

ENV 1, MANUAL 1

**Best Management Practices
for the Control of Invasive and Noxious Plant Species**



2018

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New Hampshire Department of Transportation
 BEST MANAGEMENT PRACTICES
 FOR CONTROL OF INVASIVE AND NOXIOUS PLANT SPECIES
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BEST MANAGEMENT PRACTICES FOR CONTROL OF INVASIVE AND NOXIOUS PLANT SPECIES 2018

PURPOSE AND OVERVIEW

PURPOSE

This manual provides information about invasive plant species and the methods to control or eradicate them that comply with federal and state laws and regulations. Implementing management practices will help reduce the likelihood that invasive plants will spread to other areas. It is meant to bring awareness about invasive plants to New Hampshire Department of Transportation (NHDOT) employees and contractors and the role the Department can play in limiting the spread of these species on NHDOT and nearby properties.

AUTHORITY

NHDOT Deputy Commissioner, Christopher Waszczuk

SCOPE

The information in this manual is for the management of invasive and noxious plant species for NHDOT Operations personnel, construction personnel, and contractors working for the Department.

REFERENCES

NHDOT Environmental Policy, ENV 1

GENERAL COMMENTS AND BACKGROUND

The intention of New Hampshire Statute Title XL, Chapter 430, Section 430.51-57 and its rules is to minimize the effects of invasive species on the environment and the state's economy. The NH Department of Agriculture, Markets & Food, Division of Plant Industry (NHDAMF) is the lead agency for administering the invasive species rules. These rules are effectively summed up by one central rule, Chapter Agr. 3800, which states, "**No person must collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.1, New Hampshire prohibited invasive species list.**"

Other federal and state laws and regulations that apply to invasive species:

- Federal Executive Order 13112 on Invasive Species (February 3, 1999)
- Federal Executive Order 13751 on Safeguarding the Nation from Impacts of Invasive Species (December 8, 2016)
- Federal Highway Administration Guidance on Invasive Species (August 18, 1999)
- Public Law 108-412—OCT. 30, 2004, Noxious Weed Control and Eradication Act of 2004.
- U.S. Army Corps of Engineers State Programmatic General Permit (August 2017)
- NH Department of Agriculture Code of Administrative Rules, Invasive Species, Chapter Agr 3800; RSA 430:55 (2004)
- NH Department of Environmental Services Code of Administrative Rules, Invasive Aquatic Species, Chapter Env-Wq 1303.02; RSA 487:16-a (1998)

TRAINING - NOT APPLICABLE

OVERVIEW

Invasive plants can affect transportation corridors in many ways. They can reduce sight distance, block signs, increase the risk of fire, and invade travel lanes. One species, Japanese knotweed, is particularly aggressive and can push up through pavement causing damage to the shoulders and edges of roads. Likewise, many species are capable of plugging ditch lines and blocking culverts. Noxious species can cause impacts to employee health.

NHDOT must manage properties, construction sites, and linear areas of right-of-way that can serve as pathways for the spread of invasive plants into new regions and onto adjacent lands. Proper management of vegetation on NHDOT properties is needed to ensure that roads and their related structures are not damaged or impaired.

USING THIS MANUAL

This manual has two chapters.

The first chapter discusses invasive plants and their characteristics. It covers the plant species that are on the NHDAMF “prohibited list,” NHDOT’s Priority Plants, how to identify them, how they are spread, and how to control them. There is also a section on noxious plants, such as poison ivy, and a section on resources and contacts. A glossary and illustrations of the plant terms used is included at the end of Chapter 1.

Chapter 1 is divided into six sections.

SECTION I includes general information about the characteristics of invasive plants, an overview of NHDOT invasive plant species control types, and Best Management Practices (BMPs) that are generally applicable to all species listed on the Invasive Species Control List (page 3). When followed, these BMPs will reduce the likelihood of introducing invasive plants into new areas via maintenance and construction activities.

SECTION II contains information on NHDOT Type I invasive plant species.

SECTION III is a discussion of NHDOT’s Type II Priority Plants. This section includes species-specific BMPs and their Preferred Control Methods.

SECTION IV contains information about *noxious* plants such as poison ivy and poison sumac.

SECTION V provides guidelines for using the statewide contractor for herbicide application.

