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

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I. INTRODUCTION

The negative impacts of invasive species (IS) on natural 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 (Yellow Wood Associates 2014; ECL §9-1707). Over the past 20 years, invasive species have been colonizing at increasing rates along roadsides, in campgrounds, and in waterbodies within New York State Department of Environmental Conservation (DEC or Department) administered lands within the Adirondack Park. Many of these species have the potential to colonize backcountry lands, lakes and ponds and degrade the environmental quality 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 conform with this Constitutional provision.

Management of the Adirondack Forest Preserve is guided 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.

A 2016 update to the Master Plan recognizes invasive species as a documented threat to the integrity of the Forest Preserve. To protect natural resources, minimize economic impact, preserve aesthetic value and promote human safety, the Master Plan provides in relevant part:

> *"Efforts should be made to restore and protect the native ecological communities through early detection and rapid response efforts to eradicate or control existing or newly identified invasive species populations. Subject to existing policy and guidelines, the Department will use the basic tools needed to preserve, protect and restore the natural native ecosystems of the Forest Preserve."*

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 as one of the nine land-uses set forth in the Master Plan. The UMPs must conform to the guidelines and criteria set forth in the Master Plan and apply the Master Plan's general guidelines for particular classifications of State Land within the Adirondack Park. References to invasive species will be included in UMPs as they are updated or revised.

Executive Law §816(1) provides in part that "until 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. However, in recognition of the significant threat posed by invasive forest pests, Environmental Conservation Law §9-1303 grants the Department or its duly authorized agents multiple provisions to control and prevent the spread of forest insects and forest tree diseases including "discretionary authority to poison forest areas in or near sections infested by insect pests or forest tree diseases."

Surveys of DEC administered lands document the continued introduction and expansion of invasive species into and throughout the Adirondack Park (see Section V below). Given that models indicate 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; Quirion et al 2017), 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 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 constitutional "forever wild" provisions with the overriding directive in the Master Plan to manage Forest Preserve lands for their protection and preservation. The BMPs have been developed pursuant to, and are consistent with, relevant provisions of the New York State Constitution, the Environmental Conservation Law, 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 terrestrial invasive species activities that involve work in or within 100 feet of jurisdictional wetlands on private or public lands may require a permit from the APA.

II. GOAL OF THE GUIDELINES

To protect and restore native ecological communities on DEC administered lands in the Adirondack Park through early detection and rapid response (EDRR) efforts that address existing or newly identified invasive species infestations.

III. OBJECTIVES OF THE GUIDELINES

These Guidelines describe the process through which any active invasive species management will take place on DEC administered lands in the Adirondack Park. The Guidelines provide BMPs that describe what management practices are allowed and when they can be implemented, who is authorized to implement them, and which species can be targeted. Species or techniques that are not included in this guidance may be addressed by the Department on a case-by-case basis in consultation with the Agency. 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 BMPs.

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 species on or in close proximity to the Unit. The Guidelines will guide invasive 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 invasive species on DEC administered lands using the listed BMPs. The Partnership Agreement will be accompanied with a Site-specific or Rapid Response Work Plan (Work Plan) for the invasive species management activity and include provisions for monitoring control efficacy and native plant recovery. As noted above, the Site-specific or Rapid Response Work Plan will provide detail regarding the selected management options on a site-specific basis.

IV. DEFINITIONS

2ee Special Registration – A special allowance under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) that allows a pesticide to be applied:

1. At any dosage, concentration, or frequency less than that specified on the labeling unless the label prohibits the deviation
2. Using any method of application that is not prohibited by the labeling
3. Against any target pest not specified on the labeling if the crop, animal, or site is specified on the labeling and the labeling does not prohibit the use.

Adirondack Park Invasive Plant Program (APIPP) – The Adirondack Partnership for Regional Invasive Species Management (PRISM); a program founded by the Department, Agency, NYS Department of Transportation, and the Adirondack Chapter of the Nature Conservancy whose goals are:

1. Prevent new introductions of invasive species into the PRISM
2. Coordinate a region-wide early detection & rapid response program for new infestations
3. Manage existing priority infestations to mitigate impacts

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

Agency – The New York State Adirondack Park Agency, its officers and employees.
Aquatic Invasive Animal Species – A non-native animal that requires a watery habitat, but do not always live entirely in water, that causes environmental, economic or societal harm.

Aquatic Invasive Plant Species – A completely submerged or floating non-native plant that is typically found in lacustrine or riparian settings (including lakes, ponds, rivers or streams) that causes environmental, economic or societal harm.

Aquatic Invasive Species (AIS) – Organisms that are not native to our aquatic ecosystems and can threaten New York State's aquatic ecology, economy, and human health.

Best Management Practice (BMP) – State-of-the-art mitigation measures applied on a site and species specific basis to reduce, prevent, or avoid adverse impacts.

Benthic Barrier – Mats that are placed on the lake bottom to block sunlight and smother undesirable vegetation

Biological Control – A method of controlling invasive species that relies on predation, parasitism, herbivory, or other natural mechanisms.

Certified Applicator – An individual who has successfully completed training and licensing and who holds a valid pesticide applicators license in New York State.

Control Method – A field tested recommendation for the most effective control of an invasive species. Species-specific control methods are attached in Appendix B-D. As of this writing, only non-mechanical harvesting techniques (hand-pulling, suction harvesting), temporary benthic barriers, or select biological controls are approved control methods for aquatic invasive species. Additional guidance for the use of aquatic herbicides may be developed at a later date after consultation with the Department and the Agency.

Containment – preventing an established infestation from spreading into nearby uninvaded areas

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

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

Early Detection and Rapid Response (EDRR) - a systematic effort to eradicate, contain, or control a potentially invasive non-native species introduced into an ecosystem while the infestation of that ecosystem is still localized

Eradication – eliminating all individuals 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.

General Permit 2014G-1A – An Agency issued permit for the management of terrestrial invasive

species in or within 100 feet of wetlands in the Adirondack Park

General Permit 2015G-1 – An Agency issued permit for the rapid response management or containment of AIS using benthic barriers or hand harvesting techniques within the Adirondack Park

General Permit 2015G-2 – An Agency issued permit for the management of AIS using benthic barriers or hand harvesting techniques within the Adirondack Park

General Permit GP-0-15-005 – A Department issued permit required for management of AIS using hand harvesting, suction harvesting, or benthic barriers within:

1. The bed or banks of protected streams
2. Navigable waters
3. A designated wild, scenic, or recreational river area

Herbicide – A pesticide that is registered in New York State to control plants. Due to the sensitive nature of DEC administered lands, only selected herbicide active ingredients are included for use under these Guidelines, as identified in Appendix B. In all cases, herbicides must be used in strict compliance with label precautions, the species-specific control methods found in Appendix B, and the safety precautions found in Appendix F.

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

Insecticide – A pesticide that is registered in New York State to control insects. In all cases, insecticides will be used in strict compliance with label precautions, species specific control methods found in Appendix D, and safety precautions found in Appendix F.

Invasive Forest Pest – A non-native insect or pathogen that is typically found in forest settings and causes environmental, economic or societal harm.

Invasive Species – a species that is:

1. Non-native to the ecosystem under consideration; and
2. Whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Local Eradication – eliminating all individuals 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.

Memorandum of Understanding (MOU) – Memorandum of Understanding between the Adirondack Park Agency and the Department of Environmental Conservation Concerning Implementation of the State Land Master Plan for the Adirondack Park.

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, Adopt-a-Natural Resource Agreement or contract.

Pesticide – Any substance or mixture of substances that is registered in New York State to control 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.

Pesticide Application Method – The means by which pesticide product is delivered to a target organism during a pesticide treatment. The methods of pesticide application will be by the means specified in Appendix B & D. No application will be allowed by high pressure broadcast or boom sprayers.

Rapid Response Work Plan – An abbreviated description of work to be performed on new, isolated terrestrial invasive species infestations

Site-specific Work Plan – A detailed description of work to be performed at a specific site, the BMPs that will be used to perform the work, and the desired final condition of the site upon completion.

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

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.

Terrestrial Invasive Plant Species – A non-native plant that is typically found in upland or wetland settings that can cause environmental, economic or societal harm.

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.

V. PRESENT EXTENT OF INVASIVE SPECIES ON DEC ADMINISTERED LANDS

An inventory of invasive species that are present and a measure of the extent of the invasive species infestation is essential to determining the correct course of action. The Department, APIPP and other organizations conduct ongoing regular, systematic surveys to identify and quantify the extent of invasive species on DEC administered lands in the Adirondack Park. The results of surveys are documented in Unit Management Plans (UMPs). When UMPs are updated, the best available invasive species distribution information will be included. Detailed invasive species location and population information is included in the iMap Invasive Species Database and on APIPP's website (www.adkinvasives.com).

The Department seeks 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 infestations and threats.

VI. CONTROL OF INVASIVE SPECIES AND PROCEDURE FOR IMPLEMENTATION

General parameters for the control of invasive species that apply regardless of the targeted species are set forth below. Specific control methods for select invasive species are attached as Appendix B-D. These BMPs will be implemented through Work Plans with corresponding SEQRA compliance and/or complementary permits from the Department and/or Agency, when necessary.

If the Department determines during its review of a proposed Work Plan that the proposed management activities may potentially have a material effect on the character or use of the land, water or the vegetation thereon or within, 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 are minimized since the recommended BMPs avoid and mitigate impacts to native ecological communities.

TO CONTROL TERRESTRIAL INVASIVE SPECIES:

Management of terrestrial invasive species on DEC administered lands must be approved by the Department's Central Office. Agreements with outside parties thru Volunteer Stewardship Agreements, Adopt-a-Natural Resource Agreements, and Temporary Revocable Permits for Use of State Lands, collectively referred to as Partnership Agreements in these guidelines are required to conduct invasive species management. These Partnership Agreements will require Work Plans with corresponding SEQRA compliance.

1. **Terrestrial Invasive Plants -** To accommodate mechanical or chemical EDRR efforts for terrestrial invasive plant 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.

2. **Invasive Forest Pests -** To accommodate chemical EDRR treatments for invasive forest pests, initial control of new infestations discovered on DEC administered lands within the Adirondack Park under 10 acres in extent may be conducted through an Expedited-Review Authorization process upon notification and approval from the appropriate DEC regional office.

However, Expedited-Review Authorizations for both terrestrial invasive plant species and invasive forest pests must still comply with SEQRA. 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.

