental bittersweet. Proceedings, Northeastern Weed Sci. Soc. 41:167-170.
- Batcher, M.S. and S.A. Stiles. 2000. Element Stewardship Abstract for *Lonicera maackii* (Rupr.) Maxim (Amur honeysuckle), *Lonicera Morrowii* A. Gray (Morrow's honeysuckle), *Lonicera tatarica* L. (Tatarian honeysuckle), *Lonicera x bella* Zabel (Bell's honeysuckle), the Bush honeysuckles. The Nature Conservancy, M. Tu and J. M. Randall, Eds. University of California, Davis, CA.

INVASIVE SPECIES MANAGEMENT PLAN

- Converse, C.K. 1984. Element Stewardship Abstract for *Rhamnus cathartica*, *Rhamnus frangula* (syn. *Frangula alnus*), Buckthorns. The Nature Conservancy, M. Tu and J. M. Randall, Eds. University of California, Davis, CA.
- Dreyer, G. D. 1988. Efficacy of Triclopyr in Root-killing Oriental Bittersweet (*Celastrus orbiculatus* Thunb.) Proceedings, Northeastern Weed Sci. Soc. 42: 120-121.
- Dreyer, G. D. 1994. Element Stewardship Abstract for *Celastrus orbiculata*, Asiatic Bittersweet. The Nature Conservancy, J. M. Randall, Ed. University of California, Davis, CA.
- Eckardt, N. 1987. Element Stewardship Abstract for *Rosa multiflora*, Rambler Rose, Multiflowered Rose. The Nature Conservancy, J. M. Randall, Ed. University of California, Davis, CA.
- Gover, Art., Jackson, D. R., and S. Wurzbacher, 2020. Japanese Barberry. Penn State Extension. <https://extension.psu.edu/japanese-barberry>.
- Haines, A. 2011. Flora Novae Angliae. The New England Wildflower Society, Yale University Press. New Haven, Connecticut.
- Iowa State University Extension and Outreach, Natural Resource Stewardship. Japanese Barberry Invasive Species Profile. <https://naturalresources.extension.iastate.edu/encyclopedia/japanese-barberry-invasive-species-profile>.
- Johnson, Jon, et al. Managing Multiflora Rose. Conservation Reserve Enhancement Program Technical Assistance Series. Pennsylvania State University & United States Department of Agriculture. 2007. <<http://www.pgc.state.pa.us/crep>>.
- Massachusetts Executive Office of Environmental Affairs, Department of Agricultural Resources, Fact Sheet on Glyphosate, November 26, 2003
- Massachusetts Executive Office of Environmental Affairs, Department of Agricultural Resources, Fact Sheet on Triclopyr, June 23, 1990.
- Massachusetts Invasive Plant Advisory Group, *Final Report*: “The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts,” February 28, 2005.
- Massachusetts Invasive Plant Advisory Group, “Strategic Recommendations for Managing Invasive Plants in Massachusetts” February 28, 2005.
- Massachusetts Invasive Plant Advisory Group, “Massachusetts Invasive Plant Species: Early Detection Priorities,” March 16, 2011.
- Massachusetts Invasive Plant Advisory Group, “Guidance for the Effective Management of Invasive Plants, Version 2, December 2012.

INVASIVE SPECIES MANAGEMENT PLAN

- Mehrhoff, L. J., J. A. Silander, Jr., S. A. Leicht, E. S. Mosher and N. M. Tabak. 2003. IPANE: Invasive Plant Atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA (<https://www.eddmaps.org/ipane/>)
- Pannill, Philip D. 2000. Tree of Heaven Control. Maryland Department of Natural Resources – Forest Service. Hagerstown, MD.
- Sanford, G. R. The Ecology of Common Woody Plants of Cape Cod. 2013.
- Shonbrun, S. B., Ed. 1998. Invasives: Conservation Notes of the New England Wild Flower Society. New England Wild Flower, Vol. 2:3.
- Somers, P. 2008. A Guide to Invasive Plants in Massachusetts. Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife. 2nd Edition.
- State of Vermont Department of Forests, Parks, and Recreation (various outside contributors). Best Management Practices for the Prevention and Treatment of Terrestrial Invasive Plants in Vermont Woodlands – Field Guide for Land Managers, Forestry Professionals and Landowners. 2011
- Tubbs, Carl H.; DeGraaf, Richard M.; Yamasaki, Mariko; Healy, William M. 1987. Guide to wildlife tree management in New England northern hardwoods. Gen. Tech. Rep. NE-118. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 30 p.
- Tu, M., Hurd, C. and J.M. Randall. 2001. Weed Control Methods Handbook, The Nature Conservancy, <http://tncweeds.ucdavis.edu>, version April 2001.
- USDA Growing Seasons, as cited in Appendix A in: Jackson, S. D., L. Rhodes, D. Hilgeman, T. Maguire, and M. McHugh. 2022. Massachusetts Inland Wetland Replacement Guidelines, Second Edition, Massachusetts Department of Environmental Protection, Bureau of Water Resources, Wetlands Program, 33 pp.
- Wisconsin Department of Natural Resources. Multiflora rose (*Rosa multiflora*). Madison, Wisconsin, 2004.

