Inter-Agency Guidelines for Implementing Best Management Practices to Control Terrestrial and Aquatic Invasive Species on DEC Administered Lands of the Adirondack Park

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Prepared By
NYS Department of Environmental Conservation,
The Adirondack Park Agency,
And The Adirondack Park Invasive Plant Program

I. Introduction

The negative impacts of invasive species on natural forest and aquatic communities are well documented. Colonization and unrestrained growth of invasive species cause the loss of biodiversity, interruption of normal hydrology, suppression of native vegetation, and significant aesthetic, human safety and economic impacts. Terrestrial and aquatic invasive species have been identified at increasing rates of colonization along roadsides, in campgrounds, and in water bodies of New York State Department of Environmental Conservation (DEC or Department) administered lands within the Adirondack Park over the past 20 years. Some of these species have the potential to colonize backcountry lands, lakes and ponds and degrade natural resources of these lands.

These guidelines apply to DEC administered lands within the Adirondack Park, which are comprised primarily of Forest Preserve lands. The Forest Preserve is protected by Article XIV, Section 1 of the New York State Constitution. This Constitutional provision, which became effective on January 1, 1895 provides in relevant part:

> *"The lands of the state, now owned or hereafter acquired, constituting the Forest Preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, or shall the timber thereon be sold, removed or destroyed."*

The Department has jurisdiction over the Forest Preserve, and its management of these lands must be in keeping with this Constitutional provision.

Furthermore, DEC's management of the Adirondack Forest Preserve is governed by the Adirondack Park State Land Master Plan (Master Plan), which was initially adopted in 1972 by the Adirondack Park Agency (Agency or APA), with advice from and in consultation with the Department, pursuant to Executive Law §807 (recodified as Executive Law §816). The Master Plan provides the overall general framework for the development and management of State Land in the Adirondack Park. The Master Plan sets forth the following classifications for State Land within the Adirondack Park: Wilderness, Primitive, Canoe, Wild Forest, Intensive Use, Historic, State Administrative, Wild, Scenic and Recreational Rivers, and Travel Corridors, and sets forth

management guidelines for each of these major land classifications.

Executive Law §816 requires the Department to develop, in consultation with the Agency, individual unit management plans (UMPs) for each unit of land under the Department's jurisdiction which is classified in one of the nine classifications set forth in the Master Plan. The UMPs must conform to the guidelines and criteria set forth in the Master Plan. Thus, UMPs implement and apply the Master Plan's general guidelines for particular classifications of State Land within the Adirondack Park.

Executive Law §816(1) provides in part that "(u)ntil amended, the master plan for management of state lands and the individual management plans shall guide the development and management of state lands in the Adirondack Park.

Article XIV, Section 1 of the New York State Constitution does not specifically address the issue of invasive species. However, since Article XIV directs that Forest Preserve lands be "forever kept as wild forest lands" and prohibits the removal or destruction of timber, care must be taken to ensure that decisions to eradicate invasive species do not result in a material cutting of Forest Preserve timber or adversely impact the wild forest character of Forest Preserve lands.

Although there are no explicit references to active invasive species management on Forest Preserve lands in the Master Plan, the Master Plan provisions are consistent with the concept of actively managing invasive species to protect the "wild forest" character of the Forest Preserve. For instance, page 1 of the Master Plan (2001 Update) states that, "If there is a unifying theme to the Master Plan, it is that the *protection and preservation* of the natural resources of the state lands within the Park must be paramount" (emphasis added). Surveys of DEC administered lands document the continued importation and expansion of invasive plants into and throughout the Adirondack Park (see Section II below). Given that models indicate that eradication of an invasive species becomes progressively more difficult, more expensive, and less effective the longer the species is allowed to grow without intervention (Chippendale 1991; Hobbs and Humphries 1995), it is critical for the Department and APA to address this problem in an expeditious manner.

The goal of these guidelines is to establish parameters known as best management practices (BMPs) for the control of terrestrial and aquatic invasive species while ensuring that such management activities do not alter the "forever wild" character of the Forest Preserve. These guidelines are intended to harmonize the Constitution's "forever wild" provisions with the Master Plan's overriding directive to manage Forest Preserve lands for their protection and preservation. They have been developed pursuant to, and are consistent with, relevant provisions of the New York State Constitution, the Environmental Conservation Law (ECL), the Executive Law, the State Environmental Quality and Review Act (SEQRA), the Master Plan, and all other applicable rules and regulations, policies and procedures.

It is also important to determine if any regulatory jurisdictions or permits are triggered by a proposed management activity. For example, any management activities that involve work within 100 feet of jurisdictional wetlands on private or public lands may require a permit from the APA.

II. Goal of the Guidelines

The goal of the Guidelines is to restore and protect the native ecological communities on DEC administered lands in the Adirondack Park through **e**arly detection and rapid response efforts in order to locally eradicate, suppress, or contain existing or newly identified invasive species populations.

III. Objectives of the Guidelines

These Guidelines provide a template for the process through which comprehensive active terrestrial and aquatic invasive species management will take place on DEC administered lands in the Adirondack Park. The Guidelines provide protocols for implementing BMPs on DEC administered land. The protocols describe what management practices are allowed and when they can be implemented, who can be authorized to implement the management practices, and which terrestrial and aquatic invasive species are targeted. The Guidelines are a living document and should be revisited and revised periodically to reflect the dynamic nature of invasive species and the state of knowledge of best management practices.

Reference to these Guidelines will be included in UMPs as they are drafted or revised. UMPs will also include available inventory information on the distribution of invasive terrestrial and aquatic species on or in close proximity to the Unit. The Guidelines will guide invasive terrestrial and aquatic species management activities on DEC administered land units.

The Guidelines also describe a process by which the Department may enter into Partnership Agreements with and facilitate individuals or groups to manage terrestrial and aquatic invasive species on DEC administered lands using the listed best management practices, in the appropriate circumstances. The Partnership Agreement will be accompanied with a site-specific or rapid response work plan for treatment of invasive species based on the BMPs in the Guidelines and include provision for monitoring control efficacy and native plant recovery. As noted above, the site-specific or rapid response work plan for treatment of invasive species will provide the detail regarding the selected management options on a site-specific basis.

IV. Definitions

a. Inter-Agency Guidelines (Guidelines) – The document agreed to by the Adirondack Park Agency and the Department of Environmental Conservation that outlines regulated management of terrestrial and aquatic invasive species on Department of Environmental Conservation administered lands within the Adirondack Park.

b. Agency – The New York State Adirondack Park Agency (APA), its officers and employees.

c. Department – The New York State Department of Environmental Conservation (DEC), its officers and employees.

d. Adirondack Park Invasive Plant Program (APIPP) – A partnership including the Department, the Agency, Department of Transportation, and the Adirondack Nature Conservancy whose goals are:

1. to coordinate a regional early detection and monitoring program in cooperation with staff, volunteers and the public;

2. to facilitate invasive species management and control with public and private landowners; and,

3. to increase public awareness and involvement to prevent the spread of invasive species through education and outreach.

e. DEC Administered Lands – Lands under the jurisdiction of the Department.

f. Invasive Species – "invasive species" means a species that is:

(a) nonnative to the ecosystem under consideration; and

(b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. This harm must significantly outweigh any benefits.

g. Terrestrial Invasive Plant Species – A plant that is typically found in upland or wetland settings that is capable of rapid reproduction and displacement of native species.

h. Aquatic Invasive Plant Species – A completely submerged or floating plant that is typically found in lacustrine or riparian settings (including lakes, ponds, rivers or streams) that is capable of rapid reproduction and displacement of native species.

i. Partnership Agreement – An agreement between the Department and an individual, organized group or municipal entity in the form of either a Volunteer Stewardship Agreement, Temporary Revocable Permit of Adopt-a-Natural Resource Agreement.

j. Volunteer Stewardship Agreement (VSA) – An agreement between the Department and an individual or group for the purpose of providing volunteer assistance to the Department in managing resources or facilities on public lands, as further described in Department Commissioner Policy CP-58.

k. Temporary Revocable Permit (TRP) – Department issued permit for the temporary use of State Lands and Conservation Easement lands for certain activities, as described in Department Program Policy ONR-3.

l. Adopt-a-Natural Resource Agreement (AANR) – A agreement between the Department and an individual or group for the purpose of providing volunteer assistance to the Department in managing resources or facilities on public lands, as further described in Department Program Policy ONR-1.

m. Site-specific Work Plan – A detailed description of work to be performed at a specific site, the Best Management Practices that will be used to perform the work and the desired final

condition of the site once the work is complete.

n. Rapid Response Work Plan – An abbreviated description of work to be performed on new, isolated terrestrial invasive plant infestations under 0.1 acres in size.

o. Best Management Practice (BMP) – Best management practices are state-of-the-art mitigation measures applied on a site-specific basis to reduce, prevent, or avoid adverse environmental or social impacts.

p. Control Method – A field tested recommendation for the most effective control of invasive species. Species-specific control methods for terrestrial invasive species are attached in Appendix B. As of this writing, only hand harvesting and/or benthic matting are approved control methods for aquatic invasive species. Additional guidance for the use of aquatic herbicides will be developed at a later date after consultation with the Department and the Agency.

q. Herbicide Application Method – The means by which herbicide is delivered to a target organism during an herbicide treatment. The methods of herbicide application will be by the means specified in Appendix B. No application will be allowed by high pressure broadcast or boom sprayers.

r. Herbicide – A pesticide that is registered in New York State that kills plants. Due to the sensitive nature of DEC administered lands, only selected herbicide active ingredients are included for use under these Guidelines. They include glyphosate, triclopyr, and Imazapyr. Imazapyr may only be used for upland treatments of Japanese knotweed. In wetlands, only glyphosate formulations which include language approving the product's use in or around wetlands or aquatic sites may be used. In all cases herbicides will be used in strict compliance with label precautions and the species-specific control methods found in Appendix B.

s. Pesticide – Any substance or mixture of substances that is registered in New York State to kill pests. A pesticide may be a chemical substance, biological agent (such as a virus or bacterium), antimicrobial, disinfectant, plant regulator, defoliant, or other device used against a pest.

t. Certified Applicator – An individual who has successfully completed the course of training and licensing and who holds a valid, appropriate pesticide applicators certificate in New York State.

u. Biological Control – A method of controlling pests (including insects, mites, weeds and plant diseases) that relies on predation, parasitism, herbivory, or other natural mechanisms. It can be an important component of integrated pest management (IPM) programs.