TO CONTROL AQUATIC INVASIVE SPECIES:

Management of AIS on DEC administered lands in the Adirondack Park must be completed in accordance with the BMPs described in these Guidelines. In addition, general permits must be submitted to and approved by both the Department and Agency. Applications will include a Site-specific Work Plan of the proposed management action or a description of actions to be conducted by a regional rapid response team.

VII. BEST MANAGEMENT PRACTICES FOR INVASIVE SPECIES SPREAD PREVENTION

The following BMPs apply to the prevention of invasive species.

1. Prevent the introduction of invasive species to uninvaded areas.
Invasive species can be introduced to a site or waterbody by moving contaminated equipment, watercraft, fill and other off-site material. Monitoring disturbed areas and properly inspecting, sanitizing and/or decontaminating equipment will help prevent new infestations. BMPs to prevent the introduction of invasive species include:

- Clean all clothing, boots, and equipment between projects.
- Inspect and decontaminate watercraft between waterbodies. Follow the Clean. Drain. Dry. approach.
- Begin activities in uninfested areas before operating in infested areas.
- Use native plants and weed-free seed and mulch (straw, wood fiber) for restoration activities.
- Use clean fill that does not contain invasive plant seeds or material.
- Keep equipment on-site during the entire project.
- 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 is least likely.

- Don’t move firewood or potentially infested host-wood material; unless transport is required for sanitary disposition in accordance with BMPs described in Appendix D.

2. Minimize disturbance.
Invasive plants prefer and often thrive under disturbed conditions. Do not create disturbance unless absolutely necessary. BMPs for activities involving site disturbance include:

- Before starting ground-disturbance activities, inventory invasive plant infestations both on-site and in the adjacent area.
- Minimize soil disturbance and retain desirable vegetation in and around the management area to the maximum extent possible.
- Monitor infested areas for at least three growing seasons following completion of management activities. Provide for follow-up treatments based on inspection results.
- 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 areas.
- When mowing, set the deck height to a level that prevents scouring or scarring of the soil surface.

3. 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:

- Use selective management techniques to protect and preserve existing desirable native vegetation at the site.
- Re-vegetate all disturbed soil, except on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance 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.
- In terrestrial habitats, when possible, retain relatively closed canopies to suppress growth of invasive plants and prevent their establishment.

VIII. GENERAL BEST MANAGEMENT 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 DEC administered lands 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.

2. **Erosion Control** - Some of the BMPs 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 likely. 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. **Turbidity Control –** Some of the BMP's described in Appendix C require harvesting of plants from the benthos. Where extensive aquatic vegetation removal is to be conducted, turbidity curtains must be installed, as needed, to ensure waters outside the management area are not impaired. The curtains must be removed when sediments have settled and the pre-management water clarity has returned.

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

5. **Solarization** - Because of the aggressive growth of terrestrial invasive plant species, composting harvested plant material in a typical backyard compost pile or composting bin is not appropriate. In many instances, composting terrestrial 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 terrestrial 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 obtaining the appropriate permits.

6. **Terrestrial Invasive Plant Material Collection and Transportation** – While at 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 to prevent spread or loss of the plant material during transport from the control work site to the appropriate staging or disposal location. Host-wood material that is potentially infested with invasive forest pests should be disposed of in accordance with BMPs described in Appendix D.

7. **Aquatic Plant Material Collection and Transportation –** While at the control site, place all harvested plant material in bags. Securely tie the bags and transport them overland to an appropriate staging or disposal location in a covered vehicle to prevent the spread of loss of the plant material. Aquatic plant biomass can be disposed of at an upland location, off of Forest Preserve land, where there is no potential for re-introduction to an aquatic habitat via wind or water currents. If off-site removal of biomass isn't feasible due to large volumes of plant material or significant transport distance, plant material may be scattered on Forest Preserve with permission from the Agency and Department. Disposal techniques must be in accordance with General Permits 2015G1, 2015G2 and/or GP-0-15-005.

IX. MANAGEMENT PROTOCOLS

1. 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 invasive species infestations encountered during their ordinary work to the Adirondack Park Invasive Plant Program (APIPP) or the Department. Invasive species identification and management trainings will be provided as needed.

2. All Work Plans must fulfill the requirements described within these guidelines and the complementary Agency and/or Department General Permit(s), when necessary.

a. **Site-specific Work Plans** must include a site map, an inventory of target and non-target species, an estimate of the size 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, revegetation and contingency plans, as well as any other information specified in Agency or Department permits.

b. **Rapid Response Work Plans** for mechanical or chemical control of terrestrial invasive plant infestations under 0.1 acres, or chemical control of invasive forest pest infestations under 5.0 acres, can be submitted for Expedited Review Authorization. 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, and the Applicant shall, complete a formal Site-specific Work Plan before the next field season. See Appendix E.

3. All invasive species management on State Land will be conducted using the BMPs listed in Appendix B-D, pursuant to the DEC – APA Memorandum of Understanding.

4. Any individual, group or government entity demonstrating an interest and appropriate expertise in implementing the BMPs found in Appendix B-D may apply for a Partnership

Agreement to manage invasive species. The treatment of invasive species on DEC administered 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, biomass removal, transport and disposal.

5. Written approval from the Department, in the form of a Partnership Agreement for all non-Department personnel and a Site-specific or Rapid Response Work Plan for treatment of invasive species are required to implement species-specific control methods on DEC administered land.

6. Prior to implementation of work plans for the treatment of invasive species the activity must be posted in the Environmental Notice Bulletin.

a. No work will be implemented under a Site-specific Work Plan until being noticed in the ENB for 15 days.
b. Approved EDRR plans can be implemented immediately upon being noticed in the ENB.

7. Appropriate certification and training is required for pesticide applications. The only pesticide application methods allowed under these guidelines are selective spot treatments by the following means:

a. Foliar spray application using a back-pack sprayer or hand sprayer
b. Wiper application using a wick applicator or cloth glove applicator
c. Stem injection application using a stem injection gun, unitary wash bottle, or hand sprayer
d. Cut stump application using a unitary wash bottle, paintbrush, backpack sprayer, or hand sprayer
e. Basal bark application using a backpack sprayer, hand sprayer, or paintbrush
f. Frill or tree injection method using an injection lance, hatchet and unitary wash bottle, spray bottle, hypo hatchet, Arborjet, or similar trunk injection system

8. No broadcast pesticide applications using, for example, boom or aerial sprayers, are allowed. In all cases, all directions for use and restrictions found on the pesticide label shall be followed by personnel applying pesticides. In all instances, the label is the law and should be followed accordingly.

9. 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 or insects that were missed or not impacted by the initial treatment.

10. 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.

11. Any use of motor vehicles or motorized equipment where such use is not already open to members of the public is not permitted unless specified in an approved Work Plan.

12. 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.

13. Invasive species management materials and methods evolve over time. Any deviation from the BMPs and species-specific control methods must be approved by the Department after consultation with the Agency.

14. Any invasive species management action proposal that involves tree cutting must be identified and approved in a Site-specific or Rapid Response Work Plan.

15. Appendix A of these Guidelines contains a list of target invasive species. Other species and control methods may be added over time recognizing the constant introduction of new invasive species and evolving control techniques. 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.

X. POTENTIAL ENVIRONMENTAL IMPACTS

The control methods and BMPs contained in these Guidelines are intended to restrict the use of pesticides so that adverse impacts to non-target species are minimized and native plant communities are protected. AIS will be managed using non-mechanical harvesting techniques (hand-pulling, suction harvesting), temporary benthic matting, or biological controls. Use of pesticides for aquatic invasive species control is not part of the Guidelines at this time.

The removal of invasive species reduces the potential for destruction and harm to New York's environment and economy. It is expected that by using these Guidelines invasive species infestations will be managed, and in some cases, locally eradicated. However, it should be recognized that eradication is not always an achievable or realistic goal. For large or well-established populations, containment or suppression may be a more appropriate management goal. Nevertheless, implementation of these control methods and BMPs will help ensure that natural processes continue unabated and economic impacts are minimized or avoided.

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.

XI. EFFECT OF THIS ACTION

The Guidelines seek to lay the ground rules for managing invasive species on DEC administered lands. It identifies certain species that, if left untreated, have the potential to colonize backcountry land and waterbodies 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. The control methods provide detailed guidance on the use of several techniques for managing invasive species including hand pulling, cutting, digging, matting and pesticides. Finally, the Guidelines identify a host of additional invasive species that are not yet known to be present in the Adirondack Park but will require surveillance, early detection and, after appropriate consultation with the Department and/or Agency, an expeditious response to protect DEC administered lands once they arrive.

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.

XII. 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 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 assessment of materiality of proposed actions in UMPs.

APPENDIX A. INVASIVE SPECIES OF CONCERN

The 56 species included below – in addition to all prohibited and regulated species under 6 CRR-NY 575.3 and 575.4 – 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. The species referenced below have recommended control methods that are included in Appendix B - D. This appendix should be reviewed and updated as needed.

