

Best Management Practices for Control of Non-Native Invasives

March 2011

Park Planning and Stewardship Division
Natural Resources Stewardship Section



THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION
DEPARTMENT OF PARKS, MONTGOMERY COUNTY



ABSTRACT

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Best Management Practices for Control of Non-Native Invasives

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Abstract

Natural Resources Stewardship staff (NRS) has determined that many non-native invasive plants (NNIs) present a significant threat to the quality and biodiversity of the natural areas in our 34,000-acre park system. To support the park mission to steward these lands, we have prepared fact sheets for park managers and maintenance personnel with easy-to-read information about mechanical and chemical control methods for several NNIs.



**BEST MANAGEMENT PRACTICES FOR CONTROL
OF NON-NATIVE INVASIVES**

March 2011



M-NCPPC Department of Parks, Montgomery County

**Park Planning and Resource Stewardship Division,
Natural Resources Stewardship Section**

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Best Management Practices for Control of Non-Native Invasives

Introduction

Natural Resources Stewardship staff (NRS) has determined that many non-native invasive plants (NNIs) present a significant threat to the quality and biodiversity of the natural areas in our 34,000-acre park system. To support the park mission to steward these lands, we have prepared fact sheets for park managers and maintenance personnel with easy-to-read information about mechanical and chemical control methods for several NNIs.

While individual formulas differ somewhat for each of the NNIs covered in this manual, the basic management strategy remains the same for all work on M-NCPPC Park Property: **mechanical means are used first, with emphasis placed on utilizing whatever time and labor-saving equipment is available (bush-hogs, mowers, gas-powered hedge trimmers, weed-whackers). Chemical means follow mechanical means only when necessary, and emphasis is placed on using only the smallest amount of the least harmful chemicals necessary to accomplish the task.**

The prescriptions in this publication are designed for implementation in ecologically sensitive areas with minimum impact on non-target species. NRS's "Weed Warriors" volunteer program can adequately address some invasives using hand tools, but many can be controlled only through the use of power tools (see page 4) and—**only where absolutely necessary**—herbicides. Herbicide treatments outlined in this document utilize chemicals that are not soil active and are biodegradable in the environment. This information is provided to assist staff in conducting safe and effective management of non-native invasive plants. **It is recommended that staff consult with NRS on any NNI projects for which they would like to use herbicides.**

General Statement on Invasive Plants and Control Methods

The potential for habitat destruction and environmental degradation by invasive plants has become a focus of land managers in recent years. Most of the problem species in our parks are non-native plants introduced from Asia or Europe as garden plants, for livestock forage, or to control soil erosion. During the last 100 years or so, many non-natives have "escaped" cultivation and become naturalized in our parks. Lacking the insect or animal predators that kept these plants under control in their native lands, non-native invasive plants (NNIs) have become a major problem by out competing native understory plants, killing trees, impacting bird and insect populations, and altering the composition of our forest landscapes. Experience has shown that focused and aggressive implementation of mechanical or chemical control techniques, or a combination of the two, will reduce the negative impact of invasives and encourage the return of a healthy and diverse ecosystem of plants and wildlife in the county's natural areas.

To that end, the Natural Resources Stewardship staff (NRS) has implemented an NNI Management Plan that calls for concerted efforts by park staff and citizen volunteers to remove NNIs from county parkland. NRS created the “Weed Warriors” program in 1999, and has trained more than 750 volunteers who have been working in more than 40 park locations. They have done valuable work, but their efforts are not enough. Essential to our control efforts are the allocation and training of staff from the Department of Parks who are authorized to use power tools and certified to apply herbicides. **We want to proceed cautiously in implementing chemical control projects, so this publication advocates conservative approaches to the application of herbicides.**

NRS recommends the use of two types of chemicals:

- **Glyphosate** (the active ingredient in such formulations as Roundup Original and Pro, Rodeo, and Aqua Neat)
- **Triclopyr** (the active ingredient in such formulations as Garlon or Pathfinder II).

These chemicals become inactive once they contact the soil, biodegrade relatively quickly, and present minimal danger to people and wildlife when handled properly.

Because foliar applications of chemicals have the most potential for harm because of spray drift and contact with non-target plants, **NRS advocates the use of cut stem or basal bark methods for application of herbicides in most cases.** There are plants for which foliar spraying may provide the best chance for control (e. g., Japanese stilt grass).

In these situations, we ask that park staff consult NRS in advance of initiating control efforts to ensure that treatment protocols will be carefully followed.

NRS will be continually testing chemical control approaches and updating the following fact sheets on individual plants as it becomes necessary to make changes. The recommended treatment methods, chemicals, and concentrations of active ingredients are based upon our experience to date or recommendations found in publications by reliable science and conservation organizations.

Mechanical Removal Techniques

Mechanical removal techniques include the full range of vegetation control and removal activities using power tools and hand tools. Common power tools are mowers, including bush-hog type equipment; chain saws, power pruners, and power trimmers with various attachments. Hand tools (or non-power tools) include pole saws and pole pruners; a variety of handsaws; brush axes and brush hooks; machetes, bank blades and sling blades; mattocks, axes, and pulaski axes; shovels and spading forks; loppers, hand pruners, and hedge shears; and lever-based tools such as the Weed Wrench. Many of these tools are likely included in your maintenance arsenal. Outlined below are examples of how these tools are employed in the control and removal of non-native invasive plants. Reference to specific tools is also included with the detailed information on non-native invasives beginning on page 8.

Mowing/Bush-Hogging

This technique is useful as a way to control large infestations of such species as porcelainberry where it is spreading horizontally, and forming monocultures in open fields and along forest edges. Where such infestations are accessible to bush-hogs, vines with stems up to 4 inches in diameter can be cut prior to follow-up treatment with herbicides or smaller tools. Use of bush-hogs or mowers is also appropriate for bush honeysuckle, multiflora rose, Japanese honeysuckle, kudzu, Japanese stiltgrass, mile-a-minute (aka devil's tail tearthumb), or garlic mustard, where the vegetation is accessible to mowing equipment and use of the equipment would not damage desired vegetation or create unwanted disturbance. Using heavy equipment in wet areas can create ruts that can become sites for invasions of opportunistic, unwanted plants. Soil compaction in high-quality natural areas can also lead to problems by discouraging the return of native plants from seeds banked in the soil and allow non-native invasives to return instead.