SECTION VI lists contacts and resources for more information about invasive plant identification. The websites listed in this section provide detailed identification characteristics and photographs of invasive plants. A glossary is also included to define terms used throughout the manual.

The second chapter is currently in progress. It will cover, in detail, the use of pesticides to control invasive plant species.

CHAPTER 1

SECTION I

General Information on the Characteristics of Invasive Plants and
(BMPs) for Controlling Them

SECTION I: General Information on Invasive Plants and BMPs to Control Them

Invasive plants multiply in many ways. They can be spread naturally by birds, wind, and water, or by human activities such as gardening, mowing, and transporting nursery stock. The routine activities that NHDOT must perform to build and maintain the roadway network can also inadvertently spread invasive plants. For instance, seeds or viable pieces of root and stem fragments can adhere to equipment during mowing or construction and even stick to shoes and clothing. As the equipment and material moves, it may carry seeds or plant parts from one area to another. Construction activities that remove vegetation leave the soil exposed and offer invasive plants the perfect opportunity to colonize the area. Further, using fill that might have invasive plant seeds or fragments can establish new colonies.

Eliminating or reducing the spread and establishment of invasive plants requires a proactive approach in which there are two key elements. First, new introductions, especially those that occur due to human activities, must be avoided to the maximum extent possible. Second, there must be an emphasis on **Early Detection and Rapid Response (EDRR)** for new populations. Control measures are more effective and less expensive when used on small young populations of plants rather than on larger more established populations, as shown in Figure 1.