Terrestrial Plants

Grasses

- Common reed (*Phragmites australis* ssp. *Australis)*
- Reed canary-grass (*Phalaris arundinacea*)
- Slender falsebrome *(Brachypodium slyvaticum)*
- Japanese stiltgrass (*Microstegium vimineum*)

Herbaceous Plants

- Purple loosestrife (*Lythrum salicaria*)
- Japanese, giant and bohemian knotweed (*Reynoutria spp.)*
- Yellow iris (*Iris pseudacorus*)
- Giant hogweed (*Heracleum mantegazzianum*)
- White and yellow sweet-clover (*Melilotus alba, M. officinalis*)
- Wild parsnip (*Pastinaca sativa*)
- Indian cup plant (*Silphium perfoliatum*)
- Spotted and brown knapweed (*Centaurea stoebe ssp. micranthos, C. jacea*)
- Lesser celandine (*Ranunculus ficaria*)
- Garlic mustard *(Alliaria petiolata)*

Herbaceous Vines

- Mile-a-minute vine (*Polygonum perfoliatum*)
- Black and pale swallow-wort (*Cynanchum louiseae, C. rossicum*)

Woody Vines

- Japanese honeysuckle (*Lonicera japonica*)
- Oriental bittersweet (*Celastrus orbiculata*)
- Porcelain-berry (*Ampelopsis brevipedunculata*)

Woody Shrubs

- Bush honeysuckles (*Lonicera morrowii, L. tatarica, L. maackii, L. x. bella, L. xylosteum*)

Trees

- Norway maple (*Acer platanoides*)
- Tree-of-heaven (*Ailanthus altissima*)
- Japanese angelica tree *(Aralia elata)*

Shrubs

- Autumn and Russian olive (*Eleagnus umbellata, E. angustifolia*)
- Common and glossy buckthorn (*Rhamnus cathartica, R. frangula*)
- Multiflora and rugosa rose (*Rosa multiflora, R. rugosa*)
- Japanese and European barberry (*Berberis thunbergii, B. vulgaris*)
- Winged euonymus (*Euonymus alata*)
- Scotch broom *(Cytisus scoparius)*
- Wineberry *(Rubus phoenicolasius)*

Aquatic Plants

Submerged

- Eurasian and variable-leaf watermilfoil, and parrotfeather (*Myriophyllum spicatum, M. heterophyllum, M. aquaticum*) +
- Fanwort (*Cabomba caroliniana*)+
- Curly-leaf pondweed (*Potamogeton crispus*) +
- Brazilian elodea (*Egeria densa*)+
- Hydrilla (*Hydrilla verticillata*)+

Floating

- Water chestnut (*Trapa natans*) +
- European frog-bit (*Hydrocharis morsus-ranae*) +
- Yellow floating-heart (*Nymphoides peltata*)+

Aquatic Pests

- Asian clam (*Corbicula fluminea*)
- Zebra mussel (*Dreissena polymorpha)*
- Quagga mussel (, *Dreissena rostriformis bugensis)*

Forest Pests

Insects

- Hemlock woolly adelgid (*Adelges tsugae*)

APPENDIX B. SPECIES-SPECIFIC CONTROL METHODS FOR TERRESTRIAL INVASIVE PLANTS

INTRODUCTION

The BMPs listed below are for species already present in the Adirondack region, or those present in NYS and approaching the 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), 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) 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.

GRASSES

SLENDER FALSE BROME (*Brachypodium sylvaticum*)

PLANT DESCRIPTION
Slender false brome is an annual bunch grass native to Eurasia. Mature plants reach 18+ inches tall and have a distinctive drooping growth habit. The leaf blades are bright green and have fine hairs along the margins. The lower stem is also covered with fine white hairs. Roots are reported to have a prominent wintergreen aroma when crushed. Seed spiklets are pale green and droop near the inflorescence. Slender false brome is highly invasive in a wide range of habitat types; growing well in sun or shade and moist or dry soil. Slender false brome can dominate wetlands, forests, disturbed sites, etc. Plants are spread primarily by seed that is dispersed by humans and wildlife.

MANAGEMENT OPTIONS
1. Digging/Pulling
Effectiveness:
Digging or hand pulling is an effective method for containing, suppressing, or locally eradicating early detection to small sized infestations of slender false brome. Mechanical management should be performed in late spring or early summer, prior to seed structure development.

Methods:
Slowly dig or pull each plant by the base to ensure the entire root system is removed. Root fragments that are left behind may re-sprout into new plants. Disturbed soil should be tamped down firmly after removing plants. Soil disturbance can bring existing false brome seeds to the surface, thus creating a favorable environment for additional germination within the control site.

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

Cautions:
Care should be taken to minimize soil disturbance and remove all root tissues. Re-sprouting may occur from the plant's root systems if not entirely removed. Additionally, digging disturbs the soil, may fragment rhizomes, and promotes germination of false brome and other undesirable species from the soil seed bank.

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

2. Cutting/Mowing
Effectiveness:
Cutting or mowing can be effective in containing or suppressing early detection to medium sized infestations of slender false brome. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting may need to be repeated multiple times within a growing season to prevent seed production and dispersal.

Methods:
Cut or mow slender false brome at ground level either manually or with motorized equipment just before its flowering period. Repeated mowing/cutting may be required within a growing season, and the actions must be repeated annually. Persistent mowing/cutting will prevent seed production/dispersal, but is unlikely to result in local eradication.

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 large sized slender false brome infestations. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target impacts.

Slender false brome can be effectively controlled by glyphosate based herbicides. Glyphosate based formulations will not affect subsequent seedling emergence of false brome or other plants.

Treatments:
Use glyphosate formulations only. Apply herbicide directly to the foliage of slender false brome using the selective application techniques identified below.

For spot treatments use any of the following application techniques:

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

JAPANESE STILTGRASS (*Microstegium vimineum*)

PLANT DESCRIPTION

Japanese stiltgrass is an annual grass native to Asia. It grows one to three feet tall and has a small stem that resembles bamboo. The leaves are narrow and lance shaped with a prominent, silver strip that runs along the midrib on the upper surface. The inflorescence of Japanese stiltgrass is inconspicuous, appearing from late-summer to early-fall. Stiltgrass prefers moist soil and shaded areas. It can readily invade forest understories, marshes, floodplains, wetlands, etc. where it forms dense carpets of vegetation that exclude native plant species. Japanese stiltgrass spreads primarily through seed, which are easily transported by humans and natural vectors.

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 infestations of Japanese stiltgrass. Mechanical management should be performed prior to seed structure development.

Methods:

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

Disposal:

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

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. Additionally, digging disturbs the soil, may fragment rhizomes, and promotes germination of Japanese stiltgrass and other undesirable species from the soil seed bank.

Sanitation:

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

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in containing or suppressing early detection to large sized infestations of Japanese stiltgrass. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting may need to be repeated multiple times within a growing season to prevent seed production and dispersal.

Methods:

Cut or mow Japanese stiltgrass at ground level either manually or with motorized equipment just before its flowering period. Repeated mowing/cutting may be required within a growing season,

and the actions must be performed annually. Persistent mowing/cutting will prevent seed production/dispersal, but is unlikely to result in local eradication.

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 large sized Japanese stiltgrass infestations. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Japanese stiltgrass can be effectively controlled by glyphosate based herbicides. Glyphosate based formulations will not affect subsequent seedling emergence of Japanese stiltgrass or other plants.

Treatments:
Use glyphosate formulations only. Apply herbicide directly to the foliage of Japanese stiltgrass using the selective application techniques identified below.

For spot treatments use any of the following application techniques:

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

REED CANARY GRASS *(Phalaris arundinacea)*

PLANT DESCRIPTION

Reed canary grass is a tall, coarse, perennial grass with an erect hairless stem. Its leaves are tapered and range from 3.5 to 10 inches long. The flowers are single and occur in dense clusters from May to August. New inflorescences range from green to purple and will transition to a light-brown at maturity. The ligule of reed canary is transparent, distinguishing it from several native grass species. Spread occurs vegetatively via creeping rhizome and by seed; however, the establishment of seeds is assumed to low.

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 infestations of reed canary grass. Plants should be removed before inflorescences have developed to avoid inadvertent spread or dispersal of seeds.

Methods:

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

Disposal:

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

Cautions:

Care should be taken to minimize soil disturbance and remove the entire root system. Re-sprouting can occur from small fragments of rhizome that are left behind.

Sanitation:

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

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in containing or suppressing early detection to large sized infestations of reed canary grass, however, dormant seeds in the soil are unaffected by this technique. Mowing or cutting must be repeated multiple times per growing season to prevent plants from producing seed.

Methods:

Cut or mow reed canary grass at ground level either manually or with motorized equipment before inflorescences develop. This technique will limit spread but does not usually result in mortality of existing plants. Repeat mowing/cutting may be required within a single growing season, and the actions must be performed annually.

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

Reed canary grass can be effectively controlled by both glyphosate and imazapyr based herbicides. Glyphosate will not affect subsequent seedling emergence of reed canary grass or other plants, but the use of imazapyr may inhibit seedling regeneration for several years.

Treatments:
Use glyphosate or imazapyr formulations only. Herbicide should be applied to plants as close as possible to peak flower, but prior to seed formation.

For spot treatments use any of the following application techniques:

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

COMMON REED GRASS (*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 prior to treatment to distinguish the invasive non-native lineage 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 pull up 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 at least 6-8". 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 the 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 large 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 and imazamox 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, while imazamox may provide some residual control.

Treatments:
Use glyphosate or imazamox formulations only. In wetlands, only 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. 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 least 6 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 after 6 weeks, as opposed to potentially 15 feet high without cutting, and will not go to tassel. However, since common reed is a grass, cutting will not only reduce spray height, but often stimulates increased stand density, increasing spray surface area. 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 to fill each hollow stem cavity with herbicide product. Although extremely effective, this technique is 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 techniques:

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

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 structures. 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. The disposal site should be monitored annually to ensure that no resprouting occurs.

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

HERBACEOUS PLANTS

GARLIC MUSTARD (*Alliaria petiolata*)

PLANT DESCRIPTION
Garlic mustard is a naturalized European biennial herb that typically invades partially shaded forested and roadside areas. It exudes an allelopathic compound from its root system that suppresses the growth of surrounding vegetation, creating a dense layer of garlic mustard that excludes 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 infestations of garlic mustard. Plants should be removed before seed pods are mature to avoid inadvertent seed dispersal

Methods:
Dig or pull up each plant by the base 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 large sized populations of garlic mustard, depending on habitat. Dormant seeds in the soil are unaffected by this technique. 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 high 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 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 senesced.

For spot treatments use any of the following application techniques:

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

SPOTTED AND BROWN KNAPWEED
(Centaurea stoebe ssp. micranthos & C. jacea)

PLANT DESCRIPTION
Spotted and brown knapweed are bushy biennials with a taproot native to Europe. They can form large, monotypic stands in disturbed upland habitats, and are most often associated with roadsides, railbeds, utility lines, forest edges, hiking trails, and open fields. First year plants exist as a small basal rosette of deeply divided leaves. Second year plants grow up to 3 feet in height with leaves alternately arranged on the stem. Mature plants will bloom from late June – August, producing numerous flower heads at the tips of terminal or ancillary stems. Flowers are generally pinkish-purple, but in rarer instances, can be white. They are surrounded by green scale-like structures called bracts. Knapweed spreads through prolific seed production. Each mature plant can release over 1000 seeds that can remain dormant in the soil for nearly 10 years. New rosettes may also develop from lateral roots.

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 infestations of knapweed. Plants should be removed before seed structures have developed to avoid inadvertent spread or dispersal.

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

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

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. Additionally, digging disturbs the soil, may fragment rhizomes, and promotes germination of knapweed. and other undesirable species from the soil seed bank.