Chain Saws, Power Pruners, Power Trimmers

These are power tools that are carried by hand into treatment areas. In many cases, these tools are used where staff works in teams to cut plant stems and then apply herbicide. Chain saws can make short work of a massive growth of multiflora rose where use of bush-hogs or mowers would create too much disturbance. Where a tangle of Japanese honeysuckle vines has begun to spread across the forest floor, chain saws can be used to cut stems low to the ground as another worker lifts and holds the vine mass out of the way with a rake or similar tool. Power pruners (or hedge trimmers) can cut through curtains of vertically growing porcelainberry, oriental bittersweet, or kudzu much faster than several people with hand pruners or saws. Power trimmers (sometimes known as “weed whackers” or “weed whips”) can be used to cut stands of Japanese stilt grass before it sets seed, hopefully avoiding the need for foliar spraying. English ivy can be attacked by cutting the vines covering the ground with a power trimmer, and then returning to treat re-growth with herbicide. The plant is more vulnerable at this stage.

Hand Tools

The non-power hand tools listed on the previous page should not be ignored. When soils are moist, the use of spading forks to uproot and remove infestations of wineberry is a highly effective approach. The Weed Wrench is an excellent tool for uprooting Norway maple, multiflora rose, honeysuckle, autumn olive, Japanese barberry, or wintercreeper as long as the tool's jaws can grip the plant stem. There may be cases where power tools of any kind are not appropriate for NNI control, such as situations where unwanted plants are growing in close association with threatened or endangered species. In situations like this, or in any situation where you have questions about the most appropriate or effective ways to use tools to control or remove non-native invasive plants, please contact Natural Resources.

Finally, a word about **cleaning your equipment**. Your truck tires, mower tires, boot soles, clothing, power tools, and hand tools can become what we call “vectors” for the spread of NNIs if seeds or plant parts hitch a ride away from treatment sites. Before wrapping up for the day at a work site, take some time to clean your boot soles, take off and shake out your boots and socks, check your clothing for seed or plant parts that may have adhered to them, brush or wipe off tools, remove plant parts that may still be in the cutting blades, and check tires and undercarriage

areas of wheeled equipment for obvious evidence of seeds or plant debris. Remember, the few minutes spent in the field leaving plant material on site will save hours of future control work caused by inadvertently helping an invasive get a foothold in a new place.

Application Methods for Recommended Herbicide Treatments

Cut Stem Treatments

Cut stem (or cut surface) treatments involve cutting woody stems and applying concentrated herbicides directly to the exposed stem surface. They are useful for treating vines, shrubs, and trees. Two methods are most often used – “cut stump” or “cut stem,” and “hack and squirt.” The advantages of these methods are: 1) economy, 2) minimal probability of non-target damage, 3) minimal application time, and 4) they can be used in the winter as long as the ground is not frozen or snow-covered and air temperatures will be above freezing during the middle of the day. Backpack sprayers or spray bottles are very effective for these methods.

- **Cut Stump/Cut Stem Method:** Cut plant stems horizontally at or near ground level; all cuts should be level, smooth, and free of debris. Immediately apply the herbicide to the cut surface. Delayed application may reduce the effectiveness of treatment.
- **Hack and Squirt Method:** This is sometimes called the “injection method.” Using a hatchet or similar cutting tool, make uniformly spaced cuts around the stem at chest height. The cuts should angle downward, be less than 2 inches apart, and extend into the sapwood. Apply (“inject”) herbicide to each cut to the point of overflow.

Basal Bark Treatments

Basal Bark Treatments involve the spraying or painting of woody stems with concentrated herbicides mixed with oil so that the chemical penetrates the outer bark. No cutting is required. Basal Bark Treatments are effective for controlling woody vines, shrubs, and trees. Treatments can be made any time of year, including the winter months, except when snow or water prevents spraying the very bottom basal parts of the stem. Basal Bark Treatments will have reduced effectiveness at temperatures below 40 degrees F. Proper plant identification is crucial during the dormant season due to the absence of foliage.

Apply herbicide in accordance with label instructions. To treat vegetation with a basal stem diameter of less than 3 inches, apply the specified herbicide-oil mixture completely around the stem from the root crown to a height 6 inches. Apply herbicide to the point of run-off. For larger diameter stems or those with thick bark, you may need to apply herbicide to a height of up to 18 inches.

Foliar Treatments

Foliar applications involve spraying the leaves of target species with a low concentration mixture of herbicide in accordance with label instructions. Foliar treatments should be done during the active growing season, after full leaf expansion in the spring and before fall colors are visible.

Foliar Spraying is most effective when temperatures are between 60 and 90 degrees F, the air is humid, there is a light breeze (9 mph or less), and rain is not expected for 8 to 12 hours (these factors vary with type of herbicide and type of plant – follow label instructions). Rain too soon after spraying can wash unabsorbed herbicide off of leaves and transports it into nearby streams, making retreatment necessary.

Use a nonionic surfactant such as Timberland 90 or Aqua Aid with all foliar spray herbicides that do not contain surfactant in the formulation (e.g., Rodeo or Aqua Neat), unless otherwise specified by the manufacturer's label. Surfactants increase the effectiveness of the herbicide by 1) reducing surface tension and ensuring complete foliar coverage, and 2) increasing the rate of absorption through the leaf cuticle.

Equip your backpack sprayer, hand-operated pump sprayer, or spray bottle with a flat spray tip or adjustable cone nozzle. Apply herbicide to the leaves of target plants using a consistent motion. Cover foliage thoroughly, but not to the point of run-off. All recommended herbicides require complete foliar coverage to be effective. Applications must be made while walking backward to reduce the risk of the herbicide wicking onto the applicator's clothing. Foliar treatments should *not* be done where leaves of target plants are above applicator's shoulder height.

For all chemical application methods:

- **We recommend adding an EPA-approved blue marker dye** (not food coloring) to foliar spray solutions in order to keep track of which plants have been treated.
- **Always use the lowest herbicide concentration that proves effective.**
- **Remember, the label is the law.** Always apply herbicides in accordance with specific label instructions, which include personal protective equipment and storage requirements. Park staff must also adhere to the Commission's Pesticide Application Policy.
- **If you have questions** about safety gear, first aid procedures, or herbicide use call the manufacturer at the number listed on the label for customer inquiries. For questions about which herbicides or methods to use, call Carole Bergmann (301-962-1348) or Paul Carlson (301-962-1343). For questions about Commission application policies, call Holly Thomas at (301) 650-2611.

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Detailed Information on Specific Non-Native Invasives

The following information pages represent Natural Resources Stewardship’s most up-to-date recommendations on control methods. In addition to NRS staff experience, our primary information sources include:

- National Park Service Exotic Plant Management Teams
- The Maryland Department of Natural Resources
- The Nature Conservancy’s Wildland Invasive Species Team species reports
- The Plant Conservation Alliance’s “Weeds Gone Wild” fact sheets

This information will be updated as necessary. **At the present time Natural Resources Stewardship is recommending use of triclopyr or glyphosate products ONLY** for use in Montgomery County Parks. Please contact Carole Bergmann or Paul Carlson if you have questions about mixing percentages, application methods, or application rates.