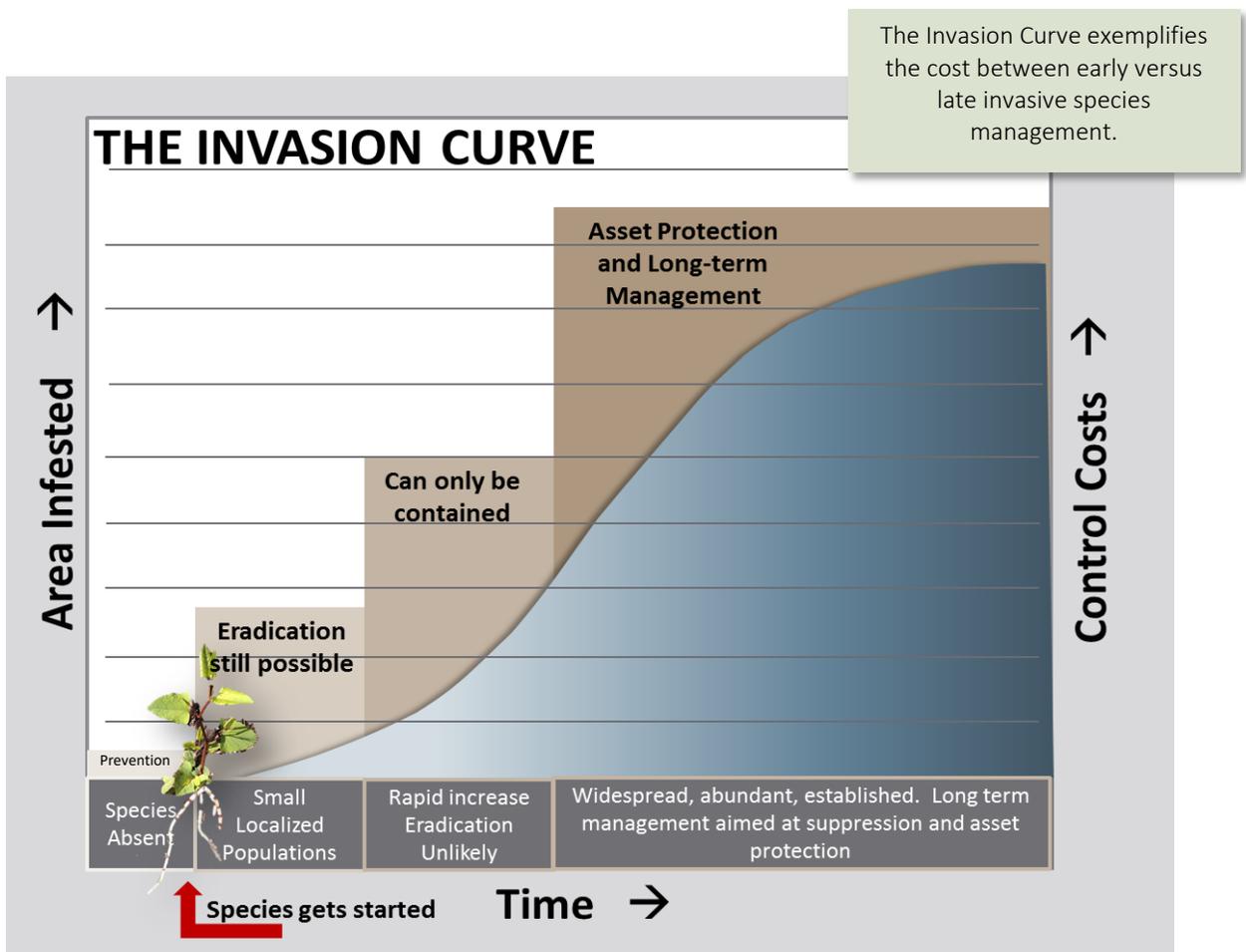


Figure 1
Chart adapted from a graphic by the US Army Corps of Engineers

SECTION I: General Information about Invasives and BMPs to Control Them

NHDOT INVASIVE SPECIES CONTROL TYPES

Both NHDAMF and the New Hampshire Department of Environmental Services (NHDES) have made rules to prohibit specific invasive plants. NHDOT classifies these prohibited invasive plants into two separate categories based on the difficulty and limitation of management options. As categorized by NHDOT:

- Invasive Species Type I are those plants that are readily spread by seeds but do not reproduce by vegetative means (root fragments or pieces of stem).
- Invasive Species Type II are plants which have the ability to reproduce by seeds *and* vegetative means making them easier to spread. These are **priority species for NHDOT**.

Type II species have at least two of the following characteristics:

- ✓ They are **easily spread** by construction and maintenance activities.
- ✓ They have **significant negative impacts** on transportation infrastructure.
- ✓ They are very **difficult to eradicate**.

The Type II species are of special concern to NHDOT because they can be found in wet or moderately wet conditions and are often encountered during roadway construction, maintenance activities, and on mitigation sites.

**Type II
Priority Species**
Difficult to eradicate
Easily spread
✦
Examples:
Japanese Knotweed
Giant Knotweed
Bohemian Knotweed
Purple Loosestrife
Common Reed

CONSTRUCTION CONTRACTS AND INVASIVE PLANTS MANAGEMENT PLANS

When construction activities cannot avoid impacting areas containing invasive plant species, appropriate containment measures and disposal methods must be in place.

For areas with invasive species, as identified by NHDOT on *Construction General Plans*, the contractor must mitigate these areas prior to clearing and grubbing. The mitigation must be in accordance with the Special Provision for Item 201.88X – Invasive Species Control Type X.

NHDOT may require an *Invasive Species Control and Management Plan* (Item 697.11), the (Plan). This plan should detail the specific method(s) for controlling the spread of the identified invasive plant species located within the construction limits and their proper disposal. The Plan must be submitted to NHDOT for review and approval prior to the start of construction. The Contractor shall perform the work necessary to control, remove and dispose of the invasive plant species found on the site according to the approved Plan throughout the life of the project.

SECTION I: General Information on Invasive Plants and BMPs to Control Them

The lists below include species from the NHDAMF's *Prohibited Invasive Plant Species List*, Agr 3800, and two species from the NHDES prohibited species (Env-Wq 1303.02).

