

CONTROL METHODS FOR PURPLE LOOSESTRIFE (*Lythrum salicaria*)

PLANT DESCRIPTION

Purple loosestrife is a wetland perennial native to Eurasia that forms large, monotypic stands throughout the temperate regions of the U.S. and Canada. It has a vigorous rootstock that serves as a storage organ, providing resources for growth in spring and regrowth if the plant has been damaged from cuttings. New stems emerge from the perennial roots enabling the plant to establish dense stands within a few years. Seedling densities can approach 10,000-20,000 plants/m² with growth rates exceeding 1 cm/day. A single, mature plant can produce more than 2.5 million seeds annually which can remain viable after 20 months of submergence in water. In addition, plant fragments produced by animals and mechanical clipping can contribute to the spread of purple loosestrife through rivers and lakes.

MANAGEMENT OPTIONS

1. Digging/pulling

Effectiveness: Can be effective in small stands i.e., <100 plants, low-med density (1-75% area), and <3 acres, especially on younger plants in unconsolidated soils.

Methods: Hand-pull plants <2 years old. Use mini-tiller for plants >2 years - gets most of roots w/minimum soil disturbance, has 3 heavy duty prongs on 1 side that are pushed under base of plant, then pry back on handle to leverage plant out of ground. Use weed wrench for plants >2 years old - good w/minimal soil disturbance. In mucky conditions, put base of wrench on small piece of wood (e.g., piece of 2x4) to keep wrench from sinking into mud. Use shovel for plants >2 years old - dig up plant, tamp down disturbed area and/or then replace soil and any existing cover.

Cautions: May increase habitat disturbance and increase spread of loosestrife. This method requires follow-up treatments of sites for 3 years to eliminate re-sprouting from fragments left behind. Must pull/dig ENTIRE rootstock or resprouting will likely occur. Must pull/dig before the plants begin setting seed or must remove flower/seed heads first (cut into bags) to prevent spread of seeds. Also remove previous year's dry seed heads. Erosion control may be necessary.

Disposal: Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

2. Cutting

Effectiveness: Can be effective in small stands i.e., <100 plants, low-med density (1-75% area), and <3 acres, especially on younger plants.

Methods: Remove flower heads before they go to seed, so seed is not spread when plant is cut or mowed. Repeated cutting and mulching is necessary to permit growth of grasses.

Cautions: Need to repeat for several years to reduce spread of plants. Doesn't affect rootstalk; thus, cut pieces can be spread that will resprout. Once severed, stems are buoyant and may disperse to other areas and re-sprout. Removal of seed heads should be done as late in the growing season as possible yet before seed set. Early cutting without additional seed head harvest could allow resprouting with greater subsequent seed production.

Disposal: Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

3. Herbicide

Effectiveness: Use when >100 plants and <3-4 acres in size.

Methods: Use glyphosate formulations only. If possible treat seedlings before they reach 12" in height. Cut and bag flower heads before applying herbicide. Apply prior to or when in flower (late July/Aug) so plants are actively growing. For spot application use a sponge tip applicator w/wick or stem injection.

Cautions: This herbicide is not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants. Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act. Choose glyphosate formulation for applications in standing water or along a shoreline.

4. Biocontrol

Two species of leaf-feeding beetle, *Galerucella californiensis* and *G. pusilla*, have been shown to be effective in controlling purple loosestrife. Over 5 million of these beetles have been released in 30 states including New York, the northeastern and midwestern states as well as all of the Canadian Provinces. The beetles have shown dramatic decreases in purple loosestrife populations with subsequent increases in populations of native species. The scientific literature indicates that the beetles are very specific to

purple loosestrife with only minor “spillover” effects that do not compromise non-target plant populations.

Effectiveness: Use if site has at least a half acre of purple loosestrife of medium to thick density. Best type of control for large patches of loosestrife >3-4 acres.

Methods: The number of beetles released per site should be based on the size of the site, the density of loosestrife and the economics of purchase. More beetles are generally better than fewer.