Acer platanoides (Norway maple)

TREE

Helpful Hints: This tree has escaped from cultivation and grows vigorously in natural areas. The five-lobed leaves are typical of most maples, but can be quite large, and the leaf petiole (stem) will **exude a milky white sap when broken**.

Mechanical: Seedlings may be pulled. Likely re-growth from sprouts should be chemically treated.

Chemical: *Herbicide treatments give best results with this invasive.* Always be prepared to spray new stump sprouts or root suckers that emerge after the top of the tree is killed.

Cut Surface (“Hack and Squirt”)

- Can be effective for larger trees if basal bark treatment doesn’t work. Use a triclopyr salt (e.g., Garlon 3A), either full-strength or diluted 1:1 in water, mixed with blue marker dye. Use care, as the Garlon 3A signal word is DANGER.
- Make cuts with a sharp hatchet, either overlapping them (frill cuts) or in a continuous girdle. Immediately apply herbicide with a spray bottle using a fine stream.
- *Avoid cut surface treatment on Norway maple during late winter/early spring due to sap flushing.*

Basal Bark Treatment

- Excellent method for all sizes, especially smaller trees.
- Use triclopyr ester @ 20% (e.g., Garlon 4 in oil—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use this method *only on re-growth* below applicator’s shoulder height.

- Use triclopyr salt @ 2% (e.g., Garlon 3A). *Always use the lowest concentration that proves effective.*
- Add approved blue marker dye.

Ailanthus altissima (Tree-of-heaven)

TREE

Helpful Hints: A fast-growing tree that forms dense stands. Similar in appearance to sumacs or black walnuts, the **leaflets have smooth edges with a tooth near the base**. When crushed they emit the odor of rancid peanut butter.

Mechanical: *Hand pulling or cutting of small trees is NOT RECOMMENDED due to vigorous re-sprouting.*

Chemical: Herbicide treatments are the most effective approach with this invasive. Always be prepared to spray new stump sprouts or root suckers that emerge after the top of the tree is killed.

Cut Surface (“Hack and Squirt”)

- Can be effective for larger trees if basal bark treatment doesn’t work. Use a triclopyr salt (e.g., Garlon 3A), either full-strength or diluted 1:1 in water, mixed with blue marker dye. Use care, as the Garlon 3A signal word is DANGER.
- Make cuts with a sharp hatchet, **spacing them** 1 to 2 inches apart. Immediately apply herbicide with a spray bottle using a fine stream. Do not cut a continuous girdle with this tree.

Basal Bark Treatment

- Excellent method for all sizes, especially smaller trees.
- Use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.

Foliar Spray

(Review **introductory sections; contact NRS before initiating any foliar spray project**)

- Use this method *only on re-growth* below applicator’s shoulder height.
- Use triclopyr salt @ 2% (e.g., Garlon 3A). *Always use the lowest concentration that proves effective.*
- Add approved blue marker dye.

Pyrus calleryana “Bradford” (Bradford pear)

TREE

Helpful Hints: This commonly-used landscaping tree is now naturalizing vigorously in parks and threatens to seriously alter habitat. The foul-smelling white flowers explode into bloom in early April (same time as early cherries).

Mechanical: Seedlings may be pulled. Likely re-growth from sprouts should be chemically treated.

Chemical: *Herbicide treatment protocols have not been firmly established with this invasive, however current methods include:*

Cut Stem Treatment

- Cut down trees and treat stumps with a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) at a 25% to 50% solution (32 to 64 ounces of herbicide per one-gallon mix).
- A subsequent foliar application may be required to control new seedlings and resprouts.

Basal Bark Treatment

- Use a triclopyr product such as **Pathfinder II**, which is Garlon 4 pre-mixed in oil and ready to use.
- *NRS has had success using this method in late winter/early spring.* Spray to wet completely around the tree from the root collar to a height of 6 – 18 inches depending upon size of tree.
- Target tree may die, but be prepared to make a subsequent foliar application on new seedlings and resprouts.

Cut Surface Treatment (“Hack and Squirt”)

- *This may be an effective method for larger trees and should be tested.*
- Use a water-based triclopyr product (e.g., Garlon 3A) at full strength, mixed with blue marker dye. Use care, as the Garlon 3A signal word is DANGER.
- Make cuts around the tree at chest level with a sharp hatchet, spacing them 1 ½ inches apart. Immediately apply herbicide in each wound with a spray bottle.
- Use this method from June through September.
- Target tree may die, but be prepared to make a subsequent foliar application on new seedlings and resprouts.

Foliar Spray

- For seedlings, resprouts, and small trees (less than 5 feet tall), a foliar spray should be effective.
- Thoroughly wet all leaves with a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) @ 2%.
- For Garlon 3A, or similar product, also add ½% non-ionic surfactant.

Akebia quinata (Fiveleaf akebia)

VINE

Helpful Hints: A non-native woody perennial vine, also known as chocolate vine. It grows as a climbing, twining vine or as a groundcover. It has slender stems that are green when young and brown at maturity. Leaves are alternate on the stem, dull blue-green, and divided into **five stalked leaflets that meet at a central point**. Flowers are small, reddish to purple-brown, occur in March or April, and have a sweet chocolate-like fragrance.

Mechanical: Bush-hog or mow vines in open, accessible areas. Power hedge trimmers, weed whips, handsaws, loppers, and hand pruners can also be used.

- *Climbing vines on trees can be cut to kill the upper portions of the vine by “cutting a window.”*
- *Cut the vine at ground level and as high as you can reach.* Portions of vines that stay rooted will remain alive and must later be treated with herbicide, pulled out, or cut repeatedly until no re-growth occurs.
- ***If time or resources are limited, cut the plant back to the ground once each year at the end of summer.***

Chemical: Both triclopyr and glyphosate products are effective.

Cut Stem Treatment

- Use triclopyr salt (e.g. Garlon 3A) @ 25% or glyphosate (e.g., Roundup products) @ 25% solution.
- Cut stem as low to the ground as possible and immediately apply herbicide.
- This approach is effective in temperatures as low as 40 degrees F.