NHDOT INVASIVE SPECIES TYPE I	
Common Name	Scientific Name
Autumn Olive	<i>Elaeagnus umbellata</i>
Barberry, European	<i>Berberis vulgaris</i>
Barberry, Japanese	<i>Berberis thunbergii</i>
Blunt-Leaved Privet	<i>Ligustrum obtusifolium</i>
Buckthorn, Common	<i>Rhamnus cathartica</i>
Buckthorn, Glossy	<i>Frangula alnus</i>
Burning Bush	<i>Euonymus alatus</i>
Common Privet	<i>Ligustrum vulgare</i>
Dames Rocket	<i>Hesperis matronalis</i>
European Black Alder	<i>Alnus glutinosa</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>
Honeysuckle, Amur	<i>Lonicera maackii</i>
Honeysuckle, Bella	<i>Lonicera x bella</i>
Honeysuckle, Japanese	<i>Lonicera japonica</i>
Honeysuckle, Morrow's	<i>Lonicera morrowii</i>
Honeysuckle, Tatarian	<i>Lonicera tatarica</i>
Japanese Stilt Grass	<i>Microstegium vimineum</i>
Kudzu	<i>Pueraria montana</i>
Mile-a-Minute Vine	<i>Persicaria perfoliata</i>
Moneywort	<i>Lysimachia nummularia</i>
Multiflora Rose	<i>Rosa multiflora</i>
Norway Maple	<i>Acer platanoides</i>
Oriental Bittersweet	<i>Celastrus orbiculatus</i>
Ornamental Jewelweed	<i>Impatiens glandulifera</i>
Swallow-Work, Black	<i>Cynanchum louiseae</i>
Swallow-Wort, Pale	<i>Cynanchum rossicum</i>
Perennial Pepperweed	<i>Lepidium latifolium</i>
Reed Sweet Grass	<i>Glyceria maxima</i>
Spotted Knapweed	<i>Centaurea stroebe</i>
Tree of Heaven	<i>Ailanthus altissima</i>
Water-Flag	<i>Iris pseudacorus</i>

NHDOT INVASIVE SPECIES TYPE II - PRIORITY	
Common Name	Scientific Name
Knotweed, Japanese	<i>Reynoutria japonica</i>
Knotweed, Giant	<i>Reynoutria sachalinensis</i>
Knotweed, Bohemian	<i>Reynoutria x bohemica</i>
Common Reed*	<i>Phragmites australis</i>
Purple Loosestrife*	<i>Lythrum salicaria</i>

*Indicates a species that is not listed on NHDAMF's Prohibited Species list but is on the New Hampshire Environmental Services Exotic Aquatic Weeds Prohibited List.

Type II - Purple Loosestrife

Lovely, but lethal to native wetland species.

Each plant can produce millions of seeds and reproduce from tiny root fragments.

Note the **square stems**.



SECTION I: General Information on Invasive Plants and BMPs to Control Them

PREVENTION

SOIL DISTURBANCE AND STABILIZATION

Invasive plants readily colonize areas of disturbed soil. It is important to **minimize soil disturbance** whenever possible. For EDRR purposes, recently disturbed sites should be monitored and managed for invasive species. The sooner invasive species are managed the greater the control and eradication success rate. Established populations are more difficult to manage and control.

1. **Stabilize disturbed soils** as soon as possible by seeding and mulching with straw, rip-rap, or gravel that is free of invasive plant material.
2. Visually inspect mulch, gravel or other earthen materials before using them to ensure that they are free of invasive species.
3. Use seeds of native species whenever possible.
4. Never plant Type I or Type II species.
5. Never bring materials such as fill, loam, mulch, straw, rip-rap or gravel into project areas from sites where invasive plants are known to occur.
6. Monitor work sites for the emergence of invasive plants, if the absence of invasive plant parts in introduced materials, such as in #5 above, cannot be guaranteed.



Chris Schnepf, University of Idaho, Bugwood.org



MOVEMENT AND MAINTENANCE OF EQUIPMENT

1. Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.
2. Move maintenance and construction equipment from areas free of invasive plants to areas infested by invasive plants whenever possible. This is especially important during ditch cleaning and shoulder scraping activities.
3. If equipment must be used in areas containing Type II Invasive Species (the priority species):
 - a. Cut and properly dispose of all aboveground plant material (see page 5 & 6).
 - b. Cover the cut area with geotextile and one foot of gravel or soil where the equipment is expected to travel. This is not necessary if the infested area was excavated and the infestation was removed. Refer to the Excavated Material Section.
 - c. Clean all equipment, machinery, and hand tools cleaned of all visible soil and plant material before leaving the project site. Equipment should be cleaned at the site of infestation.

Invasive plant seeds and fragments can hitch a ride on equipment and clothing. Avoid unintentionally transporting them by cleaning equipment and clothing before leaving a site.

SECTION I: General Information on Invasive Plants and BMPs to Control Them

Acceptable methods of cleaning include, but are not limited to:

1. Brush, broom, or other hand tools (used without water)
2. High- pressure air
3. Portable wash station that contains runoff from washing that comply with wastewater discharge regulations

CONTROL

MECHANICAL – MOWING/CUTTING

Type II plants have the ability to sprout from stem and root fragments.