Cautions: Use only if mowing, pesticide and herbicide use are not active practices on the site. The site must not be permanently flooded and should be sunny. Use only if winged loosestrife, (*Lythrum alatum*) and waterwillow (*Decodon verticillatus*) are not major components of the plant community on the release site. **Please note that identification of winged loosestrife and waterwillow should be done by a professional botanist prior to treatment to determine if this biocontrol method is appropriate.**

CONTROL METHODS FOR COMMON REED (*Phragmites australis*)

PLANT DESCRIPTION

Phragmites is a perennial grass that can grow to 14 feet in height. Flowering and seed set occur between July and September, resulting in a large feathery inflorescence, purple-hued turning to tan. Phragmites is capable of vigorous vegetative reproduction and often forms dense, virtually monospecific stands. It is unclear what proportion of the many seeds that phragmites produces are viable. **Please note that identification of phragmites should be done by a professional botanist prior to treatment to distinguish the invasive non-native race from the non-invasive native.**

MANAGEMENT OPTIONS

1. Cutting and Pulling

Effectiveness: Need to repeat annually for several years to reduce spread of plants. Hand-pulling, though labor intensive, is an effective technique for controlling phragmites in small areas with unconsolidated soils or sediments.

Methods: The best time to cut phragmites is when most of food reserves are in aerial portion of plant (when close to tassel stage, at end of July/early August) to decrease plant's vigor. Some patches may be too large to cut by hand, but repeated cutting of the perimeter of a stand can prevent vegetative expansion. Phragmites stems should be cut below the lowest leaf, leaving a 6" or shorter stump. Hand-held cutters and gas-powered hedge trimmers work well. Weed whackers with a circular blade were found to be particularly efficient, though dangerous.

Cautions: If cut before in tassel stage or at wrong time, stand density may increase because phragmites is a grass. Remove cut shoots to prevent re-sprouting and forming stolons.

Disposal: Cut or pulled material should be removed from the site and composted, land-filled or incinerated. The harvested biomass can be disposed of onsite if the seed heads are removed and the cut stems are dispersed in an upland area.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

2. Herbicide

Effectiveness: Herbicide use is a 2 year, 2 step process because the plants may need "touch-up" application, especially in dense stands since subdominant plants are protected by thick canopy and may not receive adequate herbicide in the first application.

Methods: Use glyphosate formulations only. Cut phragmites at waist-height just before onset of tassel stage. Immediately squeeze/inject 5 mil of 50% solution of glyphosate into each individual, freshly-cut stem. Secure all cut plant material; remove from site and dispose of at approved landfill or incinerator. A 50% solution of glyphosate equates to a one to one mix with distilled water. After 2 to 3 weeks following application of glyphosate, cut or mow down the stalks to stimulate the emergence and growth of other plants previously suppressed. Use spray bottle for individual foliar spot treatments or use swab or syringe with large gauge needle or Nalgene® Unitary® wash bottle (or equivalent) to apply 1-2 drops directly to cut stems if cutting done first, or cloth glove applicator.

Cautions: This herbicide is not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants. Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast w/in 12 hours because herbicide will be washed away before it can act. Choose appropriate glyphosate formulation for applications in standing water or along a shoreline.

3. Plastic

Effectiveness: Tarping can be effective in small stands i.e., <100 plants, low-med density (1-75%area). Plants die off within 3-10 days, depending on sun exposure.

Methods: Cut plants first to 6-8" (hand clippers or loppers, hand-pushed bush hog or weed whacker w/blade). After cutting a stand of phragmites, anchor a sheet of plastic over the cut area using sand bags or rocks. High temperatures under the plastic will eventually kill off the plants. This technique works best when the treated area is in direct sunlight. Black plastic is desirable, but clear plastic also works. Plastic should be at least 6 millimeters thick. Hold plastic in place with sandbags, rocks, etc. Treat runners along edge with spot application of glyphosate. Cut holes in plastic in Oct. - Nov. to promote germination of cattail shoots. The plastic can be removed the following year when the covered plants have been killed. A few phragmites shoots may return. These can be cut or hand-pulled.

Cautions: Must monitor to determine if shoots are extending out from under the plastic.

Disposal: Can leave cut material under plastic or bag all plant parts and remove from site. Dispose of in approved landfill or incinerate with appropriate permits.