Basal Bark Treatment

- Using hand or power tools, remove a band of foliage from ground level to a comfortable height in order to expose stems.
- Use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier - follow label instructions).
- Ready-to-use triclopyr products such as **Pathfinder II** may also be effective.
- This treatment can be done year round as long as temperatures stay above 50 degrees for several days.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- DO NOT USE this method for foliage on climbing vines unless they are below applicator’s shoulder height.
- Effective for the low-growing form of this plant or to low-climbing foliage in **summer or fall**.
- The recommended treatment is application of a triclopyr ester (e.g., Garlon 4) mixed with **water** at a 2% to 5% solution, and a 0.5% to 1.0% non-ionic surfactant. ***Always use the lowest concentration that proves effective.***
- Add approved blue marker dye.

Ampelopsis brevipedunculata (Porcelainberry)

VINE

Helpful Hints: A non-native grape vine that kills trees by producing heavy, smothering masses of stems and leaves. Unlike native grape vines, which should not be removed, this plant **produces multicolored fruits (in late summer-early fall)** that stand upright in flat clusters. Native grape vine fruits hang down in long clusters.

Mechanical: Bush-hog or mow vines in open, accessible areas. Power hedge trimmers, power saws, handsaws, loppers, and hand pruners can also be used.

- Climbing vines on trees can be cut to kill the upper portions of the vine by “cutting a window.”

- *Cut the vine at ground level and as high as you can reach.* Portions of vines that stay rooted will remain alive and must later be treated with herbicide, pulled out, or cut repeatedly until no re-growth occurs.

Chemical: *Triclopyr products such as Garlon are most effective with this plant.*

Cut Stem Treatment

- Use triclopyr salt @ 25% (e.g., Garlon 3A in water) OR triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.
- Take care if using triclopyr in oil near water.

Basal Bark Treatment

- Use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.
- *Application can be made in winter as long as stems are not wet or snow-covered and temperatures will be above freezing during the middle of the day.*

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- DO NOT USE this method for foliage on climbing vines unless they are below applicator's shoulder height.
- Effective for the recumbent (i.e., low-growing) form of this plant.
- Use triclopyr salt @ 2% (e.g., Garlon 3A in water) with a non-ionic surfactant at 0.5%. *Always use the lowest concentration that proves effective.*
- Add approved blue marker dye.

Celastrus orbiculatus (Asiatic or Oriental bittersweet)

VINE

Helpful Hints: A climbing, **twisting vine that kills trees by girdling.** Can grow to be several inches in diameter. The leaves are glossy green and egg-shaped, with pointed tips. The small, berry-like fruits appear in early fall—first appearing yellow and then breaking open to reveal red-orange seed cases.

Mechanical: Bush-hog or mow vines in open, accessible areas. Power hedge trimmers, power saws, handsaws, loppers, and hand pruners can also be used.

- *Climbing vines on trees can be cut to kill the upper portions of the vine by “cutting a window.”*
- *Cut the vine at ground level and as high as you can reach.* Portions of vines that stay rooted will remain alive and must later be treated with herbicide, pulled out, or cut repeatedly until no re-growth occurs.

Chemical: *Triclopyr products such as Garlon are most effective with this plant.*

Cut Stem Treatment

- Use triclopyr salt @ 25% (e.g., Garlon 3A in water) OR triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.
- Take care if using triclopyr in oil near water.

Basal Bark Treatment

- Use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions).
- Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.
- *Application can be made in winter as long as stems are not wet or snow-covered and temperatures will be above freezing during the middle of the day.*

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- DO NOT USE this method for foliage on climbing vines unless they are below applicator's shoulder height.
- May be used for the recumbent (i.e., low growing) form of this plant.
- Use triclopyr salt @ 2% (e.g., Garlon 3A in water) with a non-ionic surfactant at 0.5%. *Always use the lowest concentration that proves effective.*
- Add approved blue marker dye.

Euonymus fortunei (Wintercreeper)

VINE

Helpful Hints: An evergreen vine that can form a dense groundcover or shrub to 3 feet in height, or climb vertical surfaces such as tree trunks (up to 70 feet) using aerial rootlets. Climbing vines are **similar in appearance to English ivy**, but they produce horizontal branches that extend much farther from tree trunks. **Leaves are dark green, shiny, and egg-shaped with toothed margins and silvery veins.** Small flowers are produced in summer, but conspicuous fruits form in the fall. They are pinkish to red and split open to expose seeds with a fleshy orange seed coat.

Mechanical: Bush-hog or mow vines in open, accessible areas. Power hedge trimmers, power saws, handsaws, loppers, and hand pruners can also be used.

- *Kill the upper portions of climbing vines by “cutting a window.”*
- *Cut the vine at ground level and as high as you can reach.* Portions of vines that stay rooted will remain alive and must later be treated with herbicide, pulled out, or cut repeatedly until no re-growth occurs.

Chemical: Both triclopyr and glyphosate are effective.

Cut Stem Treatment

- Use triclopyr salt @ 25% (e.g. Garlon 3A in water) or glyphosate @ 25% (e.g., Roundup products). Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.

- Cut stem as low to the ground as possible and immediately apply herbicide.
- This approach is effective in temperatures as low as 40 degrees F.

Basal Bark Treatment

- On climbing stems, use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions), or a ready-to-use triclopyr product such as Pathfinder II.
- *Be aware of the possibility that the herbicide will be absorbed into the host tree unless it is applied carefully only to the plant stem.*
- If possible, carefully pull stem away from the base of the host tree before applying herbicide.

Foliar Spray

(Review **introductory sections; contact NRS before initiating any foliar spray project**)

- DO NOT USE this method for foliage on climbing vines unless they are below applicator's shoulder height.
- Effective for the recumbent (i.e., low-growing) form of this plant.
- Use triclopyr salt @ 2% (e.g., Garlon 3A in water) plus a 0.5% non-ionic surfactant in areas where desirable grasses are present (triclopyr will not kill grasses).
- Glyphosate @ 2% (e.g., Roundup products) may be used where risk of damage to non-target plants is minimal. *Always use the lowest concentration that proves effective.*
- Use approved blue marker dye.

Hedera helix (English ivy)

VINE

Helpful Hints: An **evergreen climbing vine** that attaches to tree trunks and branches with small, sticky root-like structures. It can also form dense patches on the ground and thrive in shady areas as well as in the sun. **Leaves are usually three-lobed with a heart-shaped base**, and are dark green, with a waxy—almost leathery—feel. It kills by smothering and can add tremendous extra weight to trees, making them susceptible to blow-over during storms.

Mechanical: Climbing vines on trees can be cut near the base and several inches higher up to kill the upper portions of the vine. Portions of vines that stay rooted will remain alive and must later be treated with herbicide, pulled out, or cut repeatedly until no re-growth occurs.

Chemical: Triclopyr may be applied to either foliage or cut stems.

- *Since English ivy remains active year round, herbicide treatment can be done in the winter.*
- Temperatures below 40 degrees F. will impede absorption of herbicides through plant tissues.
- Fall and winter applications will minimize herbicide impact on desirable plant species.