Various Website Sources

- The Global Invasive Species Initiative. The Nature Conservancy (<https://www.invasive.org/gist/>).
- Native Plant Trust (formerly New England Wildflower Society) (<https://www.nativeplanttrust.org/>).
- Invasive.org: *The Source for Information and Images of Invasive & Exotic Species*. A joint project of The University of Georgia's Bugwood Network, USDA Forest Service and USDA APHIS PPQ (<http://www.invasive.org>).
- <https://www.invasivespeciesinfo.gov/profile/multiflora-rose>

INVASIVE SPECIES MANAGEMENT PLAN

https://www.maine.gov/dacf/mnap/features/invasive_plants/acerplat.htm

<https://www.invasive.org/alien/pubs/midatlantic/control-trees.htm>

<https://www.invasive.org/alien/pubs/midatlantic/lomo.htm>

<https://www.massnrc.org/mipag/linvasive.htm>

<https://cisma-suasco.org/>

<https://thetrustees.org/wp-content/uploads/2020/07/Invasive-Plant-Management-GUIDELINES-AND-BEST-PRACTICES.pdf>

<https://www.mass.gov/massachusetts-prohibited-plant-list>

<https://vtinvasives.org/invasive/burning-bush-or-winged-euonymus>

https://wiki.bugwood.org/Archive:TNC/Euonymus_alatus

<https://www.dcr.virginia.gov/natural-heritage/invspfactsheets>



SECTION II – TABLE 1

TABLE 1 – TARGET INVASIVE SPECIES

SPECIES	MIPAG STATUS	DESCRIPTION	HABITAT and ECOLOGICAL THREATS	MANAGEMENT ACTIONS/OPTIONS
Glossy Buckthorn <i>(Frangula alnus</i> & European Buckthorn <i>(Rhamnus cathartica)</i>	Non-native Invasive (FAC) Non-native Invasive (FAC)	Deciduous, upright shrubs in the Buckthorn Family (Rhamnaceae) with Eurasian and North African origins. Heights may reach up to six meters. The shrubs' gray-brown bark is smooth with visibly speckled lenticels. Leaves are alternately arranged (Glossy) and Sub-opposite (European) and vary in shape from obovate to oblong to elliptical. They are dark green (yellow in fall) and shiny with nearly parallel (Glossy) or curved (European) veins and <u>entire (Glossy) or toothed (European) margins</u>. Yellowish-green flowers appear May to September in umbels each containing one to eight flowers. Small round juicy fruits with two to three stones change from red to black as they ripen from July to October.	Grows in full sun to full shade and is highly moisture tolerant (Glossy) or prefers upland environments (European), growing in a range of soil types. Habitats include fens, swamps, along bog edges (Glossy), and in upland habitats such as woodlands, thickets, and old fields (European). Inhabits typically wetter, less shaded areas with acidic soils (Glossy) or drier woodlands, open fields, and forest edges (European). A huge threat to native wetland and upland plant communities where it can form dense shrub layers causing suppressed growth of other wetland/upland native plant assemblages. Interferes with natural processes of succession and regeneration of native species. Fruit production is abundant, and seeds are dispersed by birds and small mammals. Re-sprouts vigorously following top removal. Shrubs cut near the base can send up sprouts nearly 6 feet high in same year.	Cutting back larger plants twice in a single growing season for two to three consecutive years results in fewer and shorter stems and reduced plant vigor. This is best done twice a season (in June and in August). Plants with stem bases less than two inches in diameter can be successfully girdled (a one inch-wide cut) during the winter months. Girdling does not disrupt soils and would not disrupt sensitive wetlands/uplands. Individual seedlings can be hand pulled or removed with a grubbing tool; however, this technique is only effective in areas of low buckthorn density. Using glyphosate without a surfactant has been reported to have the greatest control with little or no harm to non-target vegetation. Herbicide application of glyphosate has been effective on cut stumps or along girdled stems.

TABLE 1 – TARGET INVASIVE SPECIES

SPECIES	MIPAG STATUS	DESCRIPTION	HABITAT and ECOLOGICAL THREATS	MANAGEMENT ACTIONS/OPTIONS
Tatarian Honeysuckle <i>(Lonicera tatarica)</i> & Morrow's Honeysuckle <i>(L. morrowii)</i>	Non-native, Likely Invasive (FACU) Non-native Invasive (FACU)	Morrow's honeysuckle and the closely related Tatarian honeysuckle (i.e., "exotic bush honeysuckles") are deciduous, oppositely branched, hollow stemmed shrubs in the Family Caprifoliaceae. The plants are multi-stemmed, upright, deciduous shrubs that grow to 7 ft. tall. The pith of mature stems is hollow and white or tan in contrast to solid white pith of native shrub honeysuckle species. They produce yellow, white, and sometimes pink flowers, as well as round, red and orange berries.	Adapted to a wide variety of habitats, although disturbance of some kind usually precedes invasion. They prefer areas with full to partial sun, like forest openings and edges, roadsides, abandoned agricultural fields, and other disturbed habitats where sunlight is penetrating the canopy, such as after a timber harvest. Found in thickets, woods, and edges of woods. Morrow's and Tatarian honeysuckle cross to produce the invasive hybrid Belle's honeysuckle (<i>L. x bella</i>) Fruit production is abundant, and reproduction is almost entirely by seeds, typically dispersed by birds. These honeysuckles are among the earliest deciduous plant to leaf-out, with leaf break generally beginning two weeks earlier than for co-occurring trees. They form dense thickets and outcompete and displace native shrubs, trees and herbaceous plants, reduced richness and cover of native herb communities and reduce tree regeneration in early to mid-successional forests. While the fruits provide some nutrition for birds and mice in winter, their carbohydrate-rich quality is no match for the lipid-rich fruits of many native species that sustain migrating birds.	Both mechanical and chemical methods, as well as prescribed burning, have been used to control exotic bush honeysuckles. There are no known biological controls of <i>Lonicera</i> spp. Mechanical controls include grubbing or pulling seedlings and mature shrubs, and repeated clipping of shrubs. Effective mechanical management requires a commitment to cut or pull plants at least once a year and may require multiple years. Winter clipping should be avoided as it encourages vigorous re-sprouting. To be effective, mowing must be followed with an herbicide application to either cut-stumps or the regrowth. Most managers report that treatment with herbicides may be necessary for large bush honeysuckle populations. Formulations of both glyphosate and Triclopyr have been used as cut stump sprays and paints with varying degrees of success.