Note: All plastic sheeting must be removed from State lands!

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

4. Cutting

Effectiveness: Can be effective in small stands i.e., <100 plants, low-med density (1-75%area) and <3 acres.

Methods: Cut just before the end of July, most of the food reserves produced that season are removed with the aerial portion of the plant reducing the plant's vigor. This regime may eliminate a colony if carried out annually for several years. This can be done after herbicides.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

5. Pulling

Effectiveness: Can be effective in small stands i.e., <100 plants. This method is very labor intensive and best with sandy soils.

Methods: Hand-pull plants <2 years old. Use shovel for plants >2 years old-dig up plant, then replace soil and any existing cover.

Disposal: Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

6. Excavation

Effectiveness: Can be effective for patches up to 1/2 acre. Cost is the limiting factor.

Methods: When working in wetlands only tracked equipment shall be used. Rubber-tired excavators can operate from adjacent pavement or upland areas. All use of motorized equipment on State lands under the jurisdiction of DEC shall be in compliance with pertinent DEC policy regarding the use of motorized equipment on State lands.

Cautions: The patch should be excavated to below the depth of rhizome development. Follow-ups later in the season or the following year must be conducted to verify that all the plants have been removed.

Disposal: Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

CONTROL METHODS FOR GARLIC MUSTARD (*Alliaria petiolata*)

PLANT DESCRIPTION

Garlic mustard is a naturalized European biennial herb that typically invades partially shaded forested and roadside areas. It is capable of dominating the ground layer and excluding other herbaceous species. Its seeds germinate in early spring and develop a basal rosette of leaves during the first year. Garlic mustard produces white flowers between late April and June of the following spring. Plants die after producing seeds, which typically mature and disperse in August. Normally its seeds are dormant for 20 months and germinate the second spring after being formed. Seeds remain viable for up to 5 years.

MANAGEMENT OPTIONS

1. Pulling

Effectiveness: Hand pulling is an effective method for removing small populations of garlic mustard, since plants pull up easily in most forested habitats. Plants can be pulled during most of the year. However, pulling also disturbs the soil and can increase rates of germination of buried seeds. In most cases cutting is the preferred hand control option.

Methods: Soil should be tamped down firmly after removing the plant. Soil disturbance can bring garlic mustard seeds to the surface, thus creating a favorable environment for their germination.

Cautions: Care should be taken to minimize soil disturbance but to remove all root tissues. Re-sprouting is uncommon, but may occur from mature plants not entirely removed. Cutting is preferred to pulling due to potential for soil disturbance.

Disposal: If plants have capsules present, they should be bagged and disposed of to prevent seed dispersal. Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

2. Cutting

Effectiveness: Cutting is effective for medium to large sized populations depending on available time and labor resources. Dormant seeds in the soil seed bank are unaffected by this technique due to minimal disturbance of the soil.

Methods: Cut stems when in flower (late spring/early summer) at ground level either manually (with clippers or a scythe) or with a motorized string trimmer. This technique will result in almost total mortality of existing plants and will minimize re-sprouting.

Cautions: Cuttings should be conducted annually until the seedbank is depleted.

Disposal: Cut stems should be removed from the site when possible since they may produce viable seed even when cut. Bag and remove all plant parts from site. Dispose of in approved landfill or incinerate with appropriate permits.

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

3. Herbicide

Effectiveness: Glyphosate will not affect subsequent seedling emergence of garlic mustard or other plants.

Methods: Use glyphosate formulations only. Product should be applied after seedlings have emerged, but prior to flowering of second year plants. Application should be by wick applicator or spray bottle for individual spot treatments.

Cautions: This herbicide is not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants. Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act. Choose appropriate glyphosate formulation for applications in standing water or along a shoreline.