Cut Stem Treatment

- Use triclopyr salt @ 25% (e.g., Garlon 3A in water). Ready-to-use triclopyr products such as Pathfinder II are also effective and highly recommended.

- Accessible low-growing plants should be cut and herbicide immediately applied to cut stems with a spray bottle or backpack sprayer.
- For climbing vines, cut a section from the vine (i.e., “cut a window”) and treat the rooted portion with herbicide. The upper portion of the vine will eventually die.
- *English ivy’s persistence makes follow up treatments likely.*

Basal Bark Treatment

- On climbing stems, use triclopyr ester @ 20% (e.g., Garlon 4 in oil carrier—follow label instructions), or a ready-to-use triclopyr product such as Pathfinder II.
- *Be aware of the possibility that the herbicide will be absorbed into the host tree unless it is applied carefully only to the ivy stem.*
- If possible, carefully pull stem away from the base of the host tree before applying herbicide.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use triclopyr salt (e.g., Garlon 3A in water) @ 5% (high concentration required due to plant’s waxy leaf cuticle). Add a 0.5% non-ionic surfactant.
- This approach is most effective if low-growing plants are cut, allowed to re-grow, and the herbicide is applied to the new foliage (herbicide more easily penetrates the leaf cuticle of new growth).
- Use approved blue marker dye.

Lonicera japonica (Japanese honeysuckle)

VINE

Helpful Hints: A perennial vine—**semi-evergreen in our area—that climbs by twisting around trunks and limbs of shrubs and small trees.** In sunny edge areas, its smothering growth can climb 15-20 feet. Leaves are oblong or oval and occur in pairs along the stem. Stems and leaves often have fine, soft hairs. The tube-shaped flowers occur from April through the summer. They are white or pink and turn yellow with age. Small black fruits occur in the fall.

Mechanical: Bush-hog Japanese honeysuckle in accessible areas and treat re-sprouting foliage with herbicide. Mowing or cutting with power or hand tools, without follow up herbicide treatment, is effective only if repeated often.

Chemical: *Glyphosate (e.g., Roundup) is the most effective herbicide for this plant.*

Cut Stem Treatment

- Use glyphosate @ 25% (e. g., Roundup Pro) on cut surfaces *any time of the year.*
- Temperatures below 40 degrees F. will impede absorption of herbicides through plant tissues.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use glyphosate @ 2% (e.g., Roundup Pro, or Rodeo with a 0.5% surfactant if near water). *Always use the lowest concentration that proves effective.*

- Japanese honeysuckle may stay green long after other plants have lost their leaves. *Treatment during mild fall or winter weather* will minimize herbicide impact on desirable plant species.
- Add approved blue marker dye.

***Persicaria perfoliata* (Mile-a-minute or devil's tail tearthumb)**

VINE

Helpful Hints: A fast-growing, but weak-stemmed **annual vine that scrambles over shrubs and other vegetation**. It can also climb 15-20 feet if it has sufficient support and growing conditions. It kills native plants by blocking photosynthesis. The reddish stems and leaf blades are armed with downward-pointing barbs. **The leaves are light green and are shaped like an equal-sided triangle**. The metallic blue fruits appear in mid to late summer and persist until the plant dies and turns brown in the fall.

Mechanical: Seedlings and vines can easily be pulled as long as thick gloves and sturdy clothing are worn.

- ***Manual removal can be done throughout the summer; June through July is optimal before the fruits mature.***
- The vines can be “reeled in” and balled up in piles that can be left to dehydrate for several days before disposal. A garden rake is an ideal tool for this method.
- Treatment sites should be rechecked frequently.
- Where practical, mow or trim mile-a-minute to prevent the plants from flowering and fruiting.

Chemical:

- Use glyphosate with a surfactant, to ensure adherence to the waxy leaf coverings.
- Because mile-a-minute is an annual, chemical treatments will provide no control once the vines have produced seeds.

Foliar Applications

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use glyphosate products, such as Roundup Pro—or Rodeo or Aqua Neat in wet areas—@ 2% or less. If mile-a-minute is your only target, concentrations as low as 1% should work. ***Always use the lowest concentration that proves effective.***
- Add a surfactant at 0.5% to aquatic herbicides.
- Triclopyr products—e.g., Garlon 3A @ 1 to 2%—will also kill mile-a-minute.
- Impact on desirable plants is virtually unavoidable.
- Add approved blue marker dye.

***Pueraria montana var. lobata* (Kudzu)**

VINE

Helpful Hints: A **climbing, semi-woody vine** in the pea family, kudzu is famous for its rapid growth and solid blankets of leaves. **It kills by smothering, girdling, or by uprooting trees through sheer force of its weight**. Leaves are compound, composed of three lobed leaflets with hairy margins. Fragrant purple flowers appear in summer, borne in long

hanging clusters. Single stems may grow to 100 feet in length, and underground taproots may weigh as much as 400 pounds.

Mechanical: Where accessible, bush-hog or mow vines. Power trimmers, power saws, or **machetes** are very effective at reducing large concentrations.

- Locate root crowns and cut all stems growing from the crowns.
- Mark root crown locations for follow up herbicide treatment.
- *Repeated cutting can deplete kudzu's reserves and significantly retard growth.*

Chemical: Late season cutting should be followed immediately by treatment with glyphosate or triclopyr.

Cut Stem Treatment

- Use products such as Roundup Pro (glyphosate), or Garlon 3A (triclopyr),
- @ 25% and apply to the cross sections of cut stems.
- This method is effective at temperatures as low as 40 degrees F. as long as the ground is not frozen.
- Use where vines have climbed into trees and grown around non-target plants.

Root Crown Method

- ***A labor-intensive approach*** that involves cutting into the root crown and applying products such as Roundup Pro or Garlon 3A diluted 1:1 to the root crown and any underground runners. Use care, with Garlon 3A as the signal word is DANGER.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- For large, *non-climbing* infestations, use Roundup Pro or Garlon 3A @ 2%. Add a 0.5% non-ionic surfactant if directed by the label.
- Add approved blue marker dye.
- This approach is most effective when temperatures are above 65 degrees F (to assure maximum translocation of herbicide to plant roots).

Berberis thunbergii (Japanese barberry)

SHRUB

Helpful Hints: This plant is easily identified by its **spiny branches and red berries in the fall**. The plant's pale green leaves are evident in our woods in early spring, which can be a good time to locate it and begin manual removal efforts.

Mechanical: Control requires frequent, repeated bush hogging or mowing, or cutting with power tools or hand tools.