V. Present Extent of Terrestrial and Aquatic Invasive Species on Forest Preserve Lands An inventory of invasive species that are present and a measure of the extent of the invasive species populations is essential to determining the correct course of action. The Department conducts

ongoing regular, systematic surveys to identify and quantify the extent of terrestrial and aquatic invasive species on Forest Preserve units in the Adirondack Park. The results of this continued survey have been documented in Unit Management Plans (UMPs). UMPs should be periodically updated with the best available invasive species location information. DEC and partners will present a report, as needed, on the survey data from previous growing seasons. Detailed location and population information shall be provided to the Regional Land Manager for each Region and will be included in the iMap Invasive Species Database.

The Department shall seek to develop and foster a relationship with private landowners adjacent to or connecting DEC administered land units to share information regarding existing and potential invasive species populations or threats.

VI. BMPs for the Control of Terrestrial and Aquatic Invasive Species and Procedure for Implementation

The general parameters or BMPs for the control of invasive species that apply regardless of the targeted species are set forth below. Specific control methods for select terrestrial and aquatic invasive species are attached as Appendix B. These BMPs will be implemented through site-specific work plans with corresponding SEQRA compliance, which must be approved by the Department's Central Office Bureau of Forest Preserve Management. Volunteer Stewardship Agreements (VSAs), Adopt-a-Natural Resource Agreements (AANRs), and Temporary Revocable Permits for Use of State Lands (TRPs), collectively referred to as Partnership Agreements in these guidelines, with outside parties to conduct invasive species management require site-specific work plans with corresponding SEQRA compliance.

In order to accommodate early detection and rapid response (EDRR) efforts for terrestrial invasive species, initial control of new infestations discovered on DEC-administered lands within the Adirondack Park under 0.1 acres in extent may be conducted through an Expedited-Review Authorization process upon notification and approval from the appropriate DEC regional office. However, these Expedited-Review Authorizations must still comply with SEQRA through one of the five means indicated on the project authorization submission form (Appendix C). Approved Expedited-Review Authorizations allow for immediate management actions to be taken for sites that meet the EDRR criteria previously mentioned. After the growing season in which the EDRR infestation was found and managed through the Expedited-Review Authorization process, the site must be incorporated into a formal site-specific work plan within 12 months. It is anticipated that if the proposed activities conform to these guidelines, they will be consistent with constitutional directives, authorized pursuant to the APA/DEC MOU, and will not require approval through the UMP process.

If the Department determines during its review of a proposed site-specific work plan that proposed management activities may potentially have a material effect on the character or use of the land or the vegetation thereon, DEC and APA staff will then consult to determine if the activity should be addressed as part of an individual UMP or UMP Amendment. Furthermore, application of these guidelines to all such management activities on DEC administered lands throughout the Adirondack Park will ensure that cumulative impacts will be minimized due to the fact that the BMPs being implemented through these guidelines avoid and mitigate impacts to native ecological communities.

The following BMPs apply to the control and management of invasive species.

1. **Prevent the introduction of invasive plants and animals to uninvaded sites.**
Invasive species can be introduced to a site by moving infested equipment, sand, gravel, borrow, fill and other off-site material. Monitoring disturbed areas and proper sanitation of equipment will help prevent new infestations. BMPs to prevent the introduction of invasive species include:

- Clean all clothing, boots, and equipment prior to visiting site.
- Begin activities in uninfested areas before operating in infested areas.
- Use native plants and weed-free seed and mulch (straw, wood fiber).
- Use fill that does not have invasive plant seeds or material.
- Keep equipment on site during the entire project.
- Incorporate invasive plant prevention into road work layout, design, and decisions. Use uninfested areas for staging, parking and cleaning equipment. Avoid or minimize all types of travel through infested areas, or restrict to those periods when spread of seed or propagules are least likely.
- When possible, to suppress growth of invasive plants and prevent their establishment, retain relatively closed canopies.

2. **Contain and treat new invasive plants and animals or those not yet well established.**
Controlling small infestations is more effective and economical than trying to control well-established, rapidly spreading infestations. Selected control measures need to be based on species biology and the individual characteristics of an infestation. This document provides guidance on an Expedited Review Authorization for instances when new isolated invasive plant infestations under 0.1 acres in size are documented on DEC administered lands.

3. **Minimize transport of invasive plants and animals from infested to uninfested areas.**
Invasive species can be spread by moving infested materials and equipment off-site. Cleaning vehicles and equipment (usually with steam or hot water) is the most effective method of preventing an introduction. BMPs involving the transport of material and equipment off-site include:

- Determine the need and identify sites where equipment can be cleaned. Seeds and plant parts need to be collected when practical and effectively disposed of (e.g., burned, dried, bagged and taken to landfill, etc.). Remove mud, dirt, and plant parts from project equipment before moving it into a project area and clean all equipment before leaving the project site, if operating in infested areas.
- Check, clean, and, when appropriate, dry all clothing, boots, and equipment (e.g., boats, trailers, nets, etc.) prior to visiting a site.
- Don’t move firewood. All cut tree material should be either chipped or dispersed onsite.
- Inspect material sources at site of origin to ensure that they are free of invasive plant material before use and transport. Treat infested sources for eradication, and strip and stockpile contaminated material before any use.
- Inspect and document the area where material from treated infested sources is used annually for at least three years after project completion to ensure that any invasive plants transported to the site are promptly detected and controlled.
- Minimize roadside sources of seed that could be transported to other areas.
- Periodically inspect roads and rights-of-way for invasion. Inventory and mark

infestations and schedule them for treatment.

• Avoid working in infested areas if possible. Postpone such work until invasive plants have been eliminated from the site.

• When necessary to conduct work in infested areas, schedule activity when seeds or propagules are least likely to be viable and to be spread

• Perform road maintenance such as road grading, brushing, and ditch cleaning from uninfested to infested areas to help prevent moving seeds and plant material from infested areas into adjacent uninfested areas.

• Clean road graders and other equipment immediately after operating in infested areas.

• Clean all dirt and plant parts from the top and underside of mower decks.

4. **Minimize soil disturbance.**

Invasive plants prefer and often thrive under disturbed conditions. Do not disturb the soil unless absolutely necessary. BMPs for activities involving soil disturbance include:

• Before starting ground-disturbing activities, inventory invasive plant infestations both on-site and in the adjacent area.

• Minimize soil disturbance and retain desirable vegetation in and around area to the maximum extent possible.

• Monitor infested areas for at least three growing seasons following completion of activities. Provide for follow-up treatments based on inspection results.

• Do not blade roads or pull ditches where new invaders are found, if possible.

• When it is necessary to conduct soil work in infested roadsides or ditches, schedule activity when seeds or propagules are least likely to be viable and to be spread.

• Do not move soil from infested area to prevent off-site spread.

5. **Maintain desirable species.**

Establishing and maintaining competitive, desirable plants along roadsides and disturbed areas prevents or slows establishment of invasive plants. BMPs for re-vegetating disturbed areas include:

• Re-vegetate all disturbed soil, except on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site will prevent establishment of invasive plants.

• Use native material where appropriate and available. Re-vegetation may include planting, seeding, fertilizing, and mulching.

• Monitor and evaluate success of re-vegetation in relation to project plan.

• When re-vegetating areas that were previously dominated by invasive plants, try to achieve at least 90% control of the invasive before attempting restoration.

VII. General Practices

1. **Minimum Tool Approach** – State Land stewardship involving invasive species management practices should always incorporate the principles of the Minimum Tool Approach. Any group or individual implementing such practices on State Land should only use the minimum tools, equipment, devices, force, actions or practices that will effectively reach the desired management goals. Implicit in this document is the structure to implement a hierarchy of management practices based upon the target species and site conditions starting with the least intrusive and disruptive methods. For the management of submerged or floating aquatic invasive species, Agency General Permit 2008G-1B can be used for hand harvesting and benthic matting. Other management

techniques for submerged or floating aquatic invasive species may require review and approval by the Department and the Agency.

2. **Erosion Control** - Some of the species-specific best management practices described in Appendix B require digging or pulling of plants from the soil. Where vegetation is to be removed, it must be determined if the proposed control method and extent of the action will destabilize soils to the point where erosion is threatened. Generally if more than 25 square feet of soil surface is cleared or plant removal occurs on steep slopes, staked silt fencing should be installed and maintained as a temporary erosion control practice. In some cases seeding and organic, non-hay mulching may be required.

3. **Re-vegetation** - Although not required, replanting or reseeding with native species may sometimes be necessary. All of the species-specific control methods described in Appendix B are aimed at reducing or eliminating invasive species so that natives are encouraged to grow and re-establish stable conditions that are not conducive to invasive colonization. In most cases, removal or reduction of invasive populations in the Adirondacks will be enough to release native species and re-establish their dominance on a site (Smith 2009). However, the site-specific work plan for treatment of invasive species shall include yearly monitoring provisions that document native plant recovery.

4. **Solarization** - Because of the extremely robust nature of invasive species, composting terrestrial invasive plants in a typical backyard compost pile or composting bin is not appropriate. In many instances, composting invasive plants has led to new infestations through the distribution of compost material off site. However, solarization methods can be used whereby sun-generated heat is used to destroy the harvested plant materials. This process usually involves the storage of invasive plant materials in sealed 3 mil thickness (minimum) black plastic garbage bags that are placed on blacktop and exposed to the sun until the plant materials liquefy or dry out. If allowed ample sunlight, plant materials should be rendered nonviable within 2 weeks of being laid out. If a larger section of blacktop is available, make a black plastic (4 mil thickness minimum) envelope sealed on the edges with sand bags. The plant material left exposed to the sun will liquefy in the sealed envelope without danger of dispersal by wind. The bags or envelopes must be monitored to make sure the plants do not escape through rips, tears or seams in the plastic. Once invasive plant materials have gone through the solarization process and are rendered completely nonviable, they can be disposed of in an approved landfill or incinerated after attaining the appropriate permits.