CONTROL METHODS FOR JAPANESE, GIANT AND BOHEMIAN KNOTWEED
(*Fallopia japonica ssp. japonica*, *F. sachalinensis*, and *F. x. bohemica*)

PLANT DESCRIPTION

The knotweeds are herbaceous perennials which forms dense clumps 1-3 meters (3-10 feet) high. Its broad leaves are somewhat triangular and pointed at the tip. Clusters of tiny greenish-white flowers are borne in upper leaf axils during August and September. The fruit is a small, brown triangular achene. Knotweed reproduces via seed and by vegetative growth through stout, aggressive rhizomes. It spreads rapidly to form dense thickets that can alter natural ecosystems. Japanese knotweed can tolerate a variety of adverse conditions including full shade, high temperatures, high salinity, and drought. It is found near water sources, in low-lying areas, waste places, and utility rights of way. It poses a significant threat to riparian areas, where it can survive severe floods.

MANAGEMENT OPTIONS

1. Digging

Effectiveness: This method is appropriate for very small populations.

Methods: Remove the entire plant including all roots and runners using a digging tool. Juvenile plants can be hand-pulled depending on soil conditions and root development.

Cautions: Care must be taken not to spread rhizome or stem fragments. Any portions of the root system or the plant stem not removed will potentially re-sprout.

Disposal: All plant parts, including mature fruit, should be bagged and disposed of in the trash to prevent re-establishment (dispose of in an approved landfill or incinerate with appropriate permits).

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

2. Cutting

Effectiveness: Repeated cutting may be effective in eliminating Japanese knotweed. Manual control is labor intensive, but is a good option where populations are small and isolated or in environmentally sensitive areas.

Methods: Cut the knotweed close to the ground at least 3 times a year. Plant native plant species as an alternative to continued treatment.

* Stockpiling implies temporary storage prior to transfer to a permanent treatment facility.

Cautions: This strategy must be carried out for several years to obtain success. Both mechanical and herbicidal control methods require continued treatment to prevent reestablishment of knotweed.

Disposal: Bag and remove all plant parts from site (dispose of in an approved landfill or incinerate with appropriate permits).

Sanitation: Clean all clothing, boots, and equipment to prevent spread of seed. See item #7 "Sanitation" in the General Practices section.

3. Herbicide

Effectiveness: Glyphosate treatments in late summer or early fall are much more effective in preventing re-growth of Japanese knotweed the following year.

Methods: Use glyphosate formulations only. In late June/early July cleanly cut or mow down existing stalks/canes. Allow the knotweed to re-grow. After August 1, spray knotweed all re-growth with ROUNDUP®, RODEO®.

A cut-stem treatment utilizing glyphosate formulations can be an effective control for smaller colonies of knotweed. In early to mid-July cut the existing stems just below the 2nd or 3rd node above the soil surface. Immediately after cutting apply by swab or small spray bottle a 50% solution of glyphosate to the freshly-cut cross section and into the internodal cavity of each stalk/cane. Monitor treatment area by early to mid-August and repeat cut-stem treatment to any residual stems.

Stem injection is another promising control method for smaller colonies of knotweeds. Currently, a supplemental label for AQUAMASTER® (glyphosate) herbicide exists for this stem injection method. In late June/early July inject 5 mLs of AQUAMASTER® below the 2nd node above the ground of each stem in the clump. Use suitable equipment that must penetrate into the internodal region. JKInternational manufactures a stem injection tool that is suitable and recommended for this control method.

Cautions: Established stands of Japanese knotweed are difficult to eradicate even with repeated herbicide treatments. However, herbicide treatments will greatly weaken the plant and prevent it from dominating a site. Adequate control is usually not possible unless the entire stand of knotweed is treated (otherwise, it will re-invade via creeping rootstocks from untreated areas).

These herbicides are not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants.

* Stockpiling implies temporary storage prior to transfer to a permanent treatment facility.

Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act. Choose Rodeo® formulation for applications in standing water or along a shoreline.