- Cut three times a year over a period of two to four years.
- Cutting with power or hand tools may be preferable to bush hogging or mowing in high-quality natural areas to minimize disturbance.

Chemical: Apply glyphosate or triclopyr to foliar re-growth or freshly cut stems.

Cut Stem Treatment

- Use glyphosate @ 25% (e.g., Roundup Pro) or triclopyr @ 25% (e.g., Garlon 3A in water). Ready-to-use triclopyr products such as Pathfinder II are also effective.
- ***This method is most effective if done late in the growing season or while plant is dormant.***

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Early re-growth or low-growing plants can be effectively treated with foliar spray using a 2 % solution of glyphosate (e.g., Roundup Pro) or triclopyr (e.g., Garlon 3A). ***Always use the lowest concentration that proves effective.***
- Add approved blue marker dye.

Elaeagnus umbellata (Autumn olive)

SHRUB

Helpful Hints: A small, multi-stemmed tree or large thicket-forming shrub common in open areas and along edges. The **leaves are long and narrow, pale green on top and silvery underneath.**

Mechanical: Cutting with a brush-type mower, chain saw, or similar tool is effective if done in combination with herbicide application.

Chemical: Autumn olive can be treated with either glyphosate or triclopyr.

Cut Stem Treatment

- If using a glyphosate product such as Roundup Pro, apply @ 20% on cut stumps in late summer when the plant is actively translocating nutrients to its roots.
- NRS has had success using cut-stem treatment throughout the year with the ready-to-use triclopyr product, Pathfinder II.

Basal Bark Treatment

- ***Research by The Nature Conservancy indicates that the best treatment time is during the plant's dormant stage in late winter to early spring; NRS has not tested this.***
- Use Pathfinder II, a ready-to-use triclopyr product.

Foliar Spraying

- Since autumn olives are generally 5 feet high or more, have single or clustered central stems and can be easily treated using cut stump or basal bark methods, **NRS does not recommended foliar applications.**

Euonymus alatus (Winged burning bush)

SHRUB

Helpful Hints: This commonly-used landscaping shrub has naturalized in parks. Winged burning bush is deciduous, can reach 20 ft. in height, and is distinguished by corky ridges that appear along the length of young stems. Dark green leaves are opposite, smooth, rounded and taper at the tips. The leaves turn a bright crimson to purple in the fall. Flowers are inconspicuous; fruits are reddish capsules that split to reveal orange fleshy seeds.

Mechanical: Seedlings and small shrubs may be pulled. Larger plants can be cut repeatedly to control resprouts, but are better controlled with cut-stem or foliar chemical treatment.

Chemical: Herbicides containing either triclopyr or glyphosate are effective.

Cut Stem Treatment

- Cut all stems close to soil level and apply herbicide to the entire top of all cut stems.
- Use a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) at a 25% solution (32 oz. of herbicide per one-gallon mix).
- A ready-to-use triclopyr product such as **Pathfinder II** is also effective, and highly recommended.
- A subsequent foliar application may be required to control new seedlings and resprouts.

Foliar Spray

- For seedlings and resprouts less than 6 feet tall, a foliar spray should be effective.
- Thoroughly wet all leaves with a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) @ 2%.
- For Garlon 3A, or similar product, also add 0.5% non-ionic surfactant.

Ligustrum spp. (Privet)

SHRUB

Helpful Hints: Privet is a widely used landscaping shrub that has naturalized in parks. As with bush honeysuckle, there are several species. Unlike bush honeysuckle, they may be evergreen or deciduous. Privet can grow to 15 feet, have oval or elliptical opposite leaves, and white flowers that cluster at the end of stems. Fruits are clusters of blue-black berries that appear in late summer or early fall.

Mechanical: Seedlings and small shrubs may be pulled. Larger plants can be cut repeatedly to control resprouts, but are better controlled with cut-stem or foliar chemical treatment.

Chemical: Herbicides containing either triclopyr or glyphosate are effective.

Cut Stem Treatment

- Cut all stems close to soil level and apply herbicide to the entire top of all cut stems.
- Use a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) at a 25% solution (32 oz. of herbicide per one-gallon mix).
- A ready-to-use triclopyr product such as **Pathfinder II** is also effective, and highly recommended.

- A subsequent foliar application may be required to control new seedlings and resprouts.

Foliar Spray

- For seedlings and resprouts less than 6 feet tall, a foliar spray should be effective.
- Thoroughly wet all leaves with a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) @ 2%.
- For Garlon 3A, or similar product, also add 0.5% non-ionic surfactant.

Lonicera spp. (Exotic bush honeysuckles)

SHRUB

Helpful Hints: Long used as a landscaping plant, bush honeysuckles have escaped and now form thickets along stream banks, in edge areas, and in open or shaded woods. **Stems have rough vertical ridges and are hollow.** Leaves stay green into late fall and begin to show new growth in very early spring. They put out **large clusters of red berries** from mid-summer to early fall, depending on species.

Mechanical: Pulling seedlings or small plants can be useful for light infestations.

- In shaded woodlands, where the plants are somewhat less resilient, repeated cutting to the ground during the growing season may result in high mortality.
- Cutting must be repeated at least once during the year to prevent regeneration of stands that are denser than the original.

Chemical: Both *glyphosate* and triclopyr products are effective for this plant. Where possible, initiate **control prior to seed dispersal (late summer to early fall)**.

Cut Stem Treatment

- Cut all stems to ground level and apply glyphosate @ 25% (e.g., Roundup Pro).
- Natural Resources staff members have had success with the ready-to-use triclopyr product, Pathfinder II.

Foliar Spray

- Since bush honeysuckles have single or clustered central stems, and can be easily treated using the cut stem method, **NRS does not recommend foliar applications.**

Rosa multiflora (Multiflora rose)

SHRUB

Helpful Hints: This non-native rose can form very large stands in open areas and along forest or trail edges. It is a **thorny perennial shrub with arching stems and compound leaves divided into 5-11 sharply toothed leaflets.** The plant can sometimes behave like a climbing vine, scrambling up tree trunks, fences or other structures to heights of 20-30 feet. Clusters of showy, fragrant white to pink flowers begin to appear in late spring. **Small, bright red fruits**—known as rose hips—develop during the summer and remain on the plant through the winter

Mechanical: Control requires frequent, repeated bush hogging or mowing, or cutting with power tools or hand tools.

- Cut three times a year over a period of two to four years.
- Cutting with power or hand tools may be preferable to bush hogging or mowing in high-quality natural areas to minimize disturbance.

Chemical: Apply glyphosate or triclopyr to freshly cut stumps or foliar re-growth.