TABLE 1 – TARGET INVASIVE SPECIES

SPECIES	MIPAG STATUS	DESCRIPTION	HABITAT and ECOLOGICAL THREATS	MANAGEMENT ACTIONS/OPTIONS
Japanese Barberry (<i>Berberis thunbergii</i>)	Non-native Invasive (FACU)	A small to medium, dense deciduous shrub in the Family Berberidaceae. The thin, grooved branches have thin, straight spines. Newer twigs and stems turn reddish in the winter and become gray as they age. The inner bark is bright yellow on the branches and roots. European barberry (<i>Berberis vulgaris</i>), another invasive species, resembles Japanese barberry closely with the major exception being Japanese barberry has single spines whereas European barberry produces three-pronged spines	Was often planted as hedges for landscaping but has spread to native habitats. It commonly grows in woodlands, trails, roadsides, fencerows, pastures, bottomlands, and highly disturbed areas. Japanese barberry spreads by both seed and vegetative means through rhizomes so it is necessary to remove all connecting roots when digging the plant. Individual plants can spread horizontally by layering, in which roots form when branches contact the ground. The plant is capable of changing soil characteristics to outcompete native plants. Given enough individuals in an area, their leaf litter shifts the pH of the soil, making it more basic, thus further excluding many native plant species. It has early spring leaf emergence that allows it to shade out any nearby competitors. Highly adaptive, it can grow in sites from full sun to deep shade. It is very shade-tolerant and can form dense stands which shade out and displace native species. It can colonize most sites, displacing a wide range of native species, especially herbaceous spring ephemerals.	Both mechanical and chemical methods, as well as targeted burning, have been used to control Japanese Barberry. Mechanical controls include grubbing or pulling seedlings and mature shrubs, and repeated clipping of shrubs. Re-sprouting can occur if the entire root system is not removed. Manual removals are best suited to areas with only small barberry populations or areas of special ecological sensitivity. Mechanical mowing or top removal alone will not successfully control the plants since they vigorously re-sprout. However, mowing can serve as a step prior to herbicide applications to reduce plant size, allowing more efficient applications of herbicide in smaller quantities and with better coverage. Stem treatments are effective and can be implemented throughout the year. Treatment options include basal bark and cut stem treatments. Basal bark treatments use a concentrated mixture of the herbicide Triclopyr in oil applied to the entire circumference of the lower 12–18 inches of the stem. If top growth removal is preferred, cut the stems close to the soil line and treat the cut surfaces. Oil-based Triclopyr products can be applied any time after cutting, while water-based glyphosate treatments must be applied immediately after the stems are cut.

TABLE 1 – TARGET INVASIVE SPECIES

SPECIES	MIPAG STATUS	DESCRIPTION	HABITAT and ECOLOGICAL THREATS	MANAGEMENT ACTIONS/OPTIONS
Japanese Knotweed <i>Reynoutria japonica</i> (formerly <i>Fallopia japonica</i> or <i>Polygonum cuspidatum</i>)	Non-native Invasive (FACU)	An upright, herbaceous, shrub-like perennial in the Smartweed Family (Polygonaceae) native to eastern Asia. Stems erect, stout, with hollow internodes. Joints swollen. The alternate leaves are broad and oval, triangular, or heart-shaped with a pointed tip and may become six inches long and three to four inches wide. It has greenish white flowers and can spread by seed as well as growth by rhizome, runners, and stems (vegetative growth). Damaged stem segments are able to re-grow if the buds at the nodes are viable. Flowers in August and September, with seeds emerging two weeks following flowering.	May be found in fields, roadsides, waste areas, forest edges, and river shores and banks. Dense thickets threaten native plant communities in wetlands and riparian areas. Has ability to survive severe flooding and readily colonizes island habitats and shorelines. Once a population of knotweed becomes established, it spreads primarily by growth along its large rhizomes, which can grow to a length of 20 meters, but also spreads by seed. Requires high amounts of sunlight and normally does not establish within forest understories. Highly persistent and difficult to eradicate.	Manual and mechanical management techniques are most appropriate for smaller stands of knotweed and young plants. These techniques are also more feasible in environmentally sensitive areas where limitations on herbicide application exist. Pulling and digging (by hand or by machine) with extreme care to remove entire plant, roots, rhizomes, runners included. Repeated cutting and covering over multiple growing seasons also effective. Chemical control methods most effective. Laborious cut-stem and stem-injection applications can be effective. Foliar spray options best for large populations. Glyphosate and Triclopyr solutions commonly used in foliar spray applications. Glyphosate applied in spring or early summer may stunt or yellow growth, but knotweed will generally recover and continue growing. Glyphosate treatments in late summer or early fall are much more effective in preventing regrowth of knotweed the following year. Triclopyr will kill the top growth within a few days, but knotweed may re-sprout after treatment. The recommended method for control of Japanese knotweed includes a combination of manual and mechanical means via pulling, digging and cutting, along with chemical controls consisting of either the cut stem herbicide application or foliar spray. Of note, a monotypic stand of this species may require several years of repeated chemical treatment before the Japanese knotweed population is effectively controlled. Quickly establishing native plant vegetation in place of eradicated knotweed will help prevent the reestablishment of this invasive species.