CONTROL METHODS FOR JAPANESE, MORROW'S, TATARIAN,
AMUR AND BELL'S HONEYSUCKLES
(*Lonicera morrowii*, *L. tatarica*, *L. japonica*, *L. maackii*, *L. x. bella*)

PLANT DESCRIPTION – JAPANESE HONEYSUCKLE

Japanese honeysuckle (*Lonicera japonica*) is a perennial trailing or climbing woody vine of the honeysuckle family (Caprifoliaceae) that spreads by seeds, underground rhizomes, and aboveground runners. It has opposite leaves that are ovate, entire (young leaves often lobed), 4-8 cm long, with a short petiole, and variable pubescence. In the southern part of the range the leaves are evergreen, while in more northern locales the leaves are semi-evergreen and fall off in midwinter. Young stems are reddish brown to light brown, usually pubescent, and about 3 mm in diameter. Older stems are glabrous, hollow, with brownish bark that peels in long strips. The woody stems are usually 2-3 m long, (less often to 10 m). *Lonicera japonica* creates dense tangled thickets by a combination of stem branching, nodal rooting, and vegetative spread from rhizomes.

Lonicera japonica (including the varieties) is easily distinguished from native honeysuckle vines by its upper leaves and by its berries. The uppermost pairs of leaves of *Lonicera japonica* are distinctly separate, while those of native honeysuckle vines are connate, or fused to form a single leaf through which the stem grows. *Lonicera japonica* has black berries, in contrast to the red to orange berries of native honeysuckle vines. The fruits are produced September through November. Each contains 2-3 ovate to oblong seeds that are 2-3 mm long, dark-brown to black, ridged on one side and flat to concave on the other.

The fragrant white (fading to yellow) flowers of *Lonicera japonica* are borne in pairs on solitary, axillary peduncles 5-10 mm long, supported by leaflike bracts. The species has white flowers tinged with pink and purple. Individual flowers are tubular, with a fused two-lipped corolla 3-4(-5) cm long, pubescent on the outside. Flowers are produced late April through July, and sometimes through October.

MANAGEMENT OPTIONS

1. Mowing and Pulling

Effectiveness: Removing the above-ground portion of *Lonicera japonica* reduces current-year growth but does not kill the plant, and generally stimulates dense regrowth. Cut material can take root and should therefore be removed from the site (not practical with most infestations).

Methods: Hand pulling is highly effective. Pull out Japanese honeysuckle by the roots in winter wherever it climbs, aim the roots upward and tie them in place. The absence of light energy causes the trailing vines to decline precipitously next year. This method greatly reduces spraying requirements.

Disposal: All plant parts, including mature fruit, should be bagged and disposed of in the trash to prevent re-establishment (dispose of in an approved landfill or incinerate with appropriate permits).

Cautions: Mowing is an ineffective control method, stimulating growth and encouraging formation of dense, albeit shorter, mats. Bush-hogging is an ineffective control, as *Lonicera japonica* re-invades within one growing season.

2. Herbicide

Effectiveness: In northern states, *Lonicera japonica* retains some leaves through all or most of the winter (semi-evergreen or evergreen), when most native plants have dropped their leaves. This provides a window of opportunity from mid-autumn through early spring when it is easier to spot and treat with herbicides, fire or other methods without damaging native species.

Controls: A foliar application of 1.5% glyphosate shortly after the first frost appears to be the most effective treatment, applied after native vegetation is dormant and when temperatures are near and preferably above freezing. Applications within 2 days of the first killing frost are more effective than applications later in the winter. *Lonicera japonica* is less susceptible to herbicides after the first hard frost (-4°C).

Cautions: Soil disturbance should be avoided in infested areas to minimize germination of seed in the seedbank. Treated plants should be re-examined at the end of the second growing season, as plants can recover from herbicide application.

These herbicides are not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants.

Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act.

PLANT DESCRIPTIONS – BUSH HONEYSUCKLES

Exotic bush honeysuckles (Morrow's, Bell's, Amur and Tatarian) are upright, multi-stemmed, oppositely branched, deciduous shrubs that range in height from 2 m to 6 m. The opposite leaves are simple and entire, and paired; axillary flowers are showy with white, pink, or yellow corollas. The fruits of *Lonicera spp.* are red, or rarely yellow, fleshy berries.

* Stockpiling implies temporary storage prior to transfer to a permanent treatment facility.

In flower, exotic bush honeysuckles can be distinguished from all native bush honeysuckles except swamp fly-honeysuckle (*L. oblongifolia*) by their hirsute (hairy) styles. In fruit, the red or rarely yellow berries of the exotics separate them from the blue- or black-berried native waterberry (*L. caerulea*) and bearberry honeysuckle (*L. involucrata*). The exotic bush honeysuckles also generally leaf-out earlier and retain their leaves longer than the native shrub honeysuckles.