Cut Stump Treatment

- Use glyphosate @ 25% (e.g., Roundup Pro) or triclopyr @ 25% (e.g., Garlon 3A in water). Ready-to-use triclopyr products such as Pathfinder II are also effective, and highly recommended.
- ***This method is most effective if done late in the growing season or while plant is dormant.***

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Early re-growth or low-growing plants can be effectively treated with foliar spray using a glyphosate or triclopyr products @ 2% (follow label directions).
- Add approved blue marker dye.

Rubus phoenicolasius (Wineberry)

SHRUB

Helpful Hints: A non-native raspberry that has escaped cultivation and forms large patches in edge areas and in open woods. **Spiny hairs cover the arching stems (or “canes”), which may be either green or red.** The three-part leaves have heart shaped leaflets with purple veins. Green and white flowers bloom in spring; the red raspberry-type fruits occur in early to mid summer.

Mechanical:

- Small patches can be pulled by hand or dug with a spading fork, preferably when ground is moist.
- Large patches can be mowed or bush-hogged, but this *should be followed with herbicide treatment about six months later (prior to frost).*

Chemical: Wineberry can be treated with either glyphosate or triclopyr.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Foliar Spray may be applied to existing patches or to re-growth following mowing.
- Non-native blackberries and raspberries have been successfully treated in the Southeast with glyphosate products (e.g., Roundup Pro, or Rodeo in wet areas) at concentrations ranging from 0.5% to 1.5%. ***Always use the lowest concentration that proves effective.***
- Use glyphosate in late summer to early fall; mowing 40 to 60 days after treatment may increase the level of control.
- Triclopyr products (e.g., Garlon 3A in water) @ 1% may be successful if applied in midsummer.
- Add approved blue marker dye.

Viburnum spp. (Exotic viburnums)

SHRUB

Helpful Hints: A number of non-native viburnums used in landscape plantings have begun to naturalize in park woodlands, where they create thickets that exclude most other vegetation. Linden viburnum and doublefile viburnum are the two most problematic exotics. Care must be taken to distinguish non-native viburnums from the important native varieties. One key is that non-native viburnums have red fruits while native species have dark blue or black fruits. Consult NRS or Brookside Gardens staff for identification questions.

Mechanical: Seedlings and small shrubs may be pulled. Larger plants can be cut repeatedly to control resprouts, but are better controlled with cut-stem or foliar chemical treatment.

Chemical: Herbicides containing either triclopyr or glyphosate are effective.

Cut Stem Treatment

- Cut all stems close to soil level and apply herbicide to the entire top of all cut stems.
- Use a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) at a 25% solution (32 oz. of herbicide per one-gallon mix).
- A ready-to-use triclopyr product such as **Pathfinder II** is also effective, and highly recommended.
- A subsequent foliar application may be required to control new seedlings and resprouts.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- For seedlings and resprouts less than 6 feet tall, a foliar spray should be effective.
- Thoroughly wet all leaves with a water-soluble triclopyr product (e.g., Garlon 3A) or a glyphosate product (e.g., Roundup) @ 2%.
- For Garlon 3A, or similar product, also add 0.5% non-ionic surfactant.

Alliaria petiolata (Garlic mustard)

HERB

Helpful Hints: A biennial plant that sends up a flowering stem in its second year; seen throughout our parks along roads, trails, forest edges, and forest interiors. Spring **flowers are white and have four petals in the shape of a cross**. Slender, erect seed capsules form later in spring and contain hundreds of seeds that can be viable in the soil for many years. New research indicates that garlic mustard creates soil conditions that interfere with the proper growth of native tree saplings.

Mechanical: Mowing or using a power trimmer (“weed whacker”) may be practical for large infestations, *if done early in the spring*. Hand pulling of this plant, by staff or volunteer groups, can be very effective. The plant has weak roots and is easily removed.

- When cutting, flowering stems should be cut close to ground level to prevent plants from developing new growth.
- Once seedpods are present, cut material must be bagged and removed from the site.

Chemical: Where the risk to desirable plant species is minimal, application of an herbicide is effective.

- This can be done in *early spring or in late fall* (NOTE: Fall treatment involves spraying garlic mustard's first-year rosettes – the plant is a biennial. Contact NRS for further information).

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use a glyphosate product (e.g., Roundup Pro) at low concentrations, no greater than 2%. *Always use the lowest concentration that proves effective.*
- Herbicide applied during the winter to kill over-wintering rosettes may be used as long as the temperature is above 50 degrees and rain is not expected for at least 8 hours.
- Add approved blue marker dye.

Cirsium arvense (Canada thistle)

HERB

Helpful Hints: Probably the most common of the non-native thistles that are **becoming problematic in field and meadow areas of our parks**. It is a perennial with erect stems 1 to 4 feet tall, spiny lance-shaped leaves, and an extensive creeping root system. **Purple to lavender flowers appear from June through August in rounded clusters**. New plants can form from seeds—some of which may remain viable in the soil for twenty years, from the root system, and from very small root fragments.

Mechanical: Mowing or using a power trimmer (“weed whacker”) may be practical for large infestations.

- Flowering stems should be cut close to ground level to prevent plants from developing new growth.
- Mow or cut prior to seed set and repeat to exhaust the plants’ reserves.
- *Do not attempt to dig plants up as this will stimulate vigorous re-growth from below-ground stem fragments.*

Chemical: Foliar application of systemic herbicides such as glyphosate (e.g., Roundup Pro, Rodeo, or Aqua Neat) can be effective, but must usually be repeated due to the hardiness of the plant and its seed-banking potential. *Do not apply herbicide after a prolonged period below-normal rainfall.*

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use glyphosate products @ 2%. If using Rodeo or Aqua Neat, add a surfactant @ 0.5%.
- Add approved blue marker dye to ensure that each plant is treated, and treated only once.
- *“Double-spraying” or using higher concentrations of herbicide will kill leaves so quickly that chemical will not be moved to the root system.*
- Control techniques for natural areas are constrained by the need to minimize damage to intermixed native species. Careful spot application is essential.

- It takes at least two growing seasons to determine whether a control method is effective.

Microstegium vimineum (Japanese stilt grass)

HERB (Grass)

Helpful Hints: A shade-tolerant annual grass that is common along roads and trails, and in moist or floodplain areas of forests. Plants look like a delicate, miniature bamboo and lance-shaped leaves—1 to 3 inches long—have a silvery stripe on the upper surface. Spreads vigorously by roots and seeds; seeds can remain viable in soil for many years.

Mechanical: Cut maturing plants in summer where large stands are accessible to mowers or power trimmers. *The best time is late June through August, before plants go to seed.*

- *Cutting or mowing earlier in the summer—when the grass is shorter and less dense—is recommended.*
- Cutting should be repeated at the same sites for at least three years due to the seed-banking potential of this annual grass.