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

2. Cutting/Mowing
Effectiveness:
Cutting or mowing can be effective in containing or suppressing early detection to large sized infestations of knapweed, depending on the invaded habitat. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting will often need to be repeated annually to reduce an infestation to desired levels.

Methods:
Cut or mow knapweed stems when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique usually results in high mortality of existing plants and will minimize re-sprouting. Repeat mowing/cutting may be required within a single growing season, and the actions must be performed annually.

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

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

Treatments:
Use glyphosate or triclopyr formulations only. The product should be applied to second year plants as close as possible to peak flower, but prior to seed formation. First year rosettes can be treated in the fall when second year plants and native vegetation has senesced.

For spot treatments use any of the following application techniques:

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

LESSER CELANDINE (*Ficaria verna*)

PLANT DESCRIPTION

Lesser celandine is a short lived herbaceous perennial native to Eurasia. Plants are comprised of a basal rosette of dark green, kidney shaped leaves. *F. verna* flowers early in the spring, producing bright yellow flowers with 8-12 leaflets. Plants spread vegetatively via small underground bulbils and tuberous roots. Lesser celandine can form a dense carpet of vegetation in open woods, flood plains and wet meadows that excludes native ephemeral plants.

MANAGEMENT OPTIONS

1. Digging/Pulling

Effectiveness:
Digging or hand pulling is an effective method for containing, suppressing, or locally eradicating early detection to small sized infestations of lesser celandine. Care must be taken to remove all vegetative reproductive structures.

Methods:
Slowly dig up or pull each plant by the base to ensure the entire root system and vegetative reproductive structures are removed. Disturbed soil should be tamped down firmly after removing plants. Soil disturbance can create a favorable environment for additional germination within the control site.

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

Cautions:
Due to its shore life cycle, the management window for lesser celandine is limited. Mechanical management should be conducted prior to the production of vegetative reproductive structures in June. Care should be taken to minimize soil disturbance and remove all bulbils and tuberous roots.

> *NOTE: Lesser celandine closely resembles native marsh marigold (Caltha palustris). Marsh marigold will not grow in large carpets, nor does it produce bulbils. Extreme care should be taken to correctly identify lesser celandine before initiating control efforts.*

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

2. Herbicide

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

Lesser celandine can be effectively controlled using glyphosate based herbicides. Glyphosate will not affect subsequent seedling emergence of lesser celandine or other plants.

Treatments:
Use glyphosate formulations only. To minimize the production of bulbils and tubers, applications are most effective when performed prior to flowering or up to 50% flowering. Apply herbicide directly to the foliage of *F. verna.*

For spot treatments use any of the following application techniques:

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

GIANT HOGWEED *(Heracleum mantegazzianum)*

Plant Description

Giant hogweed is a biennial or perennial herbaceous plant that can reach 15-20 feet tall. Its basal leaves are large and deeply-divided, typically with three prominent lobes. In its first one to three years of growth, giant hogweed exists as an increasingly large rosette. Once mature, it produces a flowering stalk with several large, white umbels that can exceed two feet in diameter. Giant hogweed can form dense stands and spread quickly in disturbed areas such as abandoned fields and roadsides. It produces a large quantity of seeds that are easily dispersed by wind, water, and on mowing or other equipment. The sap of giant hogweed is highly toxic to humans. It contains chemicals that are activated by sunlight and may cause serious burns and blistering upon exposure.

1. Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized giant hogweed infestations. Giant hogweed 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 giant hogweed 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. Due to the persistence of the seed bank, mechanical control is usually a long-term project. It is most practical in a small area where chemical control is not an option.

Cautions:

Giant hogweed's sap is highly toxic to humans and can cause severe burns or blistering on exposed skin. Wear proper personal protective equipment such as boots, pants, a long-sleeved shirt, and gloves should 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.

> *NOTE: Giant hogweed resembles native cow parsnip (Heracleum maximum), native wild angelica (Angelica atropurpurea) and non-native queen anne's lace (Daucus carota). Extreme care should be taken to correctly identify giant hogweed before initiating control efforts.*

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

Effectivenes:
Multiple repeated cuttings or mowing over consecutive field seasons may be effective in suppressing, containing, or locally eradicating early detection to medium sized infestations of giant hogweed.

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

Caution:
Giant hogweed's sap is toxic to humans and can cause severe burns or blistering on exposed skin. 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 large sized infestations of giant hogweed. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

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

Treatments:
A foliar spray of glyphosate or triclopyr and a stem injection of glyphosate have been found to be effective in controlling infestations of giant hogweed. When treating mature flowering plants, applications should be performed when plants are actively growing and transporting nutrients to the roots, but prior to seed formation. Treatments are most effective when the

plants first begin to flower in mid-June. Foliar spray application in the fall from late August into October can be effective at targeting rosettes. For spot treatments use any of the following application techniques:

a) Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle
b) Wiper application - sponge tip applicator with wick or cloth glove applicator
c) Stem injection application- stem injection gun with a cavity needle or medical syringe

YELLOW IRIS (*Iris pseudacorus*)

Plant Description

Yellow iris 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 rhizome mass can successfully contain, suppress, or locally eradicate early detection to small sized infestations of yellow iris.

Methods:

Dig or pull up 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.

> *NOTE: Yellow iris closely resembles native blue flag iris (Iris versicolor). Extreme care should be taken to correctly identify yellow iris before initiating control efforts.*

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 large 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, which is present in late May or early June. Treatments should occur prior to seed set.

- Stem injection is another effective option in controlling *Iris pseudacorus.* Cut flowering stems and use a stem injection tool to deliver herbicide into the fleshy pith of the flowering stalk. This 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 treated more than once.

For spot treatments use any of the following application techniques:

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

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/m² with growth rates exceeding 1 cm/day. A single mature plant can produce more than 2.5 million seeds annually which can remain viable after 20 months of submergence in water. In addition, plant fragments 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:

Dig or pull up 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 promote emergence of purple loosestrife from the seed bank. 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-sprouts, the entire rootstock must be removed. In order to prevent the spread of seeds, pulling or digging must be conducted before the plants begin setting seed.

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 three times during the growing season, ensuring that no plants are allowed to go to flower or seed. Repeated mowing 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 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 large 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. Apply herbicides immediately prior to or during the flowering period (late July/Aug) so plants are actively growing and transporting nutrients to the roots.

For spot treatments use any of the following application techniques:

a. Wiper application - sponge tip applicator with wick.
b. Cut stump application - commercial-grade spray bottle, wash bottle, eye dropper, or paintbrush
c. Foliar spray application - commercial-grade spray bottle with adjustable nozzle and/or backpack sprayer with adjustable nozzle

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 cost 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 with 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 (Blossey et al. 1994).

WHITE AND YELLOW SWEETCLOVER *(Melilotus albus & M. officinalis)*

PLANT DESCRIPTION

White and yellow sweet clover are biennial invasive plants native to Europe that form large, monotypic stands in upland environments of the U.S. and Canada. Sweetclover prefers full sunlight and is most often associated with disturbed habitats such as roadsides, forest edges, and hiking trails. First year plants do not bloom and exist as a small basal rosette of deeply divided leaves. Second year plants can reach six-feet in height with leaves alternately arranged on the stem. The small fragrant flowers appear June through July and are located terminally on the branches. Flowers are creamy white or bright yellow depending on the species. Sweetclover spreads primarily through its seed, which is persistent and can remain viable in the soil for 30 years. Plants can also sprout from mature root fragments.

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 infestations of sweetclover. It is best to remove plants before seed structures have developed in order to avoid inadvertent spread or dispersal.

Methods:

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

Disposal:

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

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. Additionally, digging disturbs the soil, may fragment rhizomes, and promotes germination of *Melilotus spp.* and other undesirable species from the soil seed bank.

Sanitation:

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

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in containing or suppressing early detection to large sized infestations of sweetclover depending on the invaded habitat. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting will often need to be repeated annually to reduce an infestation to desired levels.

Methods:
Cut or mow sweetclover stems when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique usually results in high mortality of existing plants and will minimize re-sprouting. Repeat mowing/cutting may be required within a growing season, and the actions must be performed annually.

Disposal:
If possible, bag all cut plant parts and remove from site. Solarize, and dispose of in an 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 large sized sweetclover infestations. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

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

Treatments:
Use glyphosate or triclopyr formulations only. The product should be applied to second year plants as close as possible to peak flower, but prior to seed formation. First year rosettes can be treated in the fall when second year plants have senesced.

For spot treatments use any of the following application techniques:

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

WILD PARSNIP (*Pastinaca sativa*)

Plant Description

Wild parsnip is a biennial or perennial herbaceous plant of the carrot/parsley family that can reach two to five feet tall. It 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. Its leaves are pinnately compound with saw-toothed edges. Branching stems bear umbels of small yellow flowers from mid-June to early August. The plant can form dense stands and spreads quickly in disturbed areas such as abandoned fields and roadsides. It spread primarily by seeds, which are 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 hazardous to humans 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 infestations. 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, making sure to remove as much of the root system as possible. Use a digging tool for larger plants. Due to the persistence of the seed bank, mechanical control is usually a long-term project. It is most practical in a small area where chemical control is not an option.

Cautions:

Wild parsnip sap is highly toxic to humans and can cause severe burns or blistering on exposed skin. Wear proper personal protective equipment such as boots, pants, a long-sleeved shirt, and gloves should 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 mowing over consecutive field seasons may be effective in suppressing, containing, or locally eradicating early detection to medium sized infestations.

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 mowing 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 to be effective.

Cautions:
Wild parsnip's sap is toxic to humans and can cause severe burns or blistering on exposed skin. 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 infestations 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.

For spot treatments use any of the following application techniques:

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

JAPANESE, GIANT, AND BOHEMIAN KNOTWEED
(Reynoutria japonica, R. sachalinensis, and R. x bohemica)

PLANT DESCRIPTION

The knotweeds are herbaceous perennials which form dense stands exceeding ten-feet in height. Their 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. 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 can spread rapidly through fragmentation and can survive 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:

Dig or pull up the entire plant including all roots and runners using a digging tool. Juvenile plants may 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:

Repeated cuttings or mowing over consecutive field seasons can be effective in suppressing or containing early detection to medium sized infestations of knotweed.