Within the exotic bush honeysuckles, *L. maackii* alone has acuminate, lightly pubescent leaves that range in size from 3.5 to 8.5 cm long and peduncles generally shorter than 6 mm. Its flowers are white to pink, fading to yellow, 15-20 mm long. Its berries are red or with an orange cast. Height ranges to 6 m.

In North America, there has been considerable confusion regarding the correct identification of *L. morrowii*, *L. tatarica*, and *L. x bella*, their hybrid. The literature contains a number of references to plants called by the name of one of the parents, but described as having characters more like those of the hybrid, *L. x bella*. The hybrid therefore, may be more common than the literature would indicate, and accurate field identification may be similarly problematic.

The two parent species of *L. x bella*, however, are dissimilar. *L. morrowii* has leaves that are elliptic to oblong gray-green, soft-pubescent beneath, and are 3-6 cm long. Its flowers are pubescent, white fading to yellow, 1.5-2 cm long, on densely hairy peduncles 5-15 mm long. The fruits are red. The height ranges to 2 m. *L. tatarica* has leaves that are ovate to oblong, glabrous, and are 3-6 cm long. Its flowers are glabrous, white to pink, 1.5-2 cm long, on peduncles 15-25 mm long. The fruits are red or rarely yellow. Height ranges to 3 m.

L. x bella has intermediate characteristics. The leaves are slightly hairy beneath. Flowers are pink fading to yellow, on sparsely hairy peduncles 5-15 mm. long. Fruits are red or rarely yellow. Height ranges to 6 m.

MANAGEMENT OPTIONS

1. Grubbing, Pulling, Cutting

Effectiveness: 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 for a period of three to five years.

Methods: Grubbing or pulling by hand (using a Weed Wrench or a similar tool) is appropriate for small populations or where herbicides cannot be used. Mature *L. maackii* shrubs growing in shaded forest settings can be eradicated by clipping once a year, during the growing season, until control is achieved. Other bush honeysuckles growing in more open settings can be managed by clipping twice yearly, once in early spring and again in late summer or early autumn.

Disposal: All plant parts, including mature fruit, should be bagged and disposed of in the trash to prevent re-establishment (dispose of in an approved landfill or incinerate with appropriate permits).

Cautions: Any portions of the root system not removed can resprout. Because open soil can support rapid re-invasion, managers must monitor their efforts at least once per year and repeat control measures as needed. Winter clipping should be avoided as it encourages vigorous re-sprouting.

2. Herbicides

Effectiveness: Most managers report that treatment with herbicides is necessary for the control of *L. maackii* populations growing in full sun and may be necessary for all large bush honeysuckle populations.

Controls: Use formulations of glyphosate (brand names Roundup, and for use near water bodies, Rodeo) as foliar sprays or cut stump sprays and paints with varying degrees of success. Glyphosate is a non-selective herbicide which kills both grasses and broad-leaved plants. For cut stump treatments, 20-25% solutions of glyphosate can be applied to the outer ring (phloem) of the cut stem. A 2% solutions of glyphosate can be used for foliar treatments. Glyphosate should be applied to the foliage late in the growing season, and to the cut stumps from late summer through the dormant season.

Cautions: The subsequent flush of seedlings following all herbicide treatments must also be controlled.

These herbicides are not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants.

Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act.

* Stockpiling implies temporary storage prior to transfer to a permanent treatment facility.

CONTROL METHODS FOR YELLOW IRIS (*Iris pseudacorus*)

Plant Description

Yellow iris (*Iris pseudacorus*) is a robust, clumping perennial herb in the Iridaceae (Iris family). *Iris pseudacorus* is easy to identify in flower, since it is the only totally yellow-flowered Iris in wild lands in the United States. At maturity, *I. pseudacorus* grows to a height of 0.40-1.5 meters (1.3-4.9 ft) tall. Its thick fleshy rhizomes often form dense horizontal mats, with each rhizome measuring 1 to 4 cm in diameter with roots that may extend vertically 10-20 (30) cm deep. The stiff, sword-like leaves are glaucous, number approximately 10 per ramet, are about 50-100 cm long by 10-30 mm wide, have raised midribs, and are arranged with sheathing and overlapping leaf bases.