Chemical: Where monocultures exist without intermingled desired vegetation, extensive infestations can be treated with *glyphosate only* (triclopyr will not kill grasses).

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- *NRS staff has used low concentrations of glyphosate to kill stilt grass with minimal damage to non-target perennials.*
- Use Roundup-type products @ 1% for non-wetland sites. If spraying in late summer, use a 1.5% mix for better results on mature plants.
- In wetlands or near water—or if you will encounter both wet and dry sites while spraying, use products such as Rodeo or Aqua Neat at 1-1.5%, with a non-ionic surfactant @ 0.5%.
- Use a blue marker dye to ensure that patches are sprayed only one time.
- *Follow up treatments 1-2 weeks after initial spraying will ensure better control.*

Phyllostachys spp. and others (Running Bamboos)

HERB (grass)

Helpful Hints: Bamboo is a fast-growing, aggressive perennial grass that has escaped from yards and gardens to invade parkland.

Mechanical: *There is a very narrow control window for optimal mechanical treatment of bamboo, generally running from March 1 – May 31.*

- Pulling or digging can be effective for small infestations.
- If large infestations are cut back from March through May, new shoots will not grow. New growth from existing stems, called “culms,” will emerge and can be cut again. Continued spring cutting over several years may exhaust the plant and allow the underground parts to rot and die.

Chemical: *There is a very narrow control window for **optimal** herbicidal treatment of bamboo, generally running from October 1 – 31.*

- Cut bamboo back in spring as described under “Mechanical.”
- Allow any new growth to emerge and form leaves during the summer.
- Apply herbicide twice in October, allowing 10 to 14 days between treatments.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Use a glyphosate product such as Roundup Pro, or its equivalent, @ 2%. **(NOTE: Since bamboo is a grass, triclopyr products such as Garlon will not be effective.)**
- Treatment can be done as long as the temperature is above 40 degrees and no rain is expected for several hours.
- Add approved blue marker dye.

Polygonum cuspidatum (Japanese knotweed)

HERB

Helpful Hints: Originally introduced as an ornamental plant, then used for erosion control and landscape screening, Japanese knotweed has escaped into natural areas and poses a serious threat to native plants in floodplain and stream bank areas. **It is fast growing and difficult to eradicate. It can form dense stands of bamboo-like stems with oval to triangular shaped leaves up to 6 inches long.** Greenish-white flowers occur on branched sprays in mid to late summer.

Mechanical: Cutting with hand tools or power tools must be followed by herbicide treatment at some point to ensure a successful level of control.

- When near streams or ponds, pile cut plant material away from water.
- Plant parts carried away by moving water may produce new plants once in contact with soil.

Chemical: *Repeated cutting in combination with herbicide treatment appears to be the most effective control method for this plant.* Both glyphosate and triclopyr are effective.

Foliar Spray

(Review introductory sections; contact NRS before initiating any foliar spray project)

- Cut infestations once or twice during the growing season (beginning in June) to keep plants low and reduce their vigor. See “Mechanical” for recommendations about handling cut material.
- Apply foliar spray to leaves of resprouting stems beginning in August, using
- Rodeo-type herbicide (glyphosate) or Garlon 3A (triclopyr) @ 2%. Add 0.5% non-ionic **surfactant** to ensure that herbicide sticks to and penetrates leaves.
- ***The above approach should show good results after the first year, but it may take 2 or 3 years of cutting combined with foliar spraying to eradicate Japanese knotweed from an area.***
- Add approved blue marker dye.

***Ficaria verna* (Lesser celandine/fig buttercup)**

HERB

Helpful Hints: This ornamental plant has escaped and is forming large colonies in forested floodplain areas of our parks. Its shiny, dark green, kidney-shaped leaves emerge in late winter; buttercup-type flowers appear in March and April. After blooming, the plant disappears underground. It spreads by bulblets and underground tubers.

Mechanical: Since this is a low-growing, herbaceous plant of floodplain areas, mowing or cutting is not a practical control measure for this plant.

- Pulling or digging is not recommended except for *very small* infestations.
- Mature plants have many corms attached to the roots. Pulling or digging where plants cover a wide area will stimulate growth of new plants from corms that break free of roots.

Chemical: *There is a very narrow control window for herbicidal treatment of lesser celandine*, generally running from February 1 – April 15.

- Treatment should be started as soon as plants begin to emerge in late winter and continue until the impact on native species cannot be minimized.
- Treatment may be less effective once plants have begun to bloom.
- Treatment requires judgment and consideration of the condition and location of the infested site.
- Spray must be carefully controlled to avoid drift and possible impact on frogs, salamanders, and other delicate-skinned animals that are often found in this plant's habitat.

Foliar Spray

(Review information on pp. 4 & 7-8; contact NRS before initiating any foliar spray project)

- Use glyphosate products such as Rodeo or Aqua Neat @ 1.5% with a 0.5% non-ionic surfactant. *Always use the lowest concentration that proves effective.*
- Treatment can be done as long as the temperature is above 40 degrees and no rain is anticipated for 8 hours.
- Add approved blue marker dye.

Herbicide Use Guide

Generic Name	Brands/Manufacturer	Comments
<i>Triclopyr salt</i>	Garlon 3A Dow AgroSciences 44.4% active ingredient	Dicot-specific (will not kill grasses); can be used for foliar, cut surface, basal bark treatments SAFE FOR USE OVER OR NEAR WATER
<i>Triclopyr ester</i>	Garlon 4 Dow AgroSciences 61.6% active ingredient	Dicot-specific (will not kill grasses); can be used for foliar, cut surface, basal bark treatments DO NOT USE OVER OR NEAR WATER
<i>Triclopyr ester</i>	Pathfinder II Dow Agro Sciences 13.6% active ingredient	A ready-to-use product formulated for cut stem or basal bark treatments.
<i>Glyphosate w/ surfactant</i>	Roundup Original Roundup Original II Roundup Pro Monsanto Company all are 41% active ingred.	Non-selective (will kill all vegetation); can be used for foliar, cut surface, basal bark treatments DO NOT USE OVER OR NEAR WATER
<i>Glyphosate w/o surfactant</i>	Rodeo Dow AgroSciences 53.8% active ingredient Aqua Neat Riverdale 53.8% active ingredient	Non-selective (will kill all vegetation); can be used for foliar and cut surface treatments SAFE FOR USE OVER OR NEAR WATER

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Best Management Practices for Control of Non-Native Invasives



**M-NCPPC Department of Parks, Montgomery County,
Park Planning and Resource Stewardship Division,
Natural Resources Stewardship Section**