5. **Material Collection and Transportation** – While on the control site, place all cut plant material in heavy duty, 3 mil or thicker, black contractor quality plastic clean-up bags. Securely tie the bags and transport from the site in a covered vehicle in order to prevent spread or loss of the plant material during transport from the control work site to the appropriate staging or disposal location. The main root structure, root fragments and/or horizontal rhizomes from harvested Japanese, giant or bohemian knotweed infestation should be bagged only to facilitate transport to an appropriate staging area. All knotweed root structure, root fragments and rhizome propagules should be separately bagged from any cut, aerial canes and crowns. Over an open bag, remove as much adherent soil as possible from the root/rhizome structure prior to spreading the root/rhizome parts out onto a secure, impervious surface. Once completely dried out, the root/rhizome structure may be burned or disposed of in an approved landfill.

The mature, upright stems and canes of common reed and the knotweeds can be cut, formed into bundles and securely bound with rope or twine. The bundles may then be transported to an appropriate staging or disposal location that has an impervious or near- impervious surfaced area. After the bundles have completely dried out they may be burned at an approved incinerator or burn pit with an appropriate permit.

VIII. Management Protocols

a. All Department personnel whose duties involve outdoor field work on State Land (e.g., Division of Lands & Forests Staff, Biologists, field technicians, Forest Rangers, Environmental Conservation Officers, Operations staff, etc.) will report the locations of suspected terrestrial and aquatic invasive species infestations encountered during the course of their ordinary work to the Adirondack Park Invasive Plant Program (APIPP) at http://adkinvasives.com/get-involved/report-invasive-species/ and implement the species specific BMPs in Appendix B when conducting or supervising work to remove invasive species from State Land. Terrestrial and aquatic invasive species identification and management trainings will be provided as needed by APIPP.

b. All site-specific work plans must include a site map, an inventory of target and non-target species, an estimate of the size and age of the infestation, target species impacts and concerns, a Natural Heritage review, adjoining land uses and nearby State Land units, a proposed treatment method and probability of success, treatment impacts and concerns, an assessment of treatment alternatives, a history of past treatment methods used on the site, a timeframe by which the work will be undertaken and completed, a schedule of anticipated future work, monitoring provisions to determine the effectiveness of the management action and to document native plant recovery, and if needed, revegetation and contingency plans.

c. For infestations under 0.1 acres in size, an Expedited Review Authorization can be issued. The rapid response work plan for this authorization must include a site map, an inventory of the target species, an estimate of the size of the infestation, a Natural Heritage review, a proposed treatment method, and a timeframe by which the work will be undertaken and completed. A commitment will be made to complete a formal site-specific work plan before the next field season. See Appendix C

d. All invasive plant management on State Land will be conducted using the BMPs and species-specific control methods listed in Appendix B, pursuant to the DEC – APA Memorandum of Understanding.

e. Any individual or group demonstrating an interest and appropriate expertise in implementing the species-specific control methods found in Appendix B may apply for a Partnership Agreement to manage terrestrial and aquatic invasive species.

f. The treatment of invasive species on State Lands by Department personnel or any other party will only be undertaken pursuant to a site-specific or rapid response work plan for the treatment of invasive species and pursuant to all applicable State, federal and local regulations regarding pesticide use, residue removal and disposal.

g. Written approval from the Department, in the form of a Partnership Agreement and a site-specific or rapid response work plan for treatment of invasive species are required for all non-Department personnel to implement species-specific control methods and BMPs on State Land

h. Prior to implementation of work plans for the treatment of invasive species the activity must be posted in the Environmental Notice Bulletin.
    1. For treatment areas exceeding 0.1 acres in size:
        a. No work will be implemented under a site-specific work plan until being noticed in the ENB for 15 days.
    2. For areas less than 0.1 acre in size:
        a. Approved EDRR plans can be implemented immediately upon being noticed in the ENB.

i. Appropriate certification (NYS pesticide applicator/technician certification) is required for commercial pesticide applications. The only pesticide application methods allowed under these guidelines are spot treatments to individual plants by the following means:
    - Foliar spray application using a back pack sprayer or hand sprayer
    - Wiper application using a wick applicator or cloth glove applicator
    - Stem injection application using a stem injection gun, unitary wash bottle, or hand sprayer
    - Cut stump application using a unitary wash bottle, paintbrush, backpack sprayer, or hand sprayer
    - Basal bark application using a backpack sprayer, hand sprayer, or paintbrush
    - Frill or tree injection method using an injection lance, hatchet and unitary wash bottle or spray bottle, or hypo hatchet

j. **No broadcast herbicide applications using, for example, boom sprayer, are allowed. In all cases, all herbicide directions for use and restrictions found on the label shall be followed by a New York State Certified Applicator, Technician, or a properly trained and supervised apprentice in an appropriate category. In all instances, the label is the law and should be followed accordingly. All invasive species to be treated and the method of treatment to be used must be present on the herbicide product label or included in additional supplemental labeling or an approved 2ee recommendation for that product. In addition, all product labels, supplemental labels, and approved 2ee's covering an invasive species for herbicide treatment must be in the applicator's custody and made available to the Department upon request at any time before, upon, during, or after application**. The application methods described and allowed are designed to reduce or eliminate the possibility that non-target species will be impacted by the pesticide use. All pesticide treatments require follow-up inspection later in the growing season and/or over following years to assess and document effects and possibly re-treat any plants that were missed. The following guidelines apply with respect to the application of herbicides, which must be applied according to respective labels under federal and state law:

    - In wetlands, only glyphosate formulations which include language approving the

product's use in or around wetlands or aquatic sites may be used. Common examples of glyphosate based products approved for use in or around wetlands include Aquamaster®, Rodeo®, Accord Concentrate®, Roundup Custom®, and Glypro®. Applications of pesticides to, over, or near surface waters may require the incorporation of the project into a SPDES general permit for aquatic pesticide use via submission of a notice of intent to the NYSDEC Division of Water. Any invasive plant management activities that take place within 100 feet of a jurisdictional wetland within the Adirondack Park require a general permit from the Agency.

- In uplands, either glyphosate, triclopyr, or Imazapyr based products may be used. Imazapyr based products may only be used for upland treatments of Japanese knotweed (*Fallopia japonica*). Common examples of glyphosate based products used in uplands include Roundup Pro®, Roundup Pro Max®, Ranger Pro®, and Accord XRT II®. Common examples of triclopyr based products used in uplands include Garlon 4®, Garlon 4 Ultra®, Element 4®, and Pathfinder II®. Common examples of Imazapyr based products used for upland treatments of Japanese knotweed include Arsenal®, Arsenal Powerline®, and Polaris®.

- The proposed use of herbicides must be detailed in a site-specific or rapid response work plan.

Note: The mention of any pesticide product in this document does not constitute endorsement of that product

k. All appropriate and applicable signage and public notification required for pesticide application by or on behalf of the Department shall be used, including adjacent landowner notification, newspaper notice, and temporary on and off-site signs.

l. These Guidelines do not authorize the use of motor vehicles, motorized equipment, or aircraft. All use of motorized equipment on State Lands under the jurisdiction of the Department requires written approval from the Department.

m. A UMP or UMP Amendment may be required if the proposed implementation of an activity identified in these Guidelines is considered to cause a potential material change to the use of the land or the vegetation thereon due to its extent, intensity or duration.

n. Invasive species management materials and methods evolve; any deviation from the BMPs and species-specific control methods must be approved by the Department after consultation with the Agency.

o. Any invasive species management action proposal that involves tree cutting for control or access must comply with constitutional requirements and will be carried out pursuant to LF-91 and a site-specific or rapid response work plan.

p. Appendix A of these Guidelines contains a list of species that are considered terrestrial or aquatic invasive species. Other species may be added over time recognizing the constant

threat of new invasive species. Note that to be eligible for management actions under these Guidelines, species-specific control methods must be accepted by the Department after consultation with the Agency. New or revised control methods may be developed by other entities, but also must be reviewed and accepted by the Department after consultation with the Agency.

q. Those individuals or groups applying for a Partnership Agreement to manage any invasive species without an approved species-specific control method must develop and submit a control method for the species of concern. The submitted control methods will be reviewed and must be approved by the Department and the Agency before the approval of a site-specific or rapid response work plan or issuance of the Partnership Agreement. For submerged or floating aquatic invasive plant species management options are currently restricted to hand harvesting or benthic matting detailed in a site-specific work plan.

IX. Potential Environmental Impacts

The control methods and BMPs contained in these Guidelines restrict the use of herbicides so that adverse impacts to non-target species are avoided and native plant communities are restored.

Aquatic invasive species will be managed using non-mechanical harvesting techniques (hand-pulling) and temporary benthic matting as described in the Guidelines. Use of pesticides for aquatics is not part of this guidance and will be developed at a later date.

The removal of these species reduces the potential for disruption and harm to the native ecosystem. It is expected that by using the Guidelines invasive species populations will be managed, and hopefully eradicated, in a timely manner before significant impact to DEC administered lands occurs. Successful implementation of these control methods and BMPs or other recommended control methods will allow natural processes to take place undisturbed by the impacts of invasive species colonization and proliferation.

Any of the control actions described in the Guidelines has the potential for environmental impact. For example, the use of pesticides may cause mortality to non-target species and cutting trees may have both visual and ecological impacts on the landscape. It is recognized that although the BMPs and species-specific control methods seek to mitigate these impacts, the potential for impact is real and must carefully be weighed against all other possible actions, including the no-action alternative. It is believed that the protection, preservation, and restoration of native flora and fauna in the Adirondacks is an outcome that is worth reasonable associated risk. These Guidelines represent a tool for land managers to reduce the potential for disruption and harm to Forest Preserve lands from terrestrial and aquatic invasive species. It is expected that these actions will lead to the preservation and restoration of native ecological communities on State Lands within the Adirondack Park.

X. Effect of This Action

The Guidelines seek to lay the ground rules for managing terrestrial and aquatic invasive species on DEC administered lands. It identifies certain species that, if left untreated, have the potential to colonize backcountry land and water bodies causing severe disruption and degradation of natural systems. The Guidelines set out a protocol for action and recommend a set of comprehensive BMPs and specific control methods for dealing with invasive species of concern,

and outline a process for developing and incorporating new control methods for additional species. The control methods provide detailed guidance on the use of several techniques for managing terrestrial and aquatic invasive species including hand pulling, cutting, digging, matting and pesticides. Finally, the Guidelines identify a host of additional terrestrial and aquatic invasive species that require surveillance, early detection and, after appropriate consultation with the Regional Supervisor of Natural Resources a rapid response to protect DEC administered lands.