1. Avoid mowing Type II plants. Mowing for safety/sight distance concerns should be considered an interim measure as these plants will thrive from cutting alone and increase the site's population size and density.
2. Consider additional management such as herbicide application for eradication purposes. If these plants are cut, all plant material must be rendered nonviable and extra care should be taken to avoid spreading plant fragments.

In areas where there are no Type II invasive plants (Purple loosestrife, common reed, and Japanese knotweed):

1. Attempt to mow the area prior to seed maturation (approximately July 1st).
2. Identifying specific roads that are either heavily infested with invasive plants or roads that are in sensitive habitat areas.
 - a. Make those roads a priority in the mowing schedule.
3. Clean mowing equipment daily, as well as prior to transport. This is particularly important if mowing occurs after seed maturation (after July 1st).

Rendering Plants Nonviable

Drying
Bagging
Burning

SMOTHERING

Smothering is a method of control that inhibits plant growth by depriving the plant of light and air and heating up the soil.

1. Remove above ground vegetation.
2. Lay down a thick layer of black plastic or landscape fabric over the area. Overlap the target area by a foot or two.
3. Secure the edges in a manner that ensures that no light can reach under the covering and wind cannot displace it.
4. Monitor frequently for damage or displacement of the cover.



BIOLOGICAL

Biological agents such as insects, can attack invasive plant species to suppress and inhibit growth (See page 20).

HERBICIDE

Recommended for any invasive plant.

1. Herbicide applications must be carried out by a licensed applicator with a special permit from the NHDAMF.
2. Herbicide applications should be timed to be completed at least



SECTION I: General Information on Invasive Plants and BMPs to Control Them

two-years prior to the initiation of any other construction work or activities. This will minimize the potential to spread the invasive plant(s).

3. See Section V for use of the statewide herbicide contract.

DISPOSAL AND TRANSPORT OF ABOVEGROUND PLANT MATERIAL AND SOIL

When invasive plants are cut or removed for roadside maintenance, construction, or control of plants, the viable plant material must be rendered nonviable to avoid spreading it. Movement of invasive plant material and soil containing plant material requires it to be covered in a manner that prevents the release of any plant parts or soil during transport.

The following methods can be used to destroy plant material (render it non-viable). Additional methods for Type II plants are found in Section III.

DRYING

Drying is recommended for Japanese knotweed, Purple loosestrife, and Phragmites.

1. For large amounts of plant material or for plants with rigid stems:
 - a. Place the material on asphalt, tarps, or heavy plastic,
 - b. Cover with tarps or heavy plastic to prevent the material from blowing away.
2. For smaller amounts of plant material or for plants with pliable stems:
 - a. Bag the material in heavy duty (7-mil or thicker) garbage bags.
 - b. Keep plant material covered or bagged for at least one month.



The amount of time that it takes for drying is variable. The material is nonviable when it has turned brown, is partially decomposed, very slimy, or brittle. Once material is nonviable, it can be disposed in a landfill or brush pile.

BRUSH PILES

Brush piles are an option for woody shrubs, trees, vines, spotted knapweed, and large quantities of purple loosestrife, common reed, and knotweed. It is NOT recommended for any invasive plant with seeds or fruit attached, unless plants can be piled within the limits of the infestation.

1. Plant material from most invasive plants can be piled on site to dry out.
2. When piling purple loosestrife, common reed, and knotweed, care must be taken to pile stems and roots so that cut surfaces are not in contact with moist soil.

BURYING

Burying is an option for invasive plants as long as knotweed is buried at least FIVE feet below grade and within the area of infestation.

1. Bury Type I invasive plants three feet below grade and knotweed five feet below grade. This method is best used on a job site that already has disturbed soils.

SECTION I: General Information on Invasive Plants and BMPs to Control Them

CHIPPING FOR TRANSPORT is recommended for woody invasive species prior to July 1st, the common seed maturation date. Chipping and transportation may occur after July 1st if the chips are destined for burning. **Chipping is not appropriate for Type II invasive plants, or for the noxious weeds** such as poison ivy, poison sumac or giant hogweed.