TABLE 1 – TARGET INVASIVE SPECIES

SPECIES	MIPAG STATUS	DESCRIPTION	HABITAT and ECOLOGICAL THREATS	MANAGEMENT ACTIONS/OPTIONS
Oriental or Asiatic Bittersweet (<i>Celastrus orbiculatus</i>)	Non-native Invasive (UPL)	A climbing, deciduous woody vine of the Staff-tree Family (Celastraceae) native to Asia that can sometimes be a low trailing shrub spreading by orange-colored roots. Stems are brown with warty lenticels when young, but gray-barked on older stems, which can reach diameter of six inches. Leaves are alternately arranged, short-petioled, roundish to obovate, with bluntly serrated margins and abruptly pointed tips. Axillary clusters of two to three greenish flowers bloom from May through June. Globular, yellow-orange capsules with three red fleshy arils inside are produced from July to October.	Occurring mainly in uplands, it invades forest edges, woodlands, hedgerows, early successional fields, coastal areas and salt marsh rims. Grows in full sun to partial shade. Thrives in disturbed areas. Has a high reproductive rate, long-range dispersal, ability to spread by root suckering, and rapid growth rates. Berries spread by birds and humans. Climbs over, smothers, shades, and girdles native vegetation, which may die from excessive shading and/or breakage (from weight of vines). This invasive threatens our rare, native American bittersweet (<i>C. scandens</i>) through competition/displacement and hybridization. Reduces native plant biodiversity and wildlife habitat value.	Mechanical and manual control by cutting and pulling is most practical in small plots, or in areas where chemical control is not an option. Ultimately, these methods are a means of restricting growth until the roots and seeds are no longer viable. Chemical control methods are preferred and are more effective than manual techniques. While both glyphosate and Triclopyr have been used to control the species, most of the literature cites more effective control with Triclopyr. Triclopyr specifically targets broadleaf plants, reducing the chances of impacting nearby monocots. Triclopyr may be applied using several techniques, including cut-stump, and basal bark. Treatment can be by hand-cutting stems in late summer/early fall and immediately wiping the cut stem with an ultra-low volume treatment of Triclopyr-based herbicide.



SECTION III – FACT SHEETS



INVASIVE PLANTS OF OHIO

Fact Sheet 2

Common & Glossy Buckthorns

Rhamnus cathartica, *Frangula alnus*

GLOSSY BUCKTHORN



DESCRIPTION:

Glossy and common buckthorns are woody shrubs or small trees that can attain a height of 20 feet. The cut stems reveal a distinctive yellow sapwood and pink to orange heartwood.

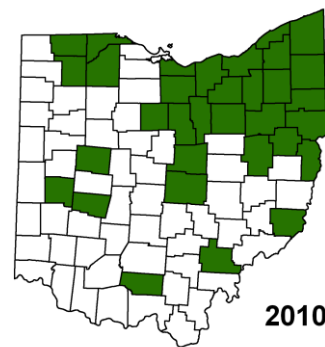
Glossy buckthorn has gray-brown bark and lightly-colored lenticels giving the bark a speckled appearance. Leaves are 1-3 inches long, shiny dark green above, oval-shaped and slightly wavy. The creamy-green flowers are 5-

petaled. Plants flower from May to June. The purple-black fruits ripen from July to September. The fernleaf buckthorn variety 'Asplenifolia' has been discovered in bogs and other peatlands in northeastern Ohio. Another form, tallhedge buckthorn 'Columnarus,' is a rare, local escape.

Common buckthorn has slender, glabrous stems often tipped with a spine. Leaves are 1 to 2½ inches long, oval, rounded or pointed at the tip 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. This dioecious shrub has small, 4-petaled yellowish-green flowers. Its dark purple-black fruits ripen July to September.

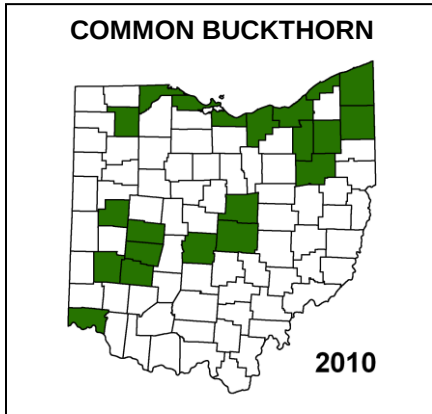
These buckthorns were introduced to North America from Eurasia as ornamental shrubs for fence rows and wildlife habitat. Introduction of buckthorn was based on its hardiness and ability to thrive in a variety of soil and light conditions. Both species are well-established in central and northern Ohio. These species may be confused with Ohio's native buckthorns, alder-leaved (*Rhamnus alnifolia*), lance-leaved (*R. lanceolata*), and Carolina buckthorns (*R. caroliniana*), which are uncommon or rare in the state.

GLOSSY BUCKTHORN



HABITAT:

Glossy buckthorn invades wetlands, which includes swamps, bogs, fens and wet meadows. It also occurs in upland habitats such as open woods, woodland edges, old fields and roadsides. Common buckthorn is primarily an invader of uplands, such as open woods, woodland edges, prairies, and open fields. It also invades flat woods, fens, and other moist to wet habitats, but less frequently than glossy buckthorn.