Methods:

Cut or mow the knotweed close to the ground weekly 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 re-sprout from small stem and rhizome fragments. Cut or mowed material should be mulched to under one 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 below-ground rhizome system, the plastic covering will usually need to be left in place for several years.

Methods:
First, cut or mow plants down to at least eight-inches, then 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 must 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, imazapyr, and imazamox based herbicides can be effective in controlling knotweed species. Imazapyr should only be incorporated into treatments of upland infestations of knotweed, while imazamox can be used for treatments in aquatic/wetland settings. Herbicide use is usually at least a 3-year process, as infestations 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, imazapyr and imazamox treatments in late summer or early fall can be effective in preventing regrowth of knotweed the following year. The use of imazapyr or imazamox may inhibit the subsequent seedling emergence of knotweed as well as other plants for several years.

Treatments:

Use glyphosate, imazapyr, imazamox 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 imazamox and/or 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 re-sprouting 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, such as a JK International Stem Injection Tool or Injectordos Pro Stem Injection System. Once the larger stems have been injected, conduct a foliar spray using a mixture of glyphosate and imazapyr/imazamox 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 treated more than once.

For spot treatments use any of the following application techniques:

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

Cautions:

Established stands of 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).

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 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 structures. 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.

INDIAN CUP PLANT *(Silphium perfoliatum)*

PLANT DESCRIPTION

Indian cup plant is a large perennial that can reach eight-feet in height. Its stems are stout and uniquely square in cross section. The leaves are opposite and are joined to form a cup around the stem. The leaves are rough in texture and have finely serrated margins. Flowers are bright yellow, two to three-inches wide with 16-35 rays. Plants spread locally via rhizomes and can disperse longer distances by seeds which are carried by water and wind.

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 infestations of indian cup plant. Plants must be removed before fruit formation to avoid inadvertent spread of seeds.

Methods:

Slowly dig up or pull each plant by the base of the stem to ensure the entire root system is removed. Indian cup plant has both a tap roots and lateral rhizomes. Disturbed soil should be tamped down firmly after removing plants, as disturbance may create a favorable environment for additional germination within the control site.

Disposal:

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

Cautions:

Care should be taken to minimize soil disturbance and remove all root tissues. Re-sprouting may occur from fragments of root material that are left behind.

Sanitation:

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

2. Cutting/Mowing

Effectiveness:

Cutting or mowing can be effective in containing or suppressing early detection to large sized infestations of indian cup plant depending on the invaded habitat; however, dormant seeds in the soil are unaffected by this technique. Mowing or cutting will often need to be repeated annually to reduce an infestation to desired levels.

Methods:

Cut or mow indian cup plant when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique usually results in high mortality of existing plants and will minimize re-sprouting. Repeat mowing/cutting may be required within a single growing season to prevent plants from releasing seed and the actions must be performed annually.

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

Indian cup plant can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of cup plant or other species.

Treatments:
Use glyphosate or triclopyr formulations only. The product should be applied as close as possible to peak flower, but prior to seed formation.

For spot treatments use any of the following application techniques:

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

HERBACEOUS VINES

MILE-A-MINUTE (*Persicaria perfoliata*)

PLANT DESCRIPTION
Mile-a-minute is an herbaceous, annual climbing vine that is native to Asia. It has triangular shaped leaves that are alternately arranged on the stem. The delicate, branched stem is covered with small recurved spines. Ocreae, or circular shaped leaves, can be found surrounding the stem near its nodes. Flowers are small and inconspicuous, but give rise to attractive metallic blue berries. Mile-a-minute spreads long distances via bird or water dispersed seeds. Once established, vines have can grow up to six inches per day. Large mats can quickly smother native vegetation and alter the quantity of light filtering through a forest canopy.

MANAGEMENT OPTIONS
1. Digging/Pulling
Effectiveness:
Digging or hand pulling is an effective method for containing, suppressing, or locally eradicating early detection to small sized infestations of mile-a-minute.

Methods:
Slowly dig up or pull each plant by the base to ensure the entire root system is removed. Control is easiest in early-summer before the sharp barbs have hardened. All mechanical control should be conducted prior to seed formation in mid to late summer. Disturbed soil should be tamped down firmly after removing plants. Soil disturbance can create a favorable environment for additional germination within the control site.

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

Cautions:
Mile-a-minute is covered with sharp barbs. Wear gloves and protective clothing to shield yourself from injury. Pull all plants prior to seed formation in mid to late summer. Repeated treatments will be required to deplete the seed bank. Care should be taken to minimize soil disturbance and remove all tuberous roots. Mile-a-minute can begin producing fruit early in the growing season. Treatments should be performed prior to July to maximize efficacy and prevent the production of new propagules.

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

2. Cutting/Mowing
Effectiveness:
Cutting or mowing can be effective in containing or suppressing early detection to medium sized infestations of mile-a-minute. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting will often need to be repeated annually to reduce an infestation to desired levels.

Methods:
Cut or mow mile-a-minute stems when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique usually results in high mortality of existing plants and will minimize re-sprouting. Repeat mowings/cutting may be required within a growing season, and the actions must be performed annually.

Disposal:
If possible, bag all cut plant parts and remove from site. Solarize, and dispose of in an 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 large sized mile-a-minute infestations. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Mile-a-minute can be effectively controlled using glyphosate or triclopyr based herbicides. These products will not affect subsequent seedling emergence of mile-a-minute or other plants.

Treatments:
Use glyphosate or triclopyr formulations only. Treat plants as close to the flowering period as possible, but prior to fruit formation. Selectively apply herbicide directly to the foliage of mile-a-minute to preserve the surrounding native vegetation.

For spot treatments use any of the following application techniques:

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

BLACK & PALE SWALLOW-WORT (*Cynanchum louiseae & C. rossicum)*

Plant Description

Members of the milkweed family (*Asclepiadaceae),* black and pale swallow-wort are herbaceous twining vines that grow three to six feet in height. Both have opposite, shiny leaves, 2" to 4" long, and have clusters of small (<1/4") flowers. Black swallow-wort usually bears purple-black, star shaped flowers while pale swallow-wort usually bears 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-dispersed, but may also be transported on clothing or animal fur. 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 perennation, 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 spp.* 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. Mechanical management should be completed before plants produce seed.

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 an 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 to achieve desired reductions. Additionally, digging disturbs the soil, may fragment rhizomes, and promote germination of *Cynanchum spp.* 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 medium sized infestations of swallow-wort.

Methods:

Cut or mow the swallow-wort close to the ground at least five 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 large 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 spp. can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of swallow-wort or other plants.

Treatments:

- Apply glyphosate or triclopyr when plants are actively growing, 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 3 years.

For spot treatments use any of the following application technique:

a) 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. Treating closer to the flowering period will ensure there is sufficient leaf surface to deliver a lethal quantity of herbicide to the roots.

WOODY VINES

PORCELAIN BERRY (*Ampelopsis brevipedunculata*)

PLANT DESCRIPTION
Porcelain berry is a woody, perennial climbing vine that is native to Asia. Leaves are alternate and dark green with 3-5 lobes. Flowers are small, greenish white, and appear from May through August. Vines begin to produce bright blue or purple, speckled berries in late-summer. Mature vines can reach 20 feet into the canopy, blocking light and smothering native plants below.

MANAGEMENT OPTIONS
1. Digging/Pulling
Effectiveness:
Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized porcelain berry infestations. Management should be performed prior to fruit formation to prevent seed dispersal.

Methods:
Dig or pull each individual porcelain berry vine, taking care to remove as much of the root system as possible. Use a digging tool or weed wrench for larger individuals. Due to the persistence of the seed bank, mechanical control is usually a long-term project. It is most practical in a small area or where chemical control is not an option.

Cautions:
Any portions of the root that is not removed can re-sprout. Management must be conducted prior to seed set and should be repeated for multiple seasons to deplete the seed bank.

> *NOTE: Porcelain berry closely resembles native grape vine (Vitis spp.). Grape vine has a brown pith, while porcelain berry has a white pith. In addition, the bark of grape vine peels or shreds, while porcelain berry does not. Extreme care should be taken to correctly identify porcelain berry before initiating control efforts.*

Disposal:
All plant parts and contaminated soil should be bagged and removed from the management site. Solarize and then dispose of plant material 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 large sized infestations of porcelain berry. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Porcelain berry can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of porcelain berry 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 can be effective in controlling infestations of porcelain berry. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. 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 using glyphosate or triclopyr is an effective and selective means to control porcelain berry. This technique is most effective on larger stems that have a larger cut-stump surface area. 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 when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. Delay in herbicide 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 porcelain berry. A triclopyr based herbicide and a penetrant should be applied to the base of the vine. If the porcelain berry vines are twining around other host shrubs or trees, avoid applying herbicide to the host plant. Treatments are most effective when conducted close to peak flower, but prior to seed formation.

For spot treatments use any of the following application techniques:

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

JAPANESE HONEYSUCKLES
(Lonicera japonica)

PLANT DESCRIPTION

Japanese honeysuckle *(Lonicera japonica)* is a perennial trailing or climbing woody vine 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 its 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 and 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 leaf like bracts. The species has white flowers tinged with pink and purple, that 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:

Dig up or pull 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. Soil disturbance should be avoided in infested areas to minimize germination of seed in the seed bank.

Disposal:

If plant parts are not able to be left on-site to decompose as described, 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 before 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 above freezing. Applications within two weeks before the first killing frost seem to be more effective than applications later in the season.

- 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 herbicide application after cutting may result in reduced effectiveness

For spot treatments use any of the following application techniques:

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

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. scanden* 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 infestations. Roots and runners will resprout unless they are completely removed, so management must be frequent enough to remove the entire root system.

Methods:

Dig or pull up 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. Due to 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 re-sprout. 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 can be effective in controlling infestations of Oriental bittersweet. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but before fruit production. 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 applying herbicide to the host plant.