BURNING

Burning is an option for any invasive plant that does not contain hazardous chemicals (e.g., poison ivy, poison sumac and giant hogweed).

Plant material should be taken to a designated burn pile. (All necessary permits must be obtained before burning.)

Propagule

A vegetative structure that can become detached from a plant and give rise to a new plant, e.g. a bud, sucker, or spore.

Examples of plants that can produce propagules are purple loosestrife, knotweed, and common reed.

STOCKPILING MATERIAL

Any excavated material that contains viable plant propagules and is not reused within the limits of the infestation must be stockpiled on an impervious surface until viable plant material is destroyed OR the material must be disposed of by burying to the appropriate depth.

Burying

5 feet below grade for knotweed
3 feet below grade for all other invasives.

Whenever possible, excavation should be avoided in areas containing Japanese knotweed, purple loosestrife, and phragmites. If excavation does occur in these areas, the BMPs described in Section II must be followed. Cover soil and plant material during transport.

Excavated material from a DOT detention pond. Material was stockpiled on site until plant materials became nonviable.



Note that the material is covered and contained.

CHAPTER 1

SECTION II

Type I Invasive Plants

SECTION II: TYPE I Invasive Plants

TYPE I INVASIVE PLANT SPECIES

Type I plants are those plants that are spread by seeds. A complete list of the Type I invasive species is on page 3. The plant species on that list likely to be found on NHDOT properties are discussed in detail in this section on pages 9-15. The *Type I plants that are only occasionally encountered during NHDOT activities* are shown below for a quick reference. If these plants are found during activities, contact your environmental coordinator.

Tree of Heaven



Garlic Mustard



Garlic Mustard



Japanese Barberry

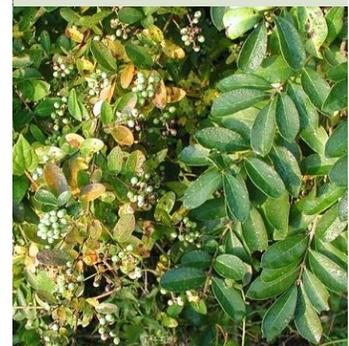


Mile-a-Minute



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Blunt-leaved Privet



Pepperweed



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Tree of Heaven



Burning Bush



Burning Bush



Burning Bush



SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Glossy Buckthorn, *Frangula alnus*

Appearance and Characteristics

A deciduous large shrub or small tree that grows up to 20'.

Stems: Bark is gray to brown with white lenticels (openings in the bark that allow for gas exchange).

Leaves: Simple, dark green, shiny with pronounced venation.

Flowers: Clusters of small, pale green to creamy white, star shaped, in spring.

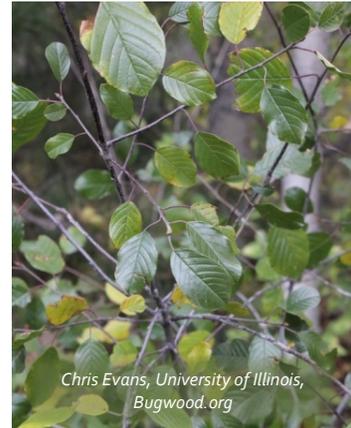
Fruit: Starts as red in color and turns dark purple or black.

Habitat: Moist woodlands and disturbed areas but tolerates a range of conditions.

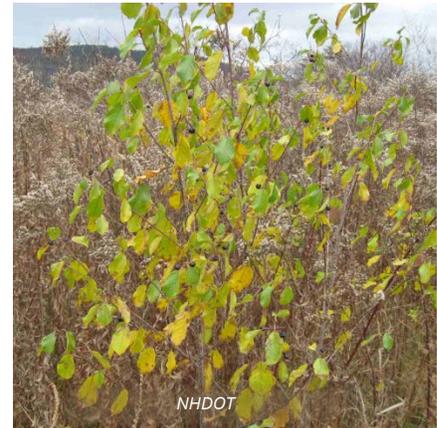
Spread: Wildlife eats the fruit and disperses the seeds.

Impact

Grows rapidly and produces many seeds. Can sprout from broken stems. Forms dense thickets.



Small white flowers in clusters in June.



Black berries in the fall. The leaves can last longer on the stems than other plants in the fall.



SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Honeysuckle, *Lonicera* spp.