INVASIVE CHARACTERISTICS:

Glossy and common buckthorns tend to form dense, even-aged thickets (of seedlings, saplings, or sprouts), crowding and shading out native shrubs and herbs, often completely displacing them.

CONTROL:

Mechanical: Hand-pulling can be effective for small populations. The entire plant, including the roots, should be removed or re-sprouting may occur. For thickets of seedlings or small saplings, repeated mowing or bush-hogging may be effective, but

vigorous re-sprouting will occur. Cutting or mowing invigorates both buckthorn species to resprout, often creating a larger problem, particularly in wetlands, so mechanical methods are generally ineffective. Prescribed burning may be used, but fire only top-kills the stems and must be repeated on a 3-5 year frequency to reduce sprouting. Most glossy buckthorn sites are often too wet to accomplish effective burning.

Chemical: Selective herbicide application is the most effective control method for woody, invasive plants. Herbicide can be applied to foliage during the growing season, cut stems (at the time of cutting), or the bark of the lower portions of the stems/trunks. Cut stem and basal bark application can be done in the dormant season, but is most effective when temperatures are above freezing. Herbicides for foliar application include Roundup, AquaNeat, Garlon 3A with Escort, Krenite with Escort, Razor, Accord, and Arsenal. Herbicides for cut stem or basal bark include Garlon 4, Stalker, Pathfinder II, and Pathway (RTU). Residual herbicides such as Escort may be necessary to control re-sprouting, but care should be taken if non-target plants are in the vicinity. Only some of these herbicides are approved for wetland habitats. Many herbicides require a penetrating or sticking agent such as Penevator Basal Oil or Nu-Film-P.



Biological: Biological controls are not available for either buckthorn species at this time.

Credits and additional information:

Plant Conservation Alliance-Alien Plant Working Group
Ohio Department of Natural Resources, www.ohiodnr.gov
The Nature Conservancy, Ohio Chapter
OIPC website, www.oipc.info

Note: Maps of species' ranges are based on records as of 2010.

Invasive Alien Plant Species of Virginia

Bush Honeysuckles: Belle's honeysuckle (*Lonicera x bella* Zabel), Fragrant honeysuckle (*L. fragrantissima* Lindley & Pax), Amur honeysuckle (*L. mackii* (Rupr.) Maxim), Morrow's honeysuckle (*L. morrowi* A. Gray), Tatarian honeysuckle (*L. tatarica* L.), European fly honeysuckle (*L. xylosteum* L.)

Description

Bush honeysuckles are upright, generally deciduous shrubs that range from 6 to 16 feet in height. The opposite, simple leaves are usually oval to oblong in shape and range in length from 1 to 2.5 inches. Flowering occurs from May to June (February to April for fragrant honeysuckle) with the fragrant, tubular flowers borne in pairs. Flower color ranges from creamy-white in most species to pink or crimson in varieties of Tatarian honeysuckle. Whitish flowers become yellow with age. The fruit is a many-seeded, red to orange berry. Exotic bush honeysuckles can be confused with our Virginia native fly honeysuckle (*Lonicera canadensis*), but this seldom-seen species is restricted to high elevation mountainous terrain. Consult an appropriate guidebook or a natural resource expert for proper identification.

Habitat

In Virginia bush honeysuckles occur most often along roadsides and in forest edges, pastures and abandoned fields. Grazed and disturbed woodlots may also be invaded by some bush honeysuckle species. Although bush honeysuckles are most common in upland habitats, Morrow's honeysuckle is known to invade fens, bogs and lakeshores in portions of the northeastern United States.

Distribution

The invasive bush honeysuckles in Virginia are natives of Europe, eastern Asia or Japan. Most species have been cultivated as ornamentals in the eastern United States since the mid-1800s. Also, some varieties

were developed and planted widely for wildlife food source. At present, bush honeysuckles are distributed locally in Virginia, particularly in northern and central regions, although their ranges appear to be expanding.

Threats

Bush honeysuckles can rapidly invade and overtake a site, forming a dense shrub layer that interferes with the life cycles of many native woody and herbaceous plants. Exotic bush honeysuckles can alter habitats they invade by decreasing light availability and depleting soil moisture and nutrients. Some species may also release chemicals into the soil that inhibit the growth of other plant species. The fruit of bush honeysuckles is fed upon by many kinds of



Morrow's honeysuckle (*L. morrowi*)

For more information, contact the Department of Conservation and Recreation or the Virginia Native Plant Society.



Department of Conservation & Recreation

CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

1500 E. Main Street, Suite 312, Richmond, VA 23219
(804) 786-7951



Virginia Native Plant Society
P.O. Box 844, Annandale, VA 22030

Invasive Alien Plant Species of Virginia

Bush Honeysuckles

birds. The birds then spread the seed throughout the landscape.

Control

Light infestations may be cleared by hand with a shovel or grubbing hoe provided the entire root is removed. Severe infestations may be controlled by repeated treatments of cutting, burning or applying herbicide.

Brush cutting plants should be done during the growing season. Generally two cuts per year are recommended, one in early spring followed by one in the late summer or early autumn. Cuts made in the winter while the plant is dormant will only encourage vigorous resprouting.

The application of an herbicide is also an effective control method. Glyphosate herbicides are recom-

mended because they are biodegradable. They will begin to break down into harmless components on contact with the soil. A glyphosate herbicide may be applied to the leaves or freshly cut stumps late in the growing season. Timing is important to insure effectiveness. Application near the end of the growing season when the plant is transporting nutrients to its roots will result in the highest rate of kill.