Adoption of the Guidelines and implementation through the UMP and site-specific or rapid response work plans gives the Department the tools needed to preserve, protect and restore the natural native ecosystems of DEC administered lands within the Adirondack Park.

XI. Responsibilities

The responsibility for interpretation and update of these Guidelines and overall management shall reside with the cooperating agencies. The Department shall be responsible for management of terrestrial and aquatic invasive species on DEC administered lands while the Agency will be responsible for providing review of, and advice on, the management activities contained in the Guidelines and the assessment of materiality of proposed actions and the management recommendations in UMPs.

Appendix A. Invasive Species

The 92 species included here are non-native organisms that either occur in New York State or are found in adjacent states. They have a proven record of being invasive and disrupting native ecosystems. Asterisked species have recommended control methods that are included in Appendix B. This appendix should be reviewed and updated annually.

Terrestrial Plants

Trees

- Black locust (*Robinia pseudoacacia*)
- Norway and sycamore-leaved maple (*Acer platanoides, A. pseudoplatanus*)
- Tree-of-Heaven (*Ailanthus altissima*)
- Japanese tree lilac (*Syringa reticulata*)
- Princess tree (*Paulownia tomentosa*)
- Crack willow (*Salix fragilis*)
- European gray willow (*Salix cinerea*)

Shrubs

- Japanese, Morrow's, tatarian, Amur, Bell's and dwarf honeysuckles (*Lonicera japonica, L. morrowii, L. tatarica, L. maackii, L. x. bella, L. xylosteum*)*
- Autumn and Russian olive (*Eleagnus umbellata, E. angustifolia*)
- Cherry eleagnus (*Eleagnus multiflora*)
- Common and Glossy buckthorn (*Rhamnus cathartica, R. frangula*)
- False Spiraea (*Sorbaria sorbifolia*)
- Multiflora and rugosa rose (*Rosa multiflora, R. rugosa*)
- Japanese and European barberry (*Berberis thunbergii, B. vulgaris*)

- False indigo (*Amorpha fruticosa*)
- Winged euonymus (*Euonymus alata*)
- Butterfly bush (*Budleja davidii*)
- Blunt-leaved and common privet (*Ligustrum obtusifolium, L. vulgare*)

Vines

- Oriental bittersweet* (*Celastrus orbiculata*)
- Porcelain-berry (*Ampelopsis brevipedunculata*)
- Mile-a-minute vine (*Polygonum perfoliatum*)
- Kudzu (*Pueraria montana var. lobata*)
- Common periwinkle (*Vinca minor*)

Herbs

- Purple loosestrife (*Lythrum salicaria*)*
- Japanese, giant and bohemian knotweed (*Fallopia japonica var. japonica, F. sachalinensis, F. x bohemica*)*
- Common reed (*Phragmites australis* ssp. *australis*)*
- Garlic mustard (*Alliaria petiolata*)*
- Yellow iris (*Iris pseudacorus*)*
- Cypress and leafy spurge (*Euphorbia cyparissias, E. esula*)
- Giant Hogweed (*Heracleum mantegazzianum*)
- White and yellow sweet-clover (*Melilotus alba, M. officinalis*)
- Wild parsnip (*Pastinaca sativa*)*
- Wild chervil (*Anthriscus sylvestris*)
- Reed canary-grass (*Phalaris arundinacea*)
- Black and Pale Swallowwort* (*Cynanchum louiseae, C. rossicum*)
- Indian Cup Plant (*Silphium perfoliatum*)
- Japanese stiltgrass (*Microstegium vimineum*)
- Flowering rush (*Butomus umbellatus*)
- Spotted and brown knapweed (*Centaurea stoebe ssp. micranthos, C. jacea*)
- Canada and bull thistle (*Cirsium arvense, C. vulgare*)
- Goutweed (*Aegopodium podagraria*)
- Lesser celandine (*Ranunculus ficaria*)
- Common and yellow foxglove (*Digitalis purpurea, D. grandiflora*)

Aquatic Plants

Submerged

- Eurasian and variable-leaf watermilfoil, and parrotfeather (*Myriophyllum spicatum, M. heterophyllum, M. aquaticum*)
- Fanwort (*Cabomba caroliniana*)
- Curlyleaf pondweed (*Potamogetion crispus*)
- Brazilian elodea (*Egeria densa*)
- Hydrilla (*Hydrilla verticillata*)
- Brittle naiad (*Najas minor*)
- Didymo (*Didymosphenia geminata*)

- Starry stonewort (*Eichhornia crassipes*)
- Water soldier (*Stratiotes aloides*)

Floating

- Waterchestnut (*Trapa natans*)
- Common frog-bit (*Hydrocharis morsus-ranae*)
- Yellow floating-heart (*Nymphoides peltata*)
- Water-lettuce (*Pistia stratiotes*)
- Pacific mosquitofern (*Azolla filliculoides*)
- Water hyacinth (*Pistia stratiotes*)
- Water primrose (*Ludwigia peploides*)
- Pond water starwort (*Callitriche stagnalis*)
- Three-stamen waterwort (*Elatine triandra*)
- European water fern (*Marsilea quadrifolia*)
- Water spangles (*Salvinia minima*)
- Giant salvinia (*Salvinia molesta*)

Insects

- Emerald ash borer (*Agrilus planipennis*)
- Asian long-horned beetle (*Anaplophora glabripennis*)
- Hemlock wooly adelgid (*Adelges tsugae*)
- Sirex woodwasp (*Sirex noctilio*)
- Asian gypsy moth (*Lymantria dispar*)
- Balsam wooly adelgid (*Adelges piceae*)
- Elongate hemlock scale (*Fiorini a externa*)

Appendix B. Species-specific Control Methods

INTRODUCTION

The species and best management practices listed below are for those species already present in the Adirondack region that have been shown to have the highest likelihood to cause significant negative impacts to the region. For management advice on other species not referenced in this document please refer to other resources or contact a professional. It is strongly recommended that the concepts of integrated pest management (IPM), integrated vegetation management (IVM), the minimal tool approach, and adaptive management be understood and incorporated into any management strategy before the implementation of a control project. It is also strongly recommended that any invasive plant management project be run through The Nature Conservancy's (TNC) Invasive Plant Management Decision Analysis Tool (IPMDAT) http://imapinvasives.org/ipmdat.html before implementation. All herbicide use shall be conducted in strict accordance with the product label as well as all local, state, and federal laws.

DEFINITIONS

a. Early Detection Infestation – For the purposes of these guidelines, an early detection infestation is classified as being a new, isolated population of under 0.1 acres in size.

b. Small Infestation – For the purposes of these guidelines, a small infestation is classified as being an isolated population of over 0.1 acres in size but under 1 acre in size.

c. Medium Infestation – For the purposes of these guidelines, a medium infestation is classified as being an isolated population of over 1 acre in size but under 1 hectare (~2.5 acres) in size.

d. Large Infestation – For the purposes of these guidelines, a large infestation is classified as being an isolated population of over 1 hectare (~2.5 acres) in size.

e. Containment – preventing an established invasive plant infestation from spreading into other uninvaded areas

f. Suppression – reducing an invasive plant infestation's density and/or cover to below a certain threshold to maintain a desirable species or ecological process

g. Local Eradication – eliminating all individuals and the seed bank of a given invasive species from a localized area (wetland, Forest Preserve unit, road corridor, etc.) with a low likelihood of needing to address the species again in the next ten years.

h. Eradication – eliminating all individuals and the seed bank of a given invasive species from a large geographic area (state, province, region, etc.) with a low likelihood of needing to address the species again in the next ten years.

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 re-growth if the plant is damaged by 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/m^2 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 can contribute to the spread of purple loosestrife through dispersal by water.

MANAGEMENT OPTIONS

1. Digging/Pulling

Effectiveness:

Digging or pulling can be effective in suppressing, containing, or locally eradicating early detection to medium sized infestations. It can be especially effective in sandy or mucky soils as removal of the entire root system is often made easier.

Methods:

Hand-pull or excavate all plants from the soil by the roots. If necessary, use a shovel, mini-tiller, or weed wrench for larger plants. Tamp down or replace all disturbed or displaced soil after removal.

Cautions:

Excavation of soil may increase habitat disturbance and increase the spread of purple loosestrife. Digging or pulling efforts will usually need to be repeated for at least 3 years to eliminate re-sprouting from rhizome fragments or seeds left behind. In order to prevent re-rooting, the entire rootstock needs to be removed. In order to prevent the spread of seeds, pulling or digging must be conducted before the plants begin setting seed or flower/seed heads must be removed beforehand. If possible, also remove the previous year's dry seed heads. Erosion control techniques may be necessary if greater than 25 square feet of soil surface is disturbed.

Disposal:

Bag all plant parts and remove from site. Solarize and then dispose of in approved landfill or incinerate with appropriate permits.

Sanitation:

Clean all clothing, boots, tools, equipment, and transport vehicles to prevent spread of propagules.

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in suppressing or containing early detection to medium sized infestations of purple loosestrife.

Methods:
Cut or mow plants down to the ground at least 3 times during the growing season ensuring that no plants are allowed to go to flower or seed. Repeat annually as needed until desired reductions are achieved. If plants are already in flower, remove flower heads before they go to seed so seed isn't spread during the cutting or mowing activity. Repeated mowings or cuttings over several years will usually be necessary to promote the growth of native vegetation and suppress the growth of purple loosestrife.

Cautions:
Repeated cuttings are often needed for several consecutive years in order to reduce the spread of plants. Cutting does not remove the plant's rootstalk and thus persistent re-sprouting is likely. Once severed, stems are buoyant and may disperse to other areas and re-sprout. Early cutting or mowing without additional flower head removal could allow resprouting with greater subsequent seed production.

Disposal:
If possible, bag all cut plant parts and remove from site. Solarize, and dispose of in approved landfill or incinerate with appropriate permits. Mowed or mulched material can be left to decompose on site.

Sanitation:
Clean all clothing, boots, and equipment to prevent the spread of propagules.

3. Herbicide
Effectiveness:
Herbicide treatments can be effective in suppressing, containing, or locally eradicating early detection to medium sized purple loosestrife infestations. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Purple loosestrife can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of purple loosestrife or other plants.