For spot treatments use any of the following application techniques:

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

WOODY SHRUBS

Due to similar biology and growth habit, many invasive woody shrubs are managed using the same techniques. The following species are approved for treatment using the general best management practices provided in this section:

Woody Shrubs Approved for Management	
Wineberry	*Rubus phoenicolasius*
Russian and autumn olive	*Elaeagnus umbellate & E. angustifolia*
Common and glossy buckthorn	*Rhamnus cathartica & Frangula alnus*
Multiflora and rugosa rose	*Rosa multiflora & Rosa rugosa*
Japanese and common barberry	*Berberis thunbergii & B. vulgaris*
Winged euonymous	*Euonymus alatus*
Scotch broom	*Cytisus scoparius*
Bush honeysuckles	*Lonicera spp.*

PLANT DESCRIPTIONS

WINEBERRY is a perennial shrub in the rose family that is native to Asia. Leaves are alternate and compound with three heart-shaped leaflets. Leaves are light-green on top and white below. Branches are long, arching, and covered with reddish-purple spines. Small greenish-white flowers appear in late spring to early summer, giving rise to edible red raspberry like fruits in mid-summer. Plants can spread long distances via animal and bird dispersed seed, but also spread locally by vegetative means. Wineberry prefers moist soil and full to partial sunlight, and can readily invade forest edges, fields, forest understories, and wetlands edges. Dense infestations exclude native vegetation and can impact recreational use.

> *NOTE: Wineberry closely resembles native raspberry species (Rubus spp.). The reddish hairs and stem, and white color of the ventral sides of the leaves can be used to distinguish wineberry from native raspberry. Extreme care should be taken to correctly identify wineberry before initiating control efforts.*

AUTUMN AND RUSSIAN OLIVE are deciduous shrubs that can reach up to 20 to 35-feet in height. The leaves of autumn olive are oval and alternately arranged on the stem, with a green upper surface and silver underside. The leaves of Russian olive are more elongate, resembling a willow, and are silver on both sides. Twigs of both species are gray and often armed with sharp thorns. Flowers have four petals, are fragrant, white to yellow, and appear in late-spring. The fruit of both species is a small, round berry. Autumn olive berries are typically red, while Russian olive fruit is yellow-orange. Both species prefer disturbed sites, where they establish and spread via seed.

COMMON AND GLOSSY BUCKTHORN are deciduous shrubs that can reach heights of 20-feet. Their main stem can grow up to 10 inches in diameter, but is more commonly 1-3 inches in shrub form. Leaves are dark-green and oval with toothed margins and distinct upcurved veins. Common buckthorn typically has 3-5 pairs of leaf veins, while glossy buckthorn has 8-9. The twigs of

common buckthorn are tipped with a spine, a characteristic that distinguishes it from glossy buckthorn. Small, round, black berries ripen in the fall and serve as the primary spread mechanism for these species.

MULTIFLORA AND RUGOSA ROSE are thorny, perennial shrubs that can grow up to 15-feet in height. Stems are long, flexible, green or reddish in color, and covered with numerous stiff, recurved thorns. Leaves are alternate and compound. Multiflora rose often has 5-11 one-inch leaflets, while rugosa rose has 7-9 (rarely 5). The leaf margins are toothed for both species. Invasive rose species bloom in late-spring or early-summer, producing numerous clusters of showy white or pink flowers. The flowers are small (1-inch wide) with five petals. In summer, flowers develop into small, hard red fruits that are approximately 1/4 inch in size.

JAPANESE AND COMMON BARBERRY are spiny deciduous shrubs that can exceed ten-feet in height. Leaves of Japanese barberry are small and oval with smooth margins, while common barberry has toothed margins. Japanese barberry has two common color morphs, a dark-green and deep-purple variety, while common is typically only green. Japanese barberry has a single spine at each node where the leaves meet the stem, while common barberry has three-spines. Flowers are very small, white to yellow in color, and bloom in April or May. Fruits are small oval bright-red berries that are approximate 1cm long. The inner roots and stem of barberry are vibrant yellow in color.

WINGED EUONYMOUS is a deciduous shrub that can grow up to 20-feet tall and wide. Its leaves are simple, opposite, and 1-3 inches long with smooth edges. Green during the summer, foliage transitions to a vibrant red in the fall. Stems are green to brown in color with four prominent wings. Plants bloom in May or early-June, producing small green flowers. Fruits mature in later summer into small, oval, bright red berries. Shrubs are adaptable to a variety of soil and light conditions, and can be found in forested wetlands, forest understories, riparian corridors, and right-of-ways.

SCOTCH BROOM is a perennial shrub that grows up to 10-feet tall. Leaves are small, alternate, and compound with 3-leaftlets. Stems are a prominent green and are five-sided. Shrubs bloom early in the season from late-May to June, producing small bright-yellow flowers along the length of the stem. Flowers give rise to fuzzy, flat seed pods that can be up to 1.5 inches long. Scotch broom can fix nitrogen, allowing it to become established in poor sites where it may form dense thickets that outcompete native shrubs and herbaceous species.

BUSH HONEYSUCKLES Exotic bush honeysuckles (Morrow's, Bell's, Amur, and Tatarian) are upright, multi-stemmed, oppositely branched, deciduous shrubs that reach up to 25-feet in height. 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. Exotic honeysuckles can be distinguished from native varieties by their hollow stems.

MANAGEMENT OPTIONS

1. Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small infestations of invasive woody shrubs. Management should be performed prior to fruit formation to prevent seed dispersal.

Methods:
Dig or pull each individual shrub, taking care to remove as much of the root system as possible. Use a digging tool or weed wrench for larger individuals. Due to the persistence of the seed bank, mechanical control is usually a long-term project. It is most practical in a small area or where chemical control is not an option.

Cautions:
Portions of the root system that are not removed can re-sprout. Management must be conducted prior to seed set and should be repeated for multiple seasons to deplete the seed bank.

Disposal:
All plant parts and contaminated soil should be bagged and removed from the management site. Solarize and then dispose of plant material in an approved landfill or incinerate with the appropriate permits. Non-fruit bearing plants can be hung roots up and left on-site to decompose.

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 infestations of woody shrubs. Dormant seeds in the soil are unaffected by this technique. Mowing or cutting will need to be repeated annually to reduce an infestation to desired levels.

Methods:
Cut or mow stems when in flower (late spring/early summer) at ground level either manually or with motorized equipment. This technique can result in mortality of existing plants and may minimize re-sprouting. However, some shrubs are will respond positively to cutting and release numerous root suckers. Repeat mowings/cutting may be required within a growing season, and the actions must be performed annually.

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 containing, suppressing, or locally eradicating early detection to large sized infestations of woody shrubs. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target impacts.

Woody shrubs can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of invasive woody shrubs 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 infestations of woody shrubs. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation.

- A cut stump application using glyphosate or triclopyr is an effective and selective means to invasive woody shrubs. This technique is most effective on mature plants that have a larger cut-stump surface area. Use this method in areas where shrubs are located within close proximity to non-target plants. Cut stump treatments should be conducted when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. Delay in herbicide application after cutting may result in reduced effectiveness.

- A basal bark application of triclopyr applied to the lower trunk can also be effective in controlling invasive woody shrubs. A triclopyr based herbicide and a penetrant should be applied to the base of the trunk. Treatments are most effective when conducted close to peak flower, but prior to seed formation.

For spot treatments use any of the following application techniques:

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

TREES

JAPANESE ANGELICA TREE *(Aralia elata)*

Plant Description

Japanese angelica tree is a fast growing deciduous tree that is native to Asia and Eastern Russia. Mature individuals can reach 40 feet or more under optimal conditions. The trunk and larger stems of *A. elata* are covered in sharp spines. Leaves are very large – up to four feet long – and compound with up to 80 oval leaflets. Clusters of white flowers appear in late summer, ripening to purplish-black round berries. Japanese angelica tree can be found in forests, edge habitats, fields, and right-of-ways. It can form large thickets that displace native plant species and wildlife.

***NOTE:* Cutting or destruction of timber on Forest Preserve lands is subject to additional permitting requirements and may require extensive review. Consult with the Department and/or Agency before conducting any management of tree species.**

1.Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of Japanese angelica tree seedlings ≤ 3" DBH. Well rooted, mature individuals cannot be effectively removed by mechanical means. Japanese angelica tree will readily re-sprout from roots fragments that are left behind.

Methods:

Dig or pull each individual seedling from the soil, taking care to remove the entire root system. Mechanical management should be performed prior to fruit production in late summer. Use a digging tool or weed wrench for larger plants. Use thick gloves to protect your skin from the plant's sharp spines.

Cautions:

Any portions of the root system not removed can re-sprout. Do not pull or dig up plants that are in fruit as this may aide in seed dispersal.

> *NOTE: Japanese angelica tree closely resembles native devils walking stick (Aralia spinosa). Extreme care should be taken to correctly identify Japanese angelica tree before initiating control efforts.*

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. Non-fruit bearing plants can be hung onsite with roots up to dry and decompose.

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 angelica tree. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Japanese angelica tree can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of Japanese angelica tree 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 infestations of Japanese angelica tree. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. If the height of the seedlings inhibits effective spraying, consider an alternative treatment method.

- A cut stem application of glyphosate or triclopyr applied immediately after cutting is an effective means of controlling Japanese angelica tree. Use this method in areas where seedlings 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, but prior to fruit formation. Delay in application after cutting may result in reduced effectiveness.

- A basal bark application of triclopyr can also be effective in controlling Japanese angelica tree. Apply a triclopyr based herbicide and penetrant to the lower portion of the tree as directed by the herbicide label.

For spot treatments use any of the following application techniques:

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

NORWAY MAPLE (*Acer platanoides*)

Plant Description

Norway maple is a large, deciduous tree than can exceed 65 feet in height. It can be distinguished from native maples because the leaves and stem ooze milky sap when cut or damaged. Leaves are dark green, with five to seven lobes. The bark is smooth and gray-brown, becoming more furrowed as the tree matures. The fruit is a double-wing samara that are arranged nearly 180 degrees from each other. Norway maple produces a large amount of seeds that can grow in low-light, outcompeting native understory/tree species.

NOTE: **Cutting or destruction of timber on Forest Preserve lands is subject to additional permitting requirements and may require extensive review. Consult with the Department and/or Agency before conducting any management of tree species.**

1.Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection to small sized infestations of Norway maple ≤ 3" DBH. Well rooted, mature individuals cannot be effectively removed by mechanical means.

Methods:

Dig or pull each individual seedling from the soil, taking care to remove the entire root system. Mechanical management should be performed prior to fruit production in late summer. Use a digging tool or weed wrench for larger plants.

Cautions:

Any portions of the root system not removed can re-sprout. Do not pull or dig up plants that are in fruit as this may aide in seed dispersal.

> *NOTE: Norway maple closely resemble native red and sugar maple (Acer rubrum, Acer saccharum). Extreme care should be taken to correctly identify invasive maple before initiating control efforts.*

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. Non-fruit bearing plants can be hung onsite with roots up to dry and decompose.