In some areas, prescribed burning may be used to control bush honeysuckles. Burns conducted during the growing season will top-kill shrubs and inhibit new shoot production. These burns will favor warm-season grasses and perennial forbs increasing species diversity and productivity.

Treatment of any severely infested areas usually requires man-

agement for a period of three to five years to inhibit growth of new shoots and eradicate target plants. Consult a natural resource specialist or an agricultural extension agent for more information on these control methods.

*Written by Dr. Charles E. Williams,
Department of Biology, Clarion
University*

References

Field, R. J. and W. A. Mitchell. 1988. Bush honeysuckles (*Lonicera* spp.). Section 7.5.5. U.S. Army Corps of Engineers Wildlife Resources Management Manual. Technical Report EL-88-4.

Harvill, A. M., Jr., et al. 1992. Atlas of the Virginia Flora, 2nd ed. Virginia Botanical Associates, Farmville, Va.

For more information, contact the Department of Conservation and Recreation or the Virginia Native Plant Society.



Department of Conservation & Recreation

CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

1500 E. Main Street, Suite 312, Richmond, VA 23219
(804) 786-7951



Virginia Native Plant Society
P.O. Box 844, Annandale, VA 22030

Invasive Alien Plant Species of Virginia

Japanese Knotweed (*Polygonum cuspidatum*)

Description

Japanese knotweed is a herbaceous perennial in the buckwheat family. It can grow three to nine and a half feet in height. It is sometimes called Mexican bamboo because of its stout, round, hollow stems and formations of dense clumps. It forms rhizomes which can reach forty-five to sixty feet in length. The leaves are two to six inches long and two to five inches wide, flattened at the base, and taper to a point at the end. The greenish-white flowers occur in clusters along the stem. Flowers bloom from August to September. The three-sided seeds are shiny black-brown. Its primary mean of reproduction appears to be vegetative. Rhizome fragments readily give rise to new plants. Japanese knotweed closely resembles giant knotweed, another member of the buckwheat family. Giant knotweed is taller and has larger leaves with a rounded leaf base. Consult a field guide or natural resource specialist for accurate identification.

Habitat

Japanese knotweed is found in moist open habitats. It has been reported from riverbanks and islands, wetlands, along roadways, hillsides, and disturbed areas in a variety of soil types. It does poorly in a forested understory.

Distribution

Native to Asia, Japanese knotweed came to the United States as an ornamental via England about a century ago. It has since spread in the wild and is now found from Nova Scotia to North Carolina. Japanese knotweed is widely scattered in Virginia.

Threats

Japanese knotweed emerges in early spring and grows rapidly to heights of six to nine feet. It forms dense, nearly pure stands which crowd out native plants. It reproduces almost solely from rhizomes. The rhizomes can regenerate from very small fragments. Fragments are transported to new sites by water and by humans moving soil as fill dirt. The deep roots enable it to outcompete other plants for water and nutrients. Once established, Japanese knotweed is very difficult to eradicate.

Control

Although not yet a serious pest in Virginia natural habitats, the presence of Japanese knotweed is of great concern. Experience in other states where it is a serious pest suggests that the best control method is prevention of establishment. The plant should be eradicated as early as possible upon its appearance. Cutting the stalks as



Japanese Knotweed (*Polygonum cuspidatum*)

often as three times during the growing season will offset growth of the rhizomes. Cutting followed immediately by application of a glyphosate herbicide has been found to be most effective. This should be done in late August through September when plants are translocating material to their root system for the winter. Several years of treatments may be needed to ensure that the rhizomes have been exterminated.

Illustration from *Newcomb's Wildflower Guide*, by Lawrence Newcomb, Little, Brown and Company. Used with permission.

12/97

For more information, contact the Department of Conservation and Recreation or the Virginia Native Plant Society.


Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES
217 Governor Street, Richmond, Virginia 23219
(804) 786-7951
<http://www.state.va.us/~dcr/vaher.html>



Virginia Native Plant Society
Blandy Experimental Farm
400 Blandy Lane, Unit 2
Boyce, Virginia 22620
(540) 837-1600
<http://www.vnps.org>

Japanese Barberry (*Berberis thunbergii*)

By Victoria Wallace, Alyssa Siegel-Miles, and Klaudia Sowizral, UConn Extension

Identifying Features:

- **OVERVIEW:** Deciduous shrub. Typically 2-3 ft. tall, but can grow up to 6 ft. Slightly wider than tall. Grows in dense thickets with arching branches (Figure 1). Zone 4-8.
- **LEAVES:** Alternate, small (up to an inch long). Ovate (**egg-shaped**), **simple, and entire (smooth edges)**; **grow in clusters** (Figure 2). Leaf tip is wider than the base. Bright green in spring and summer; turning maroon, purple, or red in autumn. Cultivars include yellow, red, and purple foliage spring through fall. In native woodland understories, it is highly conspicuous, as leaves and flowers emerge much earlier in spring and foliage remains longer into fall than most native species.
- **STEMS:** Very twiggy and deeply grooved, with multiple thin woody stems branching out from one point in the ground. **A single, sharp, long spine is evident at each leaf node.** Bark turns reddish-brown in winter; with **yellow inner bark.**
- **FLOWERS:** Small, dangling yellow flowers in clusters of 2-4 at nodes in April to May, profuse along the entire length of the stem (Figure 3). Insect-pollinated.
- **ROOTS:** **Yellow**, fibrous, and shallow; with rhizomes (underground reproductive stems).
- **FRUIT:** Many hard, elliptical, **bright red drupes** produced late summer through October (Figure 4); often persist into winter after leaves have been shed.
- **REPRODUCTION/SPREAD:** Seeds dispersed by birds and small mammals; however, most seeds fall close to the parent plant. Seeds germinate in spring, with germination rates estimated to be as high as 90% (mdinvasives.org). Clonal shoots from rhizomes sprout below ground, and tips of branches can root when they touch the ground.
- **Associated with the spread of Lyme disease.** Higher densities of rodent hosts and deer ticks prefer to shelter under barberry than under native shrubs. When populations of barberry are controlled, fewer mice and ticks are present.