Treatments:
Use glyphosate or triclopyr formulations only. In wetlands, only glyphosate formulations which include language approving the product's use in or around wetlands or aquatic sites may be used. Apply herbicides immediately prior to or when in flower (late July/Aug) so plants are actively growing and transporting nutrients to the roots.

For spot treatments use any of the following application equipment:

- Wiper application - sponge tip applicator with wick.
- Cut stump application - commercial-grade spray bottle, wash bottle, eye dropper, or paintbrush
- Foliar spray application - commercial-grade spray bottle with adjustable

nozzle and/or backpack sprayer with adjustable nozzle

Cautions:
Glyphosate based herbicides are nonselective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which can reduce its toxicity to plants.

Do not spray in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

Be sure to always take appropriate precautions, 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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a "burn down" effect on plants like some other contact herbicides do. Within 1-2 weeks following the herbicide application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots

4. Biocontrol

Two species of leaf-feeding beetle, *Galerucella calmariensis* 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 infestations with subsequent increases in native plant populations. 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:
Biocontrol releases can be effective in suppressing or containing small to large sized purple loosestrife infestations. Only use biocontrols in areas that are not permanently flooded and have at least 0.1 acres of purple loosestrife of medium to thick density.

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. Both

Cornell University and the NYS Department of Environmental Conservation have permitting and monitoring guidelines that should be reviewed prior to the release of any biological controls. Beetles may also be collected from historic release sites and moved to new areas or reared for release upon receival of the proper permits from DEC. Released beetles will persist in the environment, increase or decrease in population based on the availability of purple loosestrife, and provide long-term control.

Cautions:
Use purple loosestrife biocontrols only if mowing, pesticide, and herbicide use are not active practices at the release site. The release site must not be permanently flooded and should receive ample sunlight. If winged loosestrife, *(Lythrum alatum)* and waterwillow *(Decodon verticillatus)* are major components of the plant community at the potential release site, releasing purple loosestrife biocontrols is not recommended.

CONTROL METHODS FOR COMMON REED
(*Phragmites australis ssp. 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. The proportion of viable to non-viable seeds that Phragmites produces can vary depending on location. **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. Digging/Pulling

Effectiveness:

Digging or pulling can be effective in containing, suppressing, or locally eradicating early detection sized infestations of Common Reed. This is usually a very labor intensive control method that often has to be repeated for several years. Best results are often seen when infestations occur in sandy or mucky soils.

Methods:

Dig or hand-pull all common reed plants out from the soil by the rhizomes. Use a shovel or pitch fork for larger plants to ensure the removal of the entire root system. Tamp down or replace all disturbed or displaced soil after removal.

Disposal:

Bag and remove all plant parts from the site. Solarize and then dispose of in an approved landfill or incinerate with the appropriate permits.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Cutting /Mowing

Effectiveness:

Cutting or mowing can be effective in suppressing or containing early detection to small sized infestations. Cutting or mowing often needs to be repeated multiple times annually for several years in order to reduce the spread of plants.

Methods:

Cut or mow plants down to the ground at least 3 times during the growing season ensuring that no plants are allowed to go to seed. Common reed stems should be cut or mowed below the lowest leaf, leaving a 6" or shorter stump.

Cautions:

Common reed has the potential to re-sprout from both cut and/or mowed stem and rhizome fragments. Actions should be taken to leave all fragments on site following a cutting or mowing.

Since common reed is a grass, an insufficient number of cuttings during a growing season, may increase stand density. A cutting regime may reduce smaller colonies if carried out annually for several years. Manual or mechanical cuttings of large, high density, monospecific common reed stands, without the follow-up application of herbicide, is not recommended.

Disposal:
Cut or mowed material can be left on site to decompose. You can also solarize and dispose of cut or mowed material in an approved landfill or incinerate with appropriate permits. Do not attempt to compost rhizome or stem fragments.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

3. Matting

Effectiveness:
Matting can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of common reed. Above ground plant parts usually die off within 3-10 days of being covered, depending on sun exposure. In order to entirely kill the belowground rhizome system, the plastic covering may need to be left in place for several years.

Methods:
First, cut or mow plants down to 6-8" using a hand-pushed bush hog or weed whacker with blade. After cutting a stand of common reed, anchor a sheet of black plastic, barrier matting, or a dark tarp 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. Plastic should be at least 6 millimeters thick. Runners or shoots that extend out from under the covering can be treated with a spot application of glyphosate. In order to prevent or reduce the likelihood of this from happening, also cover a buffer area of at least 5-10 feet surrounding the infestation. The plastic covering can be removed the following year to assess whether the covered rhizome system has been killed. Common reed shoots may return and can either be re-covered or managed via another method.

Cautions:
Monitoring the site several times throughout the growing season is often required to determine if shoots are extending out from under the plastic. Tears or rips in the covering may also need to be patched to prevent re-sprouting.

Disposal:
Cut material can be left under plastic or bagged and removed from site. If removed, solarize and then dispose of plant parts in an approved landfill or incinerate with appropriate permits.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

4. Herbicide

Effectiveness:
Herbicide treatments can be effective in suppressing, containing, or locally eradicating small to

medium sized infestations of common reed. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Glyphosate based herbicides can be effective in controlling common reed. Herbicide use is usually at least a 3 year process as infestations will most often need at least one or two "touch-up" applications. This is especially true in dense stands where subdominant plants are protected by a thick canopy and may not receive adequate herbicide coverage in the first application. It is not uncommon for small to medium sized infestations to require up to 5 years of "touch-up" treatments in order to achieve local eradication. Glyphosate formulations will not affect subsequent seedling emergence of common reed or other plants.

Treatments:
Use glyphosate formulations only. In wetlands, only glyphosate formulations which include language approving the product's use in or around wetlands or aquatic sites may be used. Apply a foliar spray or wiper application near or during the tasseling stage when nutrients being transported to the rhizomes will translocate herbicide effectively. Another effective treatment option is to cut or mow down the live stalks in early summer, allow at least 6 weeks of regrowth, and conduct a foliar spray to the regrowth of plants. It is imperative that enough time (at least6 weeks) be given for plants to regrow so that enough plant surface area is present for proper coverage. Usually, previously cut plants will only reach about waist height by the end of the growing season, as opposed to potentially 15 feet high without cutting, and will not go to tassel. However, since common reed is a grass, cutting will often stimulate increased stand density which will allow for increased spray surface area and reduced spray height. A third effective treatment option that can be used in tandem with the other treatment methods specified or for small or sparse infestations is to perform a cut stem injection of individual stems. Cut each stem within a few inches of the ground and using a stem injection system or unitary wash bottle immediately fill each hollow stem cavity with glyphossate. Although extremely effective, this technique is extremely labor intensive and should not be performed entirely on medium to large infestations. If time and available resources permit, the following spring, after an initial treatment of any kind, cut or mow down the dead standing stalks to stimulate the emergence and growth of other native plants previously suppressed. This will also help in locating and treating remaining common reed plants during "touch-up" treatments.

For spot treatments use any of the following application equipment:

- Wiper application - sponge tip applicator with wick or cloth glove applicator
- Cut stem injection application – stem injection system, commercial-grade spray bottle, wash bottle, or eye dropper
- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle

Cautions:
Glyphosate based herbicides are nonselective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not spray in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast w/in 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a "burn down" effect on plants like some other contact herbicides do. Within 1-2 weeks following the herbicide application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money, or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

5. Excavation

Effectiveness:

Excavation can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of common reed. Associated costs and disturbance are usually the limiting factors with this control method.

Methods:

Excavate common reed plants below depth of rhizome using an excavating tractor and bury contaminated soil at least 5 feet deep in a disposal pit. When working in wetlands only tracked equipment shall be used. Rubber-tired excavators can operate from adjacent pavement or upland areas.

Cautions:

The patch should be excavated to below the depth of rhizome development. Follow-up monitoring later in the season and over the following years must be conducted to verify that all plants have been removed.

Disposal:

Removed contaminated soil can be buried at least 5 feet deep in a disposal pit. Disposal site should be monitored annually to ensure that no resprouting occurs.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of seed.

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, cross-shaped 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 may remain viable for up to 7 years.

MANAGEMENT OPTIONS

1. Digging/Pulling.

Effectiveness:

Digging or hand pulling is an effective method for containing, suppressing, or locally eradicating early detection to medium sized populations of garlic mustard, since plants pull up easily in most forested habitats. It is best to remove plants when seed pods are not yet mature. Plants should not be dug or pulled when seed pods begin to open in order to avoid inadvertent seed dispersal

Methods:

Slowly dig or pull up each plant by the roots to ensure that the entire root system is removed. Disturbed soil should be tamped down firmly after removing plants. Soil disturbance can bring existing garlic mustard seeds to the surface, thus creating a favorable environment for additional germination within the control site.

Cautions:

Care should be taken to minimize soil disturbance and remove all root tissues. Re-sprouting may occur from mature plant's root systems if not entirely removed.

Disposal:

Bag and remove all plant parts from site. Solarize and then dispose of in an approved landfill or incinerate with appropriate permits.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in containing or suppressing early detection to medium sized populations of garlic mustard depending on habitat. Dormant seeds in the soil are unaffected by this technique due to minimal disturbance of the soil. Mowing or cutting will often need to be

repeated annually to reduce an infestation to desired levels.

Methods:
Cut or mow garlic mustard stems when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique usually results in almost total mortality of existing plants and will minimize re-sprouting. Repeat this a few weeks later and annually to reduce the infestation further.

Cautions:
Cuttings should be conducted annually for 5 to 7 years or until the seed bank is depleted. Do not cut or mow while seed pods are present or beginning to open as this will likely aid in seed dispersal.

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. Solarize and then dispose of in an approved landfill or incinerate with appropriate permits. Mowed or mulched plant material can be left on-site to decompose.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

3. Herbicide
Effectiveness:
Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of garlic mustard. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Garlic mustard can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of garlic mustard or other plants.

Treatments:
Use glyphosate or triclopyr formulations only. The product should be applied after seedlings have emerged, but prior to flowering of second-year plants. Fall applications from late August into October can also be effective for the first year rosettes once the second year plants have been pulled or have senesced.