Flowers of *I. pseudacorus* are borne on tall erect peduncles. Each inflorescence may have one to several large, showy flowers. The flowers measure 8-10 cm in diameter and vary from pale yellow to almost orange in color. The flowers are bisexual. The perianth segments (3 sepals and 3 petals) are fused at the base, and form a flaring tube with the sepals spreading and reflexed. The 3 stamens are each individually fused by their filaments to the sepals, and the showy tongue-shaped sepals are often adorned with brown spots or purple veins, and are generally less than 6 cm long. The petals are erect and less conspicuous, and are narrower than the sepals. The 3 style branches are petal-like with two-lobed lips, are mostly < 25 mm long, and are opposite and curved over the sepals. *I. pseudacorus* has an inferior, 3-chambered ovary. Fruits are elongated capsules.

Seeds of *I. pseudacorus* are pitted, pale brown, disc-shaped (roughly circular and flattened), and measure approximately 2.0-5.0 mm in diameter and 0.5-3.0 mm tall. Seeds are arranged in three densely packed vertical rows within the seed pod or capsule. These erect capsules at maturity are a glossy green color and measure 4-8 cm in length, 5.0-8.0 mm in width, and are 3-angled and cylindrical.

1. Digging, Pulling, Cutting

Effectiveness: Manual or mechanical methods that remove the entire *I. pseudacorus* rhizome mass can successfully control small, isolated patches.

Methods: Pulling or cutting *I. pseudacorus* plants may provide adequate control, but only if it is repeated every year for several years to weaken and eventually kill the plant. Dead-heading (removing the flowers and/or fruits) from plants every year can prevent seed development and seed dispersal, but will not kill those plants. Cutting the foliage, followed by a herbicide application (see below for details), can provide good control with minimal off-target effects.

Disposal: If plants have capsules present, they should be bagged and disposed of to prevent seed dispersal. Bag and remove all plant parts from site.

Dispose of in approved landfill or incinerate with appropriate permits.

Cautions: These methods, however, are very time and labor-intensive, since even small rhizome fragments can resprout. Additionally, digging disturbs the soil, may fragment rhizomes, and promote germination of *I. pseudacorus* and other undesirable species from the soil seed bank.

Care should be taken when pulling, cutting, or digging *I. pseudacorus*, since resinous substances in the leaves and rhizomes can cause skin irritation.

2. Herbicide

Effectiveness: *Iris pseudacorus* can be effectively controlled by herbicides. Since it usually grows in or adjacent to water, an aquatic-labeled herbicide and adjuvant must be used. Glyphosate (for example, trade names Rodeo®, Aquamaster® or Glypro®) applied in a 25% solution (13% a.i.) using a dripless wick/wiper applicator, or applied in a 5 to 8% solution if sprayed, when used with the appropriate non-ionic surfactant adjuvant, can effectively kill *I. pseudacorus*. *I. pseudacorus* can be effectively controlled by stem injection utilizing Aquamaster® applied at .5 to .7 ml. of product per flowering stem.

Controls: The timing and choice of application technique will determine control efficacy and should work to minimize off-target effects. *Iris pseudacorus* can be controlled by either directly applying the herbicide to foliage, or by immediately applying herbicide to freshly cut leaf and stem surfaces. Herbicides can be directly applied to *I. pseudacorus* foliage or cut stems by a dripless wick system or using a backpack sprayer.

Cautions: These herbicides are not selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All tank mixes should be mixed with clean (ideally distilled) water because glyphosate binds tightly to sediments, which reduces toxicity to plants. Do not apply in windy conditions because spray will drift and kill other plants. Do not apply if rain is forecast within 12 hours because herbicide will be washed away before it can act.

Be sure to always take appropriate precautions and wear suitable clothing and equipment, and follow all instructions on the herbicide label. Use a biodegradable tracer dye in the herbicide mix so you can watch for accidental contact or spill of the herbicide.