From top: growth habit - mature plant (photo by [Steve Manning, bugwood.org](http://bugwood.org)); close up of leaves (photo by Alyssa Siegel-Miles); flowers (photo by [Leslie J. Mehrhoff, University of Connecticut](http://University of Connecticut)); close up of fruits (photo by [Barry Rice, forestryimages.org](http://forestryimages.org)).

Habitat:

Japanese barberry is **very adaptable and can tolerate a variety of conditions**, including drought. Prefers well-drained soils in semi-shade, but also common to sunny areas. Dense populations are found in open fields and meadows, pastures, and roadsides. **Barberry frequently escapes** into woodlands, forest edges, early successional forest, forested wetlands, and stream banks, disturbing native habitats and threatening our native flora and fauna. **Resistant to deer browsing.** When deer numbers are high, native plant populations are decimated, while barberry thrives.

Control:

For best results, integrate an early-season initial treatment (e.g., mechanical or directed burning) with a mid-season follow-up treatment (e.g., directed burning or herbicide application). Plants growing in full sun produce more seeds than those in shade, so their control should be prioritized. [Japanese Barberry Control Methods](#), by Ward, Williams, and Worthley, provides greater details.

MECHANICAL CONTROL: May be sufficient to eradicate small infestations; for established stands, mechanical controls may be used in conjunction with chemical controls or directed burning. **Mechanical control efforts should be concentrated in the early spring**, while desirable native species are still dormant, **and late fall** - foliage remains later in the season than many other species.

Pulling/digging: **Roots are shallow. Removal of seedlings and small plants is efficient.** Tools (e.g., Extractigators, weed wrenches) can help facilitate removal of larger plants. **Root crowns must be removed in order to prevent resprouting.** Removal is easiest when the soil is moist. Minimize soil disturbance; tamp down soil after completion. Thick gloves and long canvas sleeves are recommended for protection from the plant's sharp spines.

Cutting/mowing: **Repeated cutting will limit barberry's spread, but resprouting will occur from the root crown.** Resprouts can be treated with herbicide or burned with a propane torch for greater efficacy.

DIRECTED BURNING: A propane torch can be used effectively. **Burn the base of stems near the ground to kill the tissues that transport nutrients and water to the rest of the plant.** For large specimens, it is recommended to remove top growth to make the base of the stems accessible and/or to allow the plants to re-sprout to deplete their root reserves before burning (e.g., plants cut in July; burned in November of the same year). For more details, visit fs.fed.us. **Where pesticide use is restricted, mechanical removal followed by burning of resprouts is likely the most effective strategy.**

CHEMICAL CONTROL: Follow label direction when using all chemical treatments.

Foliar sprays (e.g., glyphosate; triclopyr) are recommended for large infestations. Effective from one month after leaf expansion until autumn. Fall treatment, after other plants' foliage falls, helps minimize damage to desirable plants.

Cut-stem treatments: Cutting stems and then chemically painting the cut stems is effective, although very labor intensive; preferred for smaller infestations and to minimize damage to understory natives. Cut-stump treatment can be done in any season, **except in early spring, when plant sap is flowing upwards from roots to sprouts/stems.**

Barberry plants treated with any herbicide should be monitored for at least a year, as they may resprout. Refer to [Michigan Dept. of Natural Resources](#) for more details.

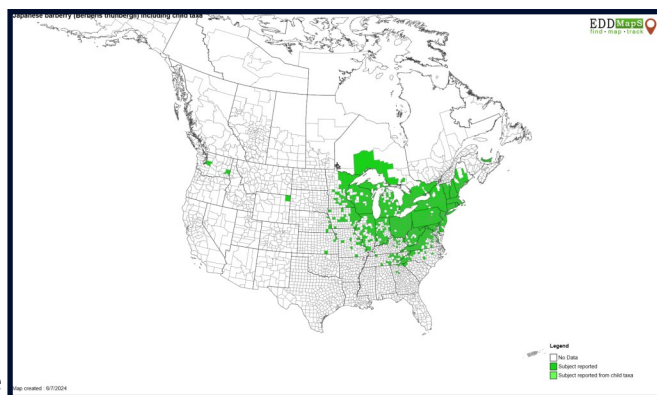
Distribution:

Japanese Barberry is found in the Northeastern U.S., as well as northern states in the Midwest. **Invasive in all New England states.** Populations extend from Maine to North Carolina, and west to Minnesota.

Background and Native Alternatives:

Japanese barberry originated from Japan and was brought to the U.S. as an ornamental in the late 1800s. Planting seed-bearing Japanese barberry is not recommended, to prevent seed production and dispersal. Seedless cultivars have recently become commercially available.

Common winterberry (*Ilex verticillata*) and highbush blueberry (*Vaccinium corymbosum*) are recommended native alternatives.



EDDMapS. 2024. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at <http://www.eddmaps.org/>; last accessed June 7, 2024.