For spot treatments use any of the following application equipment:

- Wiper application - sponge tip applicator with wick or cloth glove applicator
- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle

Cautions:
Glyphosate based herbicides are not selective (kills both monocots and dicots), thus should be applied carefully to prevent the killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses unaffected. All herbicide solutions

should be mixed with clean, potable water as glyphosate can bind tightly to organic material, which may reduce its toxicity to plants. Do not spray in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast w/in 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not crete a “burn down” effect on plants like some other contact herbicides do. Within 1-2 weeks following the herbicide application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money, or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

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 form 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 often 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 is able to spread rapidly through fragmentation and is capable of surviving severe floods.

MANAGEMENT OPTIONS

1. Digging/Pulling

Effectiveness:

Digging or pulling can be effective in containing, suppressing, or locally eradicating early detection sized infestations of knotweed.

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 rhizomes or stem fragments. Any portion of the root system or the plant stem not removed will potentially re-sprout.

Disposal:

All plant parts and contaminated soil should be bagged and disposed of to prevent re-establishment. Solarize and then dispose of in an approved landfill or incinerate with the appropriate permits.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Cutting/Mowing

Effectiveness:

Multiple repeated cuttings or mowings over consecutive field seasons can be effective in suppressing or containing early detection to small sized infestations of knotweed.

Methods:

Cut or mow the knotweed close to the ground at least 5 times a year beginning when the plants first emerge in early spring.

Cautions:
This strategy must be carried out for several years to see a reduction in infestations. Knotweed species have the potential to resprout from small stem and rhizome fragments. Cut or mowed material should be mulched to under 1 square inch in size if possible to reduce the likelihood of re-sprouting from plant fragments.

Disposal:
If possible, bag all cut plant material and remove from site. Solarize and then dispose of in an approved landfill or incinerate with appropriate permits. Mowed or mulched plant material can be left on site to decompose

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

3. Matting

Effectiveness:
Matting can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of knotweed. Above ground plant parts usually die off within 3-10 days of being covered, depending on sun exposure. In order to entirely kill the belowground rhizome system, the plastic covering will usually need to be left in place for several years.

Methods:
First, cut or mow plants down to 6-8" using a hand-pushed bush hog or weed whacker with blade. After cutting a stand of Japanese knotweed, anchor a sheet of black plastic, barrier matting, or a dark tarp 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. Plastic should be at least 6 millimeters thick. Runners or shoots that extend out from under the covering can be treated with a spot application of glyphosate. In order to prevent or reduce the likelihood of this from happening, also cover a buffer area of at least 5-10 feet surrounding the infestation. The plastic covering can be removed the following year to assess whether the covered rhizome system has been killed. Knotweed shoots may return and can either be re-covered or managed via another method.

Cautions:
Monitoring the site several times throughout the growing season is often required to determine if shoots are extending out from under the plastic. Tears or rips in the covering may also need to be patched to prevent re-sprouting.

Disposal:
Cut plant material can be left under plastic matting or bagged and removed from site. If removed, solarize and then dispose of in an approved landfill or incinerate with appropriate permits.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

4. Herbicide

Effectiveness:

Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestation of knotweed species. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Glyphosate and imazapyr based herbicides can be effective in controlling knotweed species. Imazapyr should only be incorporated into treatments of upland infestations of Japanese knotweed. Herbicide use is usually at least a 3 year process as infestations will most often need at least one or two "touch-up" applications. This is especially true in dense stands where subdominant plants are protected by a thick canopy and may not receive adequate herbicide coverage in the first application. Glyphosate and imazapyr treatments in late summer or early fall can be effective in preventing regrowth of knotweed the following year. The use of Imazapyr may inhibit the subsequent seedling emergence of knotweed as well as other plants for several years.

Treatments:

Use glyphosate and imazapyr formulations only by one or more of the following means.

- For upland infestations conduct a foliar spray using a mixture of glyphosate and imazapyr in late summer during the flowering stage when nutrients are being transported to the roots. For infestations located near water only use glyphosate formulations approved for use in and around wetland or aquatic sites. If the size of the infestation and/or the height of the plants inhibit effective spraying, cut down existing stalks/canes in early summer. Allow the knotweed to re-grow for at least six weeks and spray all re-growth when the plants are about waist high. If possible, bag, remove, and solarize cut plant material. If this is not possible, leave cut stems at the treatment site. This will ensure that if any resprouting of the cut material occurs, that it will receive treatment later in the season.

- Stem injection is another effective control method for knotweed. From the end of July until up to two weeks before the first hard killing frost, inject glyphosate between the 2nd and 3rd node from the ground of the larger stems in each clump. Use suitable equipment that penetrates into the internodal region. JK International manufactures a stem injection tool that is suitable and recommended for this control method. Once the larger stems have been injected, conduct a foliar spray using a mixture of glyphosate and imazapyr for the smaller stemmed plants on the fringes of the infestation that were not able to be injected. A marking pen should be used to identify which stems have been injected with herbicide so that stems are not injected more than once.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
- Stem injection application- stem injection gun with a short, stout needle or medical syringe

Cautions:
Established stands of Japanese knotweed can be 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).

Glyphosate and Imazapyr based herbicides are non-selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Imazapyr provides residual control which may affect subsequent seedling emergence of knotweed and other native species for several years. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not spray in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast w/in 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and imazapyr do not create a “burn down” effect on plants like some other contact herbicides do. Within 1-2 weeks following the herbicide application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

5. Excavation
Effectiveness:
Excavation can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of knotweed. Associated costs and disturbance are usually the limiting factors for this control method.

Methods:
Excavate knotweed plants below depth of rhizome using an excavating tractor and bury contaminated soil at least 5 feet deep in a disposal pit. When working in wetlands only tracked equipment shall be used. Rubber-tired excavators can operate from adjacent pavement or upland areas.

Cautions:
The patch should be excavated to below the depth of rhizome development. Follow-up monitoring later in the season and over the following years must be conducted to verify that all plants have been removed

Disposal:
Removed contaminated soil can be buried at least 5 feet deep in a disposal pit. Disposal site should be monitored annually to ensure that no new resprouting occurs.
Sanitation:
Clean all clothing, boots, and equipment to prevent spread of seed.

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 winter. 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. Digging/Pulling

Effectiveness:

Digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of Japanese honeysuckle.

Methods:

Pull or dig out Japanese honeysuckle from the soil by the roots making sure to remove as much of the root system as possible. Use a digging tool or weed wrench for larger plants if necessary.
Turn the plants upside down, aim the roots toward the sky, and fasten them in place against a tree or other vertical object to decompose.

Cautions:

Do not remove plants that are fruiting as this may aid in seed dispersal.

Disposal:

If plant parts are not able to be left on-site to senesce as described under the "Methods"

section, all plant parts should be burned or bagged and disposed of to prevent re-establishment. Solarize bagged plant material and then dispose of in an approved landfill or incinerate with appropriate permits.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Herbicide

Effectiveness:
Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of Japanese honeysuckle. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Glyphosate and triclopyr based herbicides can be effective in controlling Japanese honeysuckle. 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 without damaging native species. Glyphosate and triclopyr formulations will not affect subsequent seedling emergence of Japanese honeysuckle or other plants.

Treatments:
Use glyphosate or triclopyr formulations only by either of the following means:

- A foliar application of herbicide shortly after the first frost appears to be one of the most effective treatment options for Japanese honeysuckle. If possible, apply after native vegetation has begun to go dormant and when temperatures are near and preferably above freezing. Applications within 2 days before the first killing frost seem to be more effective than applications later in the season. *Lonicera japonica* is less susceptible to herbicides after the first hard frost (-4^{o}C). Foliar applications late in the summer or early fall after fruit formation can also be effective but pose the risk of affecting other desirable vegetation through spray drift.

- A cut stump application of herbicide applied immediately after cutting is also an effective means of controlling this species. Cut stump treatments should be conducted during the growing season after full leaf expansion when nutrients are being actively transported to the roots. Delay in application after cutting may result in reduced effectiveness

For spot treatments use any of the following application equipment:

- Cut stump application - commercial-grade spray bottle with adjustable nozzle, backpack sprayer with adjustable nozzle, wash bottle, eye dropper, or paint brush
- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle

Cautions:
Soil disturbance should be avoided in infested areas to minimize germination of seed in the seed

bank. Treated plants should be re-examined at the end of the second growing season, as plants can in some cases recover from herbicide application. Glyphosate based herbicides are non-selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not spray in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast w/in 12 hours as herbicide may 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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a "burn down" effect on plants like some other contact herbicides do. Within 1-2 weeks following the application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

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, orange, or rarely yellow, fleshy berries (Gleason and Cronquist 1991).

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, orange, or rarely yellow berries of the exotics separate them from the blue- or black-berried natives 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 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, orange, 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, orange, or rarely yellow. Height ranges to 6 m.

MANAGEMENT OPTIONS

1. Digging/Pulling

Effectiveness:
Digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of bush honeysuckle. Effective mechanical management requires a commitment to pull or dig plants out at least once a year for several years.

Methods:
Pull or dig each individual plant out by the roots making sure to remove as much of the root system as possible. Use a digging tool or weed wrench for larger plants if necessary.

Disposal:
Removed plants can be turned upside down so that the roots are pointing upwards and propped against a tree or other vertical object to senesce and decay on-site. Smaller plants, in a similar manner, can be hung from tree branches to decompose. If this is not an option, all plant parts, should be burned or bagged and disposed of to prevent re-establishment. Stockpile, dispose of in an approved landfill or incinerate with appropriate permits.

Cautions:
Any portion 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. Plants should not be removed while in fruit as this could potentially aid in seed dispersal

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Herbicides

Effectiveness:
Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of bush honeysuckle. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Glyphosate and triclopyr based herbicides can be effective in controlling bush honeysuckles. These formulations will not affect subsequent seedling emergence of bush honeysuckles or other

plants.

Treatments:
Use glyphosate or triclopyr formulations only by either of the following means:

- A foliar application of herbicide can be applied in late summer or early fall after fruit formation. Applications made just before the first hard killing frost have proven effective and reduce the risk of non-target impacts to other desirable vegetation that have already begun to senesce.