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 Norway maple. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Invasive maples can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of invasive maple 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 infestations of Norway maple. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. If the height of the seedlings inhibits effective spraying, consider an alternative treatment method.

- A cut stump application of glyphosate or triclopyr applied immediately after cutting is an effective means of controlling Norway maple. Use this method in areas where seedlings are established within or around non-target plants. Cut stump treatments should be conducted during the growing season after full leaf expansion when nutrients are being actively transported to the roots, but prior to fruit formation. Delay in application after cutting may result in reduced effectiveness.

- A basal bark application of triclopyr can also be effective in controlling Norway maple. Apply a triclopyr based herbicide and penetrant to the lower portion of the tree as directed by the herbicide label.

For spot treatments use any of the following application techniques:

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

TREE OF HEAVEN (*Ailanthus altissima*)

Plant Description

Tree-of-heaven is a fast-growing deciduous tree that can exceed 80 feet in height. Leaves are compound with 10-41 smooth edged leaflets. The plant is reported to have a rancid aroma when crushed, resembling cat urine or burnt peanut butter. The fruit is a single winged samara, which forms in late summer from clusters of small yellow flowers. Each tree can release over 100,000 seeds and sprout vegetatively, lending to rapid population expansion.

***NOTE:* Cutting or destruction of timber on Forest Preserve lands is subject to additional permitting requirements and may require extensive review. Consult with the Department and/or Agency before conducting any management of tree species.**

1.Digging/Pulling

Effectiveness:

Frequent digging or pulling can be effective in containing, suppressing, or locally eradicating early detection infestations of tree of heaven ≤ 3" DBH. Well rooted, mature individuals cannot be effectively removed by mechanical means.

Methods:

Dig or pull each individual seedling from the soil, taking care to remove the entire root system. Mechanical management should be performed prior to fruit production in late summer. Use a digging tool or weed wrench for larger plants.

Cautions:

An injured or partially removed tree-of-heaven may produce dozens of root suckers. Mechanical management is most effective when followed up by an herbicide application to address re-sprouts. Do not pull or dig up plants that are in fruit as this may aide in seed dispersal.

> *NOTE: Tree-of-heaven closely resemble native sumac (Rhus spp). Extreme care should be taken to correctly identify tree-of-heaven before initiating control efforts.*

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. Non-fruit bearing plants can be hung onsite with roots up to dry and decompose.

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 tree-of-heaven. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target effects.

Tree-of-heaven can be effectively controlled by both glyphosate and triclopyr based herbicides. Neither glyphosate nor triclopyr formulations will affect subsequent seedling emergence of tree-of-heaven 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 infestations of tree-of-heaven. These herbicides should be applied when plants are actively growing and transporting nutrients to the roots, but prior to fruit formation. If the height of the seedlings inhibits effective spraying, consider an alternative treatment method.

- A cut stump application of glyphosate or triclopyr applied immediately after cutting is an effective means of controlling tree-of-heaven. Use this method in areas where seedlings are established within or around non-target plants. Cut stump treatments should be conducted during the growing season after full leaf expansion when nutrients are being actively transported to the roots, but prior to fruit formation. Delay in application after cutting may result in reduced effectiveness. Cut stump treatments may result in extensive root suckers. Closely monitor the site after treatment and follow up with additional applications if necessary.

- A basal bark application of triclopyr can also be effective in controlling tree-of-heaven. Apply a triclopyr based herbicide and penetrant to the lower portion of the tree as directed by the herbicide label.

For spot treatments use any of the following application techniques:

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

APPENDIX C. MANAGEMENT ACTIVITIES FOR THE CONTROL OF AQUATIC INVASIVE PLANTS

INTRODUCTION

The BMPs listed below describe the different management activities currently approved for control of aquatic invasive plants. Additional management activities, such as herbicide applications, will be reviewed and added to this document at a later date. For guidance on additional management activities not referenced in these guidelines, please refer to other resources or contact a professional. It is strongly recommended that the concepts of integrated pest management (IPM), the minimal tool approach, and adaptive management be understood and incorporated into any management strategy before the implementation of a control project.

DEFINITIONS

a. Early Detection Infestation – For the purposes of these guidelines, an early detection infestation is classified as a population within a single waterbody with an aggregate invaded area of no more than 0.5 acres in size.

b. Small Infestation – For the purposes of these guidelines, a small infestation is classified as a population within a single waterbody with an aggregate invaded area of over 0.5 acres in size but under 1 acre in size.

c. Medium Infestation – For the purposes of these guidelines, a medium infestation is classified as a population within a single waterbody with an aggregate invaded area of over 1 acre in size but under 3 acres in size.

d. Large Infestation – For the purposes of these guidelines, a large infestation is classified as a population within a single waterbody with an aggregate invaded area over 3 acres in size.

HAND HARVESTING AND DIVER ASSISTED SUCTION HARVESTING (DASH)

Hand harvesting or DASH is most commonly used to manage infestations of submerged or floating aquatic invasive plants. The following list of species are approved for management via this method in the Adirondack Park: Eurasian watermilfoil, variable-leaf watermilfoil, parrot-feather, fanwort, curly-leaf pondweed, Brazilian elodea, hydrilla, water chestnut, European frog-bit, and yellow floating heart. Additional species may be considered for management using this technique, but prior authorization from the Agency is required. The Agency requires permits for regulated activities conducted in or impacting wetlands in the Adirondack Park. Therefore, Agency General Permit 2015G-1 or 2015G-2 and a Department General Permit GP-0-15-005 may be required. Contact the Agency and Department for guidance on appropriate permit(s) for specific project.

Effectiveness:
Hand harvesting can be effective in suppressing, containing, or locally eradicating early detection to medium sized infestations of aquatic invasive plants. It is important to consider the biology of the plant when scheduling harvesting. Harvesting should be conducted prior to the production of seeds, nutlets, tubers and/or turions which typically form in late summer.

Methods:
Gently hand-pull all plants from the sediment by the roots. Plants should be pulled slowly to minimize fragmentation. Special attention should be given to ensure that the root ball, if present, is removed. For floating plants, harvesting can be conducted from a boat or by wading in the shallows. For submerged plants, trained SCUBA divers should be deployed. If using DASH, hand-pull each plant and then use the suction hose to transport it to the surface. The suction nozzle must not be used to directly remove vegetation from bottom sediments. If possible, return to the project area multiple times each growing season to remove plants that were missed or emerged from the seed bank.

Cautions:
Harvesters should take special care to remove all invasive plant material, including roots and fragments, since resprouting could occur if left onsite. If possible, spotters in surface watercraft should collect any floating plant fragments that result from harvesting efforts.

Disposal:
Bag all plant biomass and remove from the management site. Compost in an upland location or dispose of in an approved landfill. If transporting harvested plant material offsite is not feasible due to volume and/or distance, harvested materials may be scattered on adjacent upland areas at least 50 horizontal feet from the shoreline and in a manner that will not eliminate or impede growth of native vegetation. For Forest Preserve lands, all biomass material should be removed from the area and properly disposed of at a site off of Forest Preserve. Consult with the Agency and Department if offsite disposal is not feasible.

Sanitation:
Clean, drain and dry all tools, equipment, boats, and trailers between management sites to prevent spread of AIS.

BENTHIC BARRIERS

Benthic barriers or mats are made of plastic, fiberglass, nylon, or other non-toxic materials and are placed over submerged aquatic invasive plant beds to block sunlight (preventing photosynthesis and plant growth) or over aquatic invasive mollusk populations to suffocate them (reducing/eliminating available dissolved oxygen). The following list of species are approved for management via this method in the Adirondack Park: Eurasian watermilfoil, variable-leaf watermilfoil, curly-leaf pondweed, zebra mussels, quaqqa mussels, and Asian clam. Additional species may be considered for management using this technique, but prior authorization from the Agency is required. For this management technique an Agency General Permit 2015G-1 or 2015G-2 may be required. Contact the Agency and Department for guidance on appropriate permit(s) for specific project.

Effectiveness:

Benthic barriers can be effective in suppressing, containing or locally eradicating early detection to medium sized infestations.

Methods:

For shallow infestations, barriers can be installed by wading in the water. Deeper infestations should be installed by deploying trained SCUBA divers. Overlap each barrier by four to six inches to prevent vegetation from escaping through seams. Larger overlaps may be necessary if barriers are being deployed to deplete oxygen and kill aquatic pests. Barriers should be securely fastened to the bottom with stakes or anchors. Under the DEC General Permit, benthic barriers and all materials used to anchor them must be removed within three months from date of installation. The APA General Permit limits the matted area to no more 3 acres at any single treatment area. Multiple 3 acre installations may occur within a waterbody provided that no more than 10 percent of the littoral area is matted at any one time. Refer to APA general permits for specific requirements concerning removal dates.

Cautions:

Heavy plant growth can make installation of barriers difficult; it may be necessary to time the barrier placement with a low growth period, usually in early spring after ice-out. This technique is unselective and will impact all plant species under the matted area. Pre-installation vegetation surveys are required to ensure there will be no impacts to NYS rare, threatened, endangered or exploitable vulnerable species through the management activity. Consider a breathable matting material to allow for gases to escape. Maintenance is critical to minimize plant regrowth in sediments or silt that deposits on the barriers. In areas of high wave energy or flow (i.e. deltas) large amounts of sediment can be deposited on top of the barrier within a single season. Barriers deployed around docks have the potential to foul boat propellers.

Disposal:

Benthic barriers will kill the target invasive species onsite. Offsite disposal of plant material is not required.

Sanitation:

Clean, drain and dry all tools, equipment, boats, and trailers between management sites to prevent spread of AIS.

BIOLOGICAL CONTROL

Biological control (biocontrol) focuses on the selection and introduction of organisms that have an impact on the growth or reproduction of the target plant. Stocking an infested waterbody with a biocontrol will hopefully reduce the negative impacts of the target plant by reducing its density and health.

Eurasian watermilfoil

There are two insects, *Acentria ephemerella* (an aquatic moth) and *Euhrychiopsis lecontei* (a weevil), that have been investigated and approved as biocontrol agents for Eurasian watermilfoil. The caterpillars of the aquatic moth feed on the growing tips of the Eurasian watermilfoil, and overwinter on the plants near the lake bottom. The milfoil weevil adult feeds on the leaflets and stem material. The adult weevils overwinter on the shoreline. This technique is a regulated activity in the Adirondack Park and requires permits from the Department and the Agency. Contact the Agency and Department for guidance on appropriate permit(s) for specific project.