SOURCES: BugwoodWiki. (Updated 2014, August 19). *Berberis thunbergii*/NJ. https://wiki.bugwood.org/Berberis_thunbergii/NJ#Flowers
Connecticut Invasive Plants Council. (2018, October). *Connecticut Invasive Plant List*. https://cipwg.uconn.edu/wp-content/uploads/sites/244/2023/04/CT-Invasive-Plant-List-2018_Scientific-Name.pdf.
Maine Natural Areas Program. (n.d.). *Maine Invasive Plants Bulletin #2504: Japanese Barberry*. University of Maine Cooperative Extension. <https://extension.umaine.edu/publications/wp-content/uploads/sites/52/2015/04/2504.pdf>.
Michigan Department of Natural Resources. (2012, February). *Invasive Species - Best Control Practices: Japanese Barberry*. <https://mnfi.anr.msu.edu/invasive-species/JapaneseBarberryBCP.pdf>.
National Park Service & U.S. Fish and Wildlife Service. (2010). Japanese Barberry. In *Plant Invaders of Mid-Atlantic Natural Areas*, 4th ed. <https://www.invasive.org/alien/pubs/midatlantic/beth.htm>
Varricchio, E. & Connecticut Invasive Plant Working Group. (n.d.). *Connecticut's Invasive Plant Management Calendar: The Top 10 Invasive Plants* [PowerPoint slides]. Connecticut Invasive Plant Working Group. <https://cipwg.uconn.edu/wp-content/uploads/sites/244/2018/10/Invasive-Plant-Management-Calendar.pdf>.

UConn Extension is committed to providing equal access and full participation for individuals with disabilities within all our programs and activities. Visit [s.uconn.edu/accessibility](https://uconn.edu/accessibility) for more resources. UConn is an equal opportunity program provider and employer. Updated June 2024

Funds to support the creation of this document were provided by the Crop Protection and Pest Management Extension Implementation Program [grant no. 2017-70006-27201/project accession no. 1013777] from the USDA National Institute of Food and Agriculture.



United States Department of Agriculture
National Institute of Food and Agriculture

Invasive Alien Plant Species of Virginia

Oriental Bittersweet (*Celastrus orbiculatus* Thunb.)

Description

Oriental bittersweet is a deciduous, twining vine with alternate, nearly round, glossy leaves. Small, greenish flowers occur in clusters in the axils. The leathery capsule surrounding the seed ripens to a bright orange. The native species, American bittersweet (*Celastrus scandens*), differs from the invasive by its leaves, which are somewhat longer than wide, and the terminal panicle of flowers. Consult a natural resource specialist for an accurate identification.

Habitat

This species grows in alluvial woods, roadsides, thickets and old home sites. From there it may spread to undisturbed mesic or dry-mesic forests.

Distribution

Oriental bittersweet, a native of Asia, was brought to the United States for cultivation during the middle of the nineteenth century. It is now naturalized in 21 of the 33 states where it was introduced, a region extending from Maine south to Georgia, and west to Iowa. Oriental bittersweet is found in over half the counties of Virginia.

Threats

This plant can overrun natural vegetation in much the same way as kudzu (*Pueraria lobata*), over-topping all other vegetation and forming thick, nearly pure stands. It can strangle shrubs and tree limbs, and weaken a

tree by girdling the trunk and weighting the crown, making the tree more susceptible to wind and ice damage. There is some evidence that it can hybridize with American bittersweet, thus threatening genetic integrity of the native species.

Control

Light infestations of a few small plants can be controlled by cutting the vines and handpulling the roots. Dense infestations can be treated by cutting the vines followed immediately by application of a glyphosate herbicide to the stumps. Merely cutting vines without removing or killing the roots will only stimulate vigorous re-growth. To ensure rootkill, a late-season foliar application of herbicide may be necessary. Glyphosate herbicides are recommended because they are biodegradable. However, glyphosate is a nonselective, systemic herbicide that affects all green vegetation. To be safe and effective, herbicide use requires careful knowledge of the chemicals, appropriate concentrations, and the effective method and timing of their application. Contact a natural resource specialist for more information about controlling invasive plant species.

Alternative Plants for Cultivation

Many native species of vines are available through local nurseries or mail order. American bittersweet (*Celastrus scandens*) is our native bittersweet and does not exhibit the



Oriental Bittersweet (*Celastrus orbiculatus* Thunb.)

invasive tendencies of Oriental bittersweet. Crossvine (*Bignonia capreolata*), trumpet honeysuckle (*Lonicera sempervirens*), and trumpet creeper (*Campsis radicans*) are all climbing vines which produce bright red-orange flowers attractive to hummingbirds. Virgin's bower (*Clematis virginiana*) is a climbing vine which blooms in clusters of fragrant white flowers. Virginia creeper (*Parthenocissus quinquefolia*) grows well in the shade and its cluster of dark purple berries are an important food for birds. For more information on native plants for cultivation contact the Virginia Native Plant Society (see address below).

Illustration from *New Britton & Brown Illustrated Flora of the Northeast U.S. and Adjacent Canada*, by H.H. Gleason, New York Botanical Gardens Scientific Publications. Used with permission.

5/99

For more information, contact the Department of Conservation and Recreation or the Virginia Native Plant Society.



Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES
217 Governor Street, Richmond, VA 23219
(804) 786-7951; <http://www.state.va.us/~dcr/vaher.html>

Jim Gilmore, Governor • John Paul Woodley, Jr., Secretary of Natural Resources • David G. Brickley, Director, Department of Conservation and Recreation



Virginia Native Plant Society

Blandy Experimental Farm
400 Blandy Farm Lane, Unit 2
Boyce, VA 22620
(540) 837-1600
<http://www.vnps.org>