There are several species of honeysuckle on the NHDOT Type I list. Each species has slightly different characteristics. The arrangement of leaves opposite each other along the stem is a characteristic that is common to all of the honeysuckles.

Japanese honeysuckle is shown here as an example.

Impact

Can girdle saplings and form dense mats in the canopies of trees.

Appearance and Characteristics

Stems: A deciduous vine that can grow up to 4" in diameter and over 50 feet long. Corky. Peels easily.

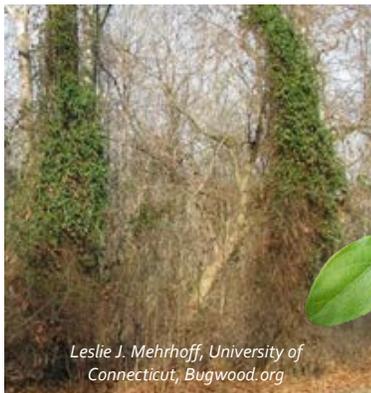
Leaves: Arranged opposite each other along the stem. Medium green, oval. Older leaves are smooth along their edges. Young leaves may be lobed. Either type of leaf may be on the same stem.

Flowers: Clusters of creamy white to white tubular in the axils of the leaves in spring.

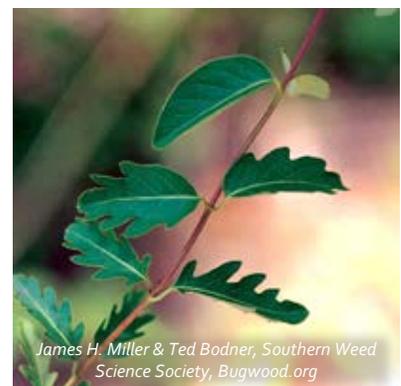
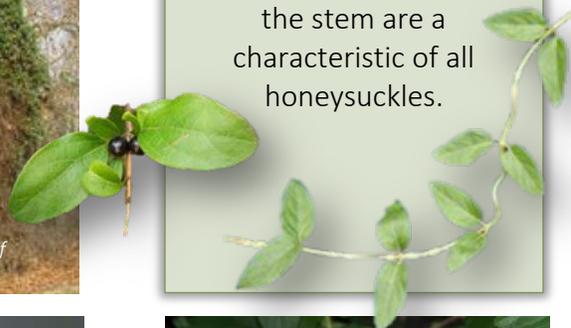
Fruit: Begins green in color and gradually turns black.

Habitat: Old fields and disturbed sites, but it can adapt to various light and moisture conditions.

Spread: Wildlife, runners and roots.



Leaves that are arranged opposite each other along the stem are a characteristic of all honeysuckles.



SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Spotted Knapweed, *Centaurea stoebe*

Appearance and Characteristics

Herbaceous perennial bush with a deep root.

Leaves: Arranged in a rosette, bluish green, somewhat hairy. The leaves get smaller toward the top of the stem.

Flowers: Pinkish purple flower heads composed of dozens of florets attached to a receptacle covered with fringed bracts with brown tips (creating a spotted appearance to the receptacle).

Fruit: Each floret produces one seed.

Habitat: Old fields, roadsides, sunny disturbed sites.

Spread: Wind and wildlife.



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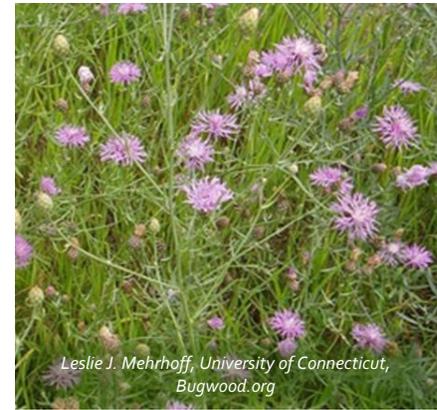
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SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Multiflora Rose, *Rosa multiflora*

Appearance and Characteristics	Impact
<p>A perennial shrub that grows up to 15' or more in height.</p> <p>Stems: Green to red (old stems are brownish) long, with curved thorns. Can be very thorny. Forms dense thickets.</p> <p>Leaves: Serrate, alternately arranged around stem, compound with 7-9 leaflets and having fringe at base.</p> <p>Flowers: Clusters of white or pink, June to July.</p> <p>Fruit: Small, rose hips turn red in fall and last through the winter.</p> <p>Habitat: Grows in a variety of conditions, prefers full sun.</p> <p>Spread: Wildlife eats the fruit and disperses the seeds.</p>	<p>Very aggressive, restricts movement.</p> <p>Fringed petiole helps to distinguish this rose from other rose species. Note serrated leaves.</p>



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Hips that look like berries persist through the winter.