Effectiveness:
These biological control agents can be effective in suppressing medium to large infestations. However, rearing, transporting, stocking, and establishing populations of these insects can be difficult and cost prohibitive.

Cautions:
Biocontrol weevils require suitable over-wintering habitat (vegetation, leaf litter, etc.). The large quantities of insects required to sustain a permanent population of herbivores are currently unavailable.

APPENDIX D. SPECIES-SPECIFIC CONTROL METHODS FOR INVASIVE FOREST PESTS

INTRODUCTION

The species and BMPs listed below are for invasive insects that are present in Adirondack Park and known to cause significant negative impacts. 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), the minimal tool approach, and adaptive management be understood and incorporated into any management strategy before the implementation of a control project. All insecticide use shall be conducted in strict accordance with the product label as well as local, state, and federal laws.

DEFINITIONS

a. Early Detection Infestation – For the purposes of these guidelines, an early detection infestation is classified as a new, isolated population that could likely be locally eradicated through insecticide treatment. Early detection infestations shall not exceed 5 acres.

b. Established Infestation – For the purposes of these guidelines, an established infestation is classified as being a population that has already completed multiple reproductive events and is unlikely to be eradicated through insecticide treatment. Infestations will be considered established when they exceed 5 acres.

CONTROL METHODS FOR HEMLOCK WOOLLY ADELGID
(Adelges tsugae)

PEST DESCRIPTION
Hemlock woolly adelgid (HWA) is an aphid-like insect that feeds on eastern hemlock causing extensive mortality. It is spread through wind, by movement of birds and wild animals, as well as planting of infested nursery stock. HWA feeds on hemlock twigs, producing a woolly bundle near the base of hemlock needles to protect itself and its eggs. HWA reproduces asexually in the US and produces two generations per year, allowing for rapid population growth. While this pest is impacted by cold winters, its high reproductive rate assures rapid reestablishment after cold weather events. This pest is moving north and will eventually invade the expansive hemlock forests of the Adirondacks. The following BMPs can be deployed to avoid tree mortality, erosion, stream sedimentation, warming stream water temps, and loss of regional biodiversity.

MANAGEMENT OPTIONS

1. Pesticides

Effectiveness:
Systemic insecticides can be effective in suppressing, containing, or locally eradicating early detection sized infestations. They are the most effective control method to treat individual trees infested by HWA. The timing and choice of application technique will determine control efficacy and should aim to minimize off-target impacts.

Imidacloprid and dinotefuran based insecticides can be effective in controlling the hemlock woolly adelgid. Imidacloprid moves slowly through the tree, sometimes taking up to a year to reach the canopy. Older trees that may have compromised vascular systems or crown decline from adelgids may not be able to translocate imidacloprid into the crown quickly enough to survive. However, treatments with imidacloprid have been found to be effective for up to 7 years following a single application (Benton et al. 2015). Dinotefuran translocates into the tree canopy much more rapidly than Imidacloprid, usually within 2 to 3 weeks, and can provide control during the same application season.

Treatments:
Systemic insecticides should be applied in spring or fall when the soils are moist and trees are actively growing. The spring treatment window opens when the soils thaw, while fall treatments can start in late August/September and close usually around the end of October or in early November when soils begin to freeze. Use imidacloprid and/or dinotefuran only by one or more of the following means:

a) **Basal bark spray**: provides effective and efficient control of woolly adelgids, with minimal off-target effects. Numerous imidacloprid products are labeled for application via basal bark spray, while only one dinotefuran product is currently approved in New York State under a Special Local Needs (SLN) registration. A tank mix of the two pesticides is frequently used to provide both immediate and long term control. The basal bark spray technique uses a low pressure handheld or backpack sprayer to apply pesticide product to the basal 5 feet of each tree's trunk. Applications should be made until the bark is wet, but not to the point of run off.

Basal bark spray can be used near waterways since a limited amount of product comes into contact with the ground.

b) **Trunk injection:** is a higher-cost application method with the least off-target effects. Techniques that inject imidacloprid into the tree after drilling a small diameter hole into the xylem have been demonstrated to be effective. Although injection is a time consuming application technique, it is useful near water because the imidacloprid is contained within the tree. A marking pen or tape should be used to ensure trees are not injected more than once.

The most appropriate and effective treatment method should be selected based on the size of the infestation. Management efforts should consider the following guidance based on the scale of the infestation:

Early Detection Infestations: Treatment of individual infested hemlock trees, as well as a buffer area of un-infested hemlocks around the infestation, is appropriate for early detection infestations. Because HWA can be extremely difficult to detect at low population levels, the inclusion of purportedly uninfested host trees in the treatment is critical, as it greatly increases the odds of successfully eliminating outlying populations when detected early. Response time is critical; immediate treatment before the next dispersal period (April – July) will greatly increase the potential for local eradication of hemlock woolly adelgid from the site and prevent continued spread.

Established Infestations: Once an infestation is well established, treatments should be focused to preserve high-priority hemlock trees/populations and minimize woolly adelgid spread. Priorities for hemlock conservation will vary by site, but should include hemlock trees that provide slope stabilization, protection of high-quality watersheds, individual magnificence/strong genetic traits, cultural value, and/or known habitat for rare, threatened or endangered species. In these situations, a mixture of chemical treatment and biocontrol releases will likely be the most effective.

2. Biological control

There are several predatory insect species being studied for HWA biocontrol, and four have been released experimentally in New York: *Sasajiscymnus tsugae* (Coleoptera: Coccinellidae) from Japan, *Laricobius nigrinus* (Coleoptera: Derodontidae) from the Pacific Northwest, and the Silver flies *Leucopis argenticollis and L. piniperda*, also from the Pacific Northwest.

Recovery of *Sasajiscymnus tsugae* from the many release sites on the east coast - including release sites in the Hudson Valley - was undesirable, and this species is no longer considered a viable biocontrol. Active biocontrol work continues with *L. nigrinus*, and *Leucopis spp.*, which are cleared for general release in New York State under supervision of DEC-permitted biological control specialists.

Laricobius nigrinus
This small beetle from the Pacific Northwest feeds exclusively on HWA. Developing larvae feed on eggs and small nymphs, while adults feed on the larger nymphs and adults of

overwintering HWA. This species has become established and spread from release sites in many eastern states. It has become established at three of 17 release sites in New York. Confirmed establishment is difficult to assess for this species, as it may take several years before populations are large enough to recapture. New York release efforts have used beetles supplied by labs in VA and TN as well as wild-collected beetles from the Pacific Northwest. The demand for predators in the south has been high, so supplies for NY have been limited. Wild collections can be problematic because *L. nigrinus* can be difficult to find from year to year due to HWA population fluctuations.

Leucopis argenticollis and L. piniperda
These small fly species are native to both US coasts, and in the Pacific Northwest is the second most abundant HWA predator. East coast populations feed on the Pine Bark Adelgid and not on HWA, therefore work has commenced with the west coast biotype. The larvae of these flies feed on HWA eggs and early instar nymphs; one of the benefits of *Leucopis spp.* is that they have two generations per year just like HWA, and the larvae are present to feed during both generations.

Effectiveness:
Biological control can be effective in suppressing established infestations, and is the only viable long-term control method for hemlock woolly adelgid. Only use biocontrols in areas that have sufficient Adelgid populations to support establishment of predators.

Methods:
Release protocols are still under development, and control data is being collected in Georgia, Tennessee, North Carolina, Virginia, West Virginia, Maryland, and Pennsylvania. More beetles are generally better than fewer. Released predator insects will persist in the environment, increase or decrease in population based on the availability of HWA, and provide long-term control.

Cautions:
There are multiple factors that contribute to the establishment success of each biocontrol insect. Evaluate your proposed release site to ensure conditions are suitable for establishment.

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

EXPEDITED-REVIEW AUTHORIZATION FORM FOR CONTROL OF INVASIVE 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 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):

PESTICIDE TREATMENT DESCRIPTION

Proposed Start Date:

Pesticide 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 F. PESTICIDE LABELS AND SAFETY TIPS

Please refer to the New York State Pesticide Administration Database (NYSPAD) for the most up to date pesticide product labels and information. http://www.dec.ny.gov/nyspad/

PESTICIDE USE SAFETY TIPS

Safety First. Always take appropriate safety precautions; wear suitable clothing and equipment, and follow all instructions on the herbicide label. Use a biodegradable tracer dye in the herbicide mix to monitor accidental exposure or spills, and to keep track of where you have already applied herbicide.

Be Mindful of Environmental Conditions. 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 cease 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 Patient. Systemic pesticides – such as glyphosate, imazapyr, triclopyr, imazamox, imidacloprid, and dinotefuran – may require up to two weeks to take effect. Do not waste pesticide, money or effort by spraying more than once during a growing season.

Use the Appropriate Herbicide to Protect Native Plants. Glyphosate, imazapyr, and imazamox based herbicides are non-selective (kills both monocots and dicots) and will impact all types of vegetation. Triclopyr formulations are selective and will only affect broadleaf weeds, leaving grasses and conifers unaffected.

Use the Minimal Tool Approach. Pesticide application is only one tool in the natural resource management toolbox. Evaluate all available control options before resorting to chemical means. Treatment actions should eliminate invasive species while aiming to maintain desirable native species.

APPENDIX G. LIST OF ACRONYMNS

AANR	Adopt-a-Natural Resource Agreement
AIS	Aquatic Invasive Species
APA	New York State Adirondack Park Agency
APIPP	Adirondack Park Invasive Plant Program
BMP	Best Management Practice
DASH	Diver Assisted Suction Harvesting
DEC	New York State Department of Environmental Conservation
ECL	Environmental Conservation Law
EDRR	Early Detection and Rapid Response
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
EDRR	Early Detection and Rapid Response
IPM	Integrated Plant Management
IPMDAT	Invasive Plant Management Decision Analysis Tool
IS	Invasive Species
MOU	Memorandum of Understanding
PRISM	Partnership for Regional Invasive Species Management
SEQRA	State Environmental Quality Review Act
TRP	Temporary Revocable Permit
UMP	Unit Management Plan
VSA	Voluntary Stewardship Agreement

APPENDIX H. BIBLIOGRAPHY AND REFERENCES

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