- A cut stump application of herbicide applied immediately after cutting is also an effective means of controlling this species. Cut stump treatments can be conducted throughout the growing season with varying effectiveness. However, there is a window of opportunity in the fall and early spring where treatments tend to be most effective and other non-target plants are dormant; reducing the risk of non-target impacts. Delay in application after cutting may result in reduced effectiveness

- A basal bark treatment of herbicide applied directly to the lower trunk of each plant can be an effective means of controlling this species. Basal bark treatments can be conducted throughout the growing season with varying effectiveness. However, there is a window of opportunity in the fall and early spring where treatments tend to be most effective and other non-target plants are dormant; reducing the risk on non-target impacts.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
- Cut stump application - commercial-grade spray bottle with adjustable nozzle, backpack sprayer with adjustable nozzle, wash bottle, eye dropper, or paintbrush
- Basal bark application – commercial-grade spray bottle with adjustable nozzle, backpack sprayer with adjustable nozzle, or paintbrush.

Cautions:
The subsequent flush of seedlings following all herbicide treatments must also be controlled. Glyphosate based herbicides are non-selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not spray in windy conditions as spray may drift and kill other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a "burn down" effect on plants like some other contact herbicides do. Within 1-2 weeks following the application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money, or effort by spraying plants more than once in a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

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
Effectiveness:
Digging or pulling methods that remove the entire *I. pseudacorus* rhizome mass can successfully contain, suppress, or locally eradicate early detection to small sized infestations of yellow iris.

Methods:
Dig or pull each plant clump out by the roots making sure to remove as much of the root system as possible. Digging or pulling *I. pseudacorus* plants may provide adequate control, but only if it is repeated every year for several years to address any resprouting.

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

Cautions:
Digging or pulling can be very time and labor-intensive, as even small broken off rhizome fragments have the potential to resprout. Additionally, digging disturbs the soil and may promote germination of *I. pseudacorus* and other undesirable species from the soil seed bank. Care should be taken when pulling or digging *I. pseudacorus*, since resinous substances in the leaves and rhizomes can cause skin irritation.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Herbicide

Effectiveness:

Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of yellow iris. The timing and choice of application technique will determine control efficacy and should work to minimize off-target effects.

Iris pseudacorus can be effectively controlled by glyphosate based herbicides. Since it usually grows in or adjacent to water, an aquatic-labeled glyphosate based herbicide is often required. Glyphosate formulations will not affect subsequent seedling emergence of yellow iris or other plants.

Treatments:

- A foliar application of glyphosate can be applied throughout the growing season when nutrients are being transported to the roots. In general, spring or fall treatments seem to be somewhat more effective than summer. However identification to distinguish between yellow flag and the native blue flag iris is difficult without the flower. Yellow iris is easily identified when in flower in late May or early June.

- Stem injection is another effective option in controlling *Iris pseudacorus.* Cut flowering stems with clippers 8-9 inches above the root crown or 3-4 inches above the water's surface if plants are submerged. Then, using a stem injection gun, push a cavity needle into the soft pithy center of the stem. This creates a hollow area in the center that will hold the herbicide. Slowly inject the product into the hollow while slowly withdrawing the cavity needle. This stem injection technique can be useful in minimizing injury to neighboring plants when compared to spray techniques. Also, stem injections can be conducted during windy or rainy conditions. A marking pen should be used to identify which stems have been injected with herbicide so that stems are not injected more than once.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
- Stem injection application- stem injection gun with a cavity needle or

medical syringe

Glyphosate based herbicides are nonselective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not apply in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a “burn down” effect on plants like some other contact herbicides do. Within 1-2 weeks following the application the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

CONTROL METHODS FOR BLACK & PALE SWALLOW-WORTS
(*Cynanchum louiseae & C. rossicum*)

Plant Description

Members of the milkweed family (*Asclepiadaceae),* both black and pale swallow-wort are herbaceous, with twining vines growing three to six feet in height. Both have opposite, shiny leaves, 2" to 4" long, and both have clusters of small (<1/4") flowers. Black swallow-wort usually bears purple-black, star shaped flowers while pale swallow-wort usually shows light maroon, star shaped flowers, but this cannot be used for reliable identification. The flowers of Black swallow-wort have petals that are about half as wide (at the base) as they are long, whereas the flowers of pale swallow-wort are much narrower at the base than their length. In addition, the inner petals of Black swallow-wort flowers are hairy, whereas the inner petals of pale swallow-wort are hairless. Both produce seed pods, bearing numerous seeds which are typically wind-distributed, but they may also be transported on clothing or on animal fur. Both Black and Pale swallow-wort grow from strong, central rhizomes. While some suggest this provides an asexual means of distribution, others contend the primary benefit is in perenniation not dispersal. The vines typically twine and sprawl over other vegetation and die back to the ground each year. Fruits are long slender green pods (two to three inches), that turn dark brown when ripe. They appear in pairs or sometimes threes, similar to milkweed pods, but longer and narrower. Seeds are also like common milkweed seeds, rounded and flattened, each with an attached tuft of silky hair. In winter, stems may be found entangled in small shrubs with remnants of old seedpods still attached.

1. Digging/Pulling

Effectiveness:

Digging or pulling methods that remove the entire *Cynanchum sp.* root crown can successfully contain, suppress, or locally eradicate early detection to small sized infestations of swallow-wort.

Methods:

Dig or pull up each individual swallow-wort plant from the soil by the roots making sure to remove as much of the root system as possible. Digging up the root crowns can be effective but is usually time and labor intensive as the whole root crown of each plant must be removed and the process often needs to be repeated for several years. Pulling the plants by hand generally leads to resprouting but can prevent seed production, especially if repeated during the growing season. A less effective method is seed pod picking, which also limits seed production, but does little damage to the existing population. It is extremely important to ensure that populations of swallow-wort are not allowed to go to seed as control measures usually need to persist for an additional 5 years after the last year of seed dispersal.

Disposal:

If plants have seed pods present, they should be bagged and disposed of to prevent seed dispersal. Bag all plant parts and contaminated soil and remove from site. Solarize and then dispose of in approved landfill or incinerate with appropriate permits.

Cautions:

Digging or pulling methods are often very time and labor-intensive and need to be repeated for several years in order to achieve desired reductions. Additionally, digging disturbs the soil,

may fragment rhizomes, and promote germination of *Cynanchum sp.* and other undesirable species from the soil seed bank. Do not dig or pull plants that have seed pods that are starting to open as this may aid in seed dispersal.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Cutting/Mowing

Effectiveness:
Multiple repeated cuttings or mowings over consecutive field seasons may be effective in suppressing or containing early detection to small sized infestations of swallow-wort.

Methods:
Cut or mow the swallow-wort close to the ground at least 5 times a year beginning when the plants first emerge in early spring ensuring that no plants are allowed to go to seed.

Cautions:
This strategy must be carried out for several years to see a reduction in infestations. Do not cut or mow if seed pods are present as this may aide in seed dispersal.

Disposal:
If possible, bag all cut plant material and remove from site. Solarize and then dispose of in an approved landfill or incinerate with appropriate permits. Mowed or mulched plant material can be left on-site to decompose.

Sanitation:
Clean all clothing, boots, and equipment to prevent spread of propagules.

3.Herbicide

Effectiveness:
Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of swallow-wort. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Cynanchum sp. can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of swallow-worts or other plants.

Treatments:

- A foliar spray of glyphosate or triclopyr has been found to be effective in controlling *Cynanchum sp*. These herbicides should be applied when plants are actively growing, after flowering has begun but before the formation of seed pods. Plants that are sprayed before pods form will usually not produce a viable seed crop that season. Swallow-wort control may take a few years of repeated treatments since seeds may remain viable in the soil for up to 5 years.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle

Cautions:
Avoid the temptation to spray the plants as soon as they emerge in May. Only when the plants flower will they be large enough to receive enough spray on the exposed leaf surface to deliver a killing dose to the roots.

Glyphosate based herbicides are non-selective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not apply in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act. Herbicide applications should come to a close at least two weeks before the first hard killing frost to allow sufficient time for the product to take effect. Do not apply after the first hard killing frost as plants will no longer actively absorb herbicide into the roots.

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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a “burn down” effect on plants like some other contact herbicides do. Within 1-2 weeks the plants will begin to look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

CONTROL METHODS FOR ORIENTAL BITTERSWEET
(*Celastrus orbiculatus*)

Plant Description

Oriental bittersweet is a rapidly spreading deciduous, twining vine with alternate round, glossy leaves. It often twines around and drapes itself over other trees and shrubs in successional fields and along forest edges, often completely covering the supporting vegetation. In the shade it grows less vigorously, sometimes forming small tailing shrubs. The outer surfaces of its roots are characteristically bright orange. The branches are round, glabrous, light to dark brown, usually with noticeable lenticels. Small greenish flowers occur in clusters in the leaf axils. At maturity, globular, green to yellow fruits split open to reveal three red-orange, fleshy arils that contain the seeds. This species may be distinguished from the native American bittersweet (*Celastrus scandens)* by the location of its fruit. *C. orbiculatus* has small clusters in the leaf axils while *C. scandens* has clusters only at its branch tips. Oriental bittersweet has been shown to hybridize with American bittersweet which may lead to the loss of American bittersweet's genetic identity through introgression.

1.Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized Oriental bittersweet populations. Roots and runners will resprout unless they are completely removed, so management must be frequent enough to eventually remove the entire root system.

Methods:

Dig or pull each individual oriental bittersweet vine from the soil by the roots making sure to remove as much of the root system as possible. Use a digging tool or weed wrench for larger vines. Because of the persistence of the seed bank and oriental bittersweet's ability to spread by root suckering, mechanical control is usually a long-term project. It is most practical in a small plot, or in an area where chemical control is not an option. Pulling or digging plants is rarely successful unless all the root material can be removed. Even then, germination of seeds will continue for several growing seasons.

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. Do not pull or dig up plants that are in fruit as this may aide in seed dispersal.

Disposal:

All plant parts and contaminated soil should be burned or bagged and disposed of to prevent re-establishment. Solarize and then dispose of in an approved landfill or incinerate with the appropriate permits.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

2.Herbicide

Effectiveness:

Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of Oriental bittersweet. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Oriental bittersweet can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of Oriental bittersweet or other plants.

Treatments:

Use glyphosate or triclopyr formulations only by one or more of the following means:

- A foliar spray of glyphosate or triclopyr has been found to be effective in controlling populations of Oriental bittersweet. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots. Although spring and summer herbicide applications appear to be more effective, the ideal times to spray are in the early spring or immediately after the first hard frost when most native plants are dormant but bittersweet is still actively photosynthesizing. Treatments made during these times reduce or eliminate the risk of affecting non-target species. If the size of the infestation or the height of the plants inhibits effective spraying, mow or cut all vines in the early summer, allow at least 6 weeks of regrowth, and then spray the regrowth.

- A cut stump application of glyphosate or triclopyr applied immediately after cutting is also an effective means of controlling Oriental bittersweet. Use this method in areas where vines are established within or around non- target plants, or where vines have grown into the canopy. Cut stump treatments should be conducted during the growing season after full leaf expansion when nutrients are being actively transported to the roots. Delay in application after cutting may result in reduced effectiveness.

- A basal bark application of triclopyr applied to the lower trunk of each vine can also be effective in controlling Oriental bittersweet. A string trimmer or hand saw should be used to remove a band of the foliage from the main vine near the ground. A triclopyr based herbicide and a penetrant should then be applied to the exposed vine. If the Oriental bittersweet vines are twining around other host shrubs or trees, avoid as much as possible applying herbicide to the host plant. This treatment method can be conducted year round although efficacy may vary seasonally. For best results temperatures should be above 50ºF for several days.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
- Cut stump application - commercial-grade spray bottle with adjustable nozzle, backpack sprayer with adjustable nozzle, wash bottle, eye dropper, or paintbrush
- Basal bark application – commercial-grade spray bottle with adjustable nozzle, backpack sprayer with adjustable nozzle, or paintbrush

Cautions:
Glyphosate based herbicides are nonselective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not apply in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act.

Be sure to always take appropriate precautions, 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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a “burn down” effect on plants like some other contact herbicides do. Within 1-2 weeks the plants will look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

CONTROL METHODS FOR WILD PARSNIP
(Pastinaca sativa)

Plant Description

Wild parsnip is a biennial or perennial herbaceous plant that can reach two to five feet tall. Its basal leaves are pinnately compound with saw-toothed edges. Branching stems with reduced, sessile leaves bear umbels of small yellow flowers from mid-June to early August. Wild parsnip, which is also known as poison parsnip, is a member of the carrot/parsley family. It typically grows a low, spindly rosette of leaves in the first year while the root develops. In the second year it flowers on a tall stalk and then dies. The plant can form dense stands and spreads quickly in disturbed areas such as abandoned fields and roadsides. It produces broad, oval seeds before dying off. These seeds are easily dispersed by wind, water, and on mowing or other equipment. Wild parsnip can form dense stands that out-compete native grassland plants, reducing biodiversity. Wild parsnip is also toxic to humans if exposed skin comes in contact with the plant's sap. The sap contains chemicals that are activated by sunlight and may cause serious burns and blistering.

1. Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized wild parsnip populations. Wild parsnip plants have a long branching tap root and efforts must be made to remove as much of this root as possible to prevent re-sprouting.

Methods:

Dig or pull each individual wild parsnip plant from the soil by the roots making sure to remove as much of the root system as possible. Use a digging tool for larger plants. Because of the persistence of the seed bank, mechanical control is usually a long-term project. It is most practical in a small plot, or in an area where chemical control is not an option. Pulling or digging plants is rarely successful unless all the root material can be removed. Even then, germination of seeds will continue for several growing seasons.

Cautions:

Wild parsnip's sap is toxic to humans and can cause severe burns or blistering on exposed skin. In order to prevent this, proper personal protective equipment such as boots, pants, a long-sleeved shirt, and gloves should be worn at all times while managing this plant. 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. Do not pull or dig up plants that are in seed as this may aide in dispersal.

Disposal:

All plant parts and contaminated soil should be bagged and disposed of to prevent re-establishment. Solarize and then dispose of in an approved landfill or incinerate with the appropriate permits.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

2. Cutting/Mowing

Effectiveness:

Multiple repeated cuttings or mowings over consecutive field seasons may be effective in suppressing, containing, or locally eradicating early detection to medium sized infestations of wild parsnip.

Methods:

Cut or mow the wild parsnip plants close to the ground beginning when the plants first come into flower in mid-June. Cuttings or mowings should be repeated at least once a month or as new flowering plants are observed until the end of the growing season. Due to wild parsnip's persistent seed bank, this approach will likely need to be continued for several consecutive years in order to be effective.

Cautions:

Wild parsnip's sap is toxic to humans and can cause severe burns or blistering on exposed skin. In order to prevent this, proper personal protective equipment such as boots, pants, a long-sleeved shirt, and gloves should be worn at all times while managing this plant. Additional precautions may be necessary if mowing or cutting equipment results in excessive sap splash. In these situations protective eye glasses and head protection may also be necessary. This strategy must be carried out for several years to see a reduction in infestations. Do not cut or mow if plants have already gone to seed as this will likely aid in dispersal.

Disposal:

If possible, bag all cut plant material and remove from site. Solarize and then dispose of in an approved landfill or incinerate with appropriate permits. Mowed or mulched plant material can be left on-site to decompose.

Sanitation:

Clean all clothing, boots, and equipment to prevent spread of propagules.

3. Herbicide

Effectiveness:

Herbicide treatments can be effective in containing, suppressing, or locally eradicating early detection to medium sized infestations of wild parsnip. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Wild parsnip can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of wild parsnip or other plants.

Treatments:

A foliar spray of glyphosate or triclopyr has been found to be effective in controlling populations of wild parsnip. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots. Treatments have been shown to be most effective when the plants first come into flower in mid-June. Fall applications from late August into October can also be effective for the first year rosettes once the second year plants have been pulled or have senesced. Herbicide treatment of adult plants after they have already gone to seed is not advised as these plants will die back naturally after seed dispersal. Treating plants that have

already gone to seed will not influence subsequent seed viability.

For spot treatments use any of the following application equipment:

- Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
- Wiper application - sponge tip applicator with wick or cloth glove applicator

Cautions:
Wild parsnip's sap is toxic to humans and can cause severe burns or blistering on exposed skin. In order to prevent this, proper personal protective equipment such as boots, pants, a long-sleeved shirt, and gloves should be worn at all times while managing this plant.

Glyphosate based herbicides are nonselective (kills both monocots and dicots), thus should be applied carefully to prevent killing of non-target species. Triclopyr formulations are selective and will only affect broadleaf weeds leaving grasses and conifers unaffected. All herbicide solutions should be mixed with clean, potable water as glyphosate binds tightly to organic material, which may reduce its toxicity to plants.

Do not apply in windy conditions as spray may drift and affect other non-target plants. Do not apply if rain is forecast within 12 hours as herbicide may be washed away before it can act.

Be sure to always take appropriate precautions, 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 and to keep track of where you have already applied herbicide.

Be patient. Systemic herbicides like glyphosate and triclopyr do not create a "burn down" effect on plants like some other contact herbicides do. Within 1-2 weeks the plants will look sick. There may be dead tissue spots on most leaves and many yellowing leaves. Do not waste herbicide, money or effort by spraying plants more than once during a growing season. Sick plants cannot effectively absorb the herbicide through the leaf surface or translocate the herbicide to the roots.

Appendix C. Expedited-Review Authorization Form for Control of Invasive Plant Species on Adirondack DEC Managed Lands

EXPEDITED-REVIEW AUTHORIZATION FORM FOR CONTROL OF INVASIVE PLANT SPECIES ON DEC ADMINISTERED LANDS OF THE ADIRONDACK PARK

STATE LAND UNIT INFORMATION

STATE LAND UNIT:

Site specific work plan already completed? No ☐ Yes ☐ Covered by UMP? No ☐ Yes ☐

Site ≤ 100' from a wetland? No ☐ Yes ☐ Site located in State Forest or WMA? No ☐ Yes ☐

If all above are "No": Site specific SEQR required and workplan attached? No ☐ Yes ☐

Location Map attached: ☐ Photo(s) attached: ☐

UTM Coordinates (NAD83) of Infestation: 18 E N

TARGET PLANT SPECIES

Invasive Specie(s) to be controlled:

INFESTATION CHARACTERISTICS

Area of Infestation:

NATURAL HERITAGE

Natural Heritage Review Completed: ☐ Listed Species Present? No ☐ Yes ☐

Listed Species (if any):

HERBICIDE TREATMENT DESCRIPTION

Proposed Start Date:

Herbicide Active Ingredient & Formulation:

Project Narrative:

AUTHORIZATION (DEC ONLY)

This project as described is in compliance with the terms and conditions of the Inter-Agency Guidelines for Implementing Best Management Practices for the Control of Terrestrial and Aquatic Invasive Species on DEC Administered Lands in the Adirondack Park, the Adirondack State Land Master Plan, and all other applicable rules and regulations, policies and procedures.

_____ _____

Regional Forester Date

Appendix D. Herbicide Labels and Material Safety Data Sheets (MSDS)*

*Please refer to Cornell University's Product, Ingredient, and Manufacturer System (PIMS) for the most up to date pesticide product information.
http://pims.psur.cornell.edu/

Appendix E. Bibliography and References

Chippendate, J.F. 1991. Potential returns to research on rubber vine (*Cryptostegia grandiflora*). M.S. Thesis University of Queensland, Brisbane.

Elton, Charles S. 2000. *The ecology of invasions by animals and plants*. Chicago, IL: University of Chicago Press.

Hobbs, Richard J. and Stella E. Humphries. 1995. An integrated approach to the ecology and management of plant invasions. *Conservation Biology* 9(4): 761-770.

Huxel, Gary R. 1998. Rapid displacement of native species by invasive species: effects of hybridization. *Biological Conservation* 4(Nov): 143-52.

Kurdila, Julianne. 1995. The introduction of exotic species into the United States: there goes the neighborhood. *Boston College Environmental Affairs Law Review* 16: 95-118.

Pimental, David *et al*. 1999. Environmental and economic costs of nonindigenous species in the United States. *Bioscience* 50: 53-65.

Roberts, L. 1990. Zebra mussel invasion threatens U.S. waters. *Science* 249: 1370-1372.

The Nature Conservancy. 1996. America's Least Wanted: Alien Species Invasions of U.S. Ecosystems. Arlington, VA: The Nature Conservancy.

Williams, Mark H. and Bryan Griffiths. 1997. *Biological invasions*. Norwell, MA: Kluwer Academic Publishers.

Smith, Hilary. 2009. Is restoration necessary following invasive plant removal? An assessment of three species in the Adirondack Park. Unpublished Masters Thesis.