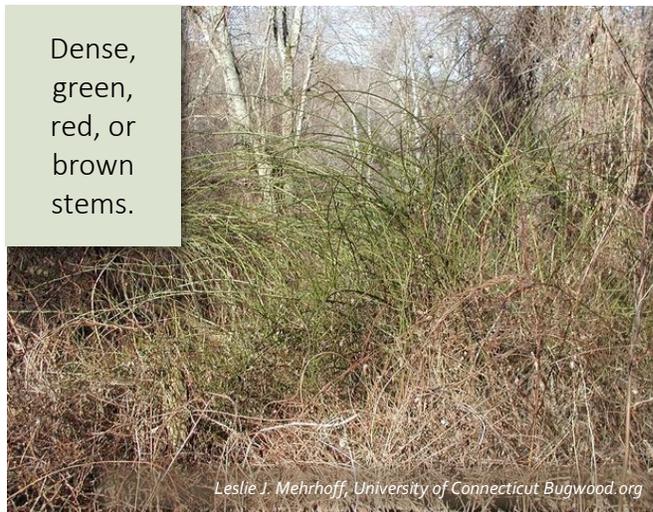


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Dense, green, red, or brown stems.



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SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Oriental Bittersweet, *Celastrus orbiculatus*

Appearance and Characteristics

A perennial deciduous woody vine that grows up to 60'.

Stems and branches: Woody, brown to gray, can grow up to 4" in diameter.

Leaves: Alternately arranged on vine, light green, elliptical or circular.

Flowers: Small, light green to white in the axils of the leaves.

Fruit: Start small and greenish and ripen into round yellow balls that split revealing red berries that last through the winter.

Habitat: Adapts to a variety of conditions.

Spread: Wildlife eats the fruit and disperses the seeds.

Impact

Very aggressive, restricts movement, girdles trees.



SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Autumn Olive, *Elaeagnus umbellata*

Appearance and Characteristics

A deciduous shrub that grows up to 20'.

Stems and branches: Have thorns.

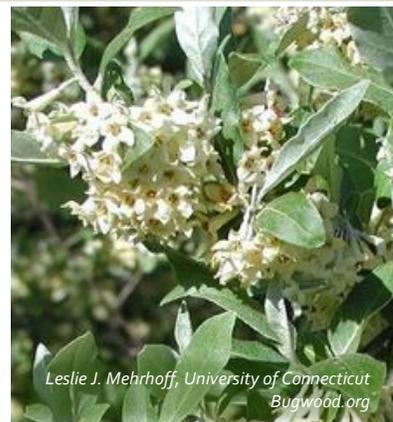
Leaves: Alternately arranged on branch. Top of leaves are bright to grey green and silvery on the underside.

Flowers: Small, cream colored tubular flowers in clusters in late spring.

Fruit: Round, red, juicy with one seed in fall.

Habitat: Invades disturbed areas.

Spread: Wildlife eats the fruit and disperses the seeds.



Thorns on
branches



Leaves are
silvery on
underside



SECTION II: Type I Invasive Plants Commonly Found on NHDOT Properties

Black Swallowwort, *Cynanchum louiseae*

Appearance and Characteristics

Herbaceous perennial vine up to 6.5 feet.

Vine : Twining.

Leaves: Opposite, dark green, lanceolate, smooth edges.

Flowers: Small, dark maroon/purplish.

Fruit: Pods (like milkweed). Seeds tufted with white hairs.

Habitat: Uplands, tolerates wide range light and moisture.

Spread: Wind.



All photos on this page are by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Chapter 1
Section III
NHDOT Type II Priority Invasive Plant Species

Section III – NHDOT Type II Priority Invasive Plant Species

Knotweed, *Reynoutria* spp.

The three species of knotweed (Japanese, Bohemian, and Giant) are similar and control measures are applicable for all.

Appearance and Characteristics	Impact
<p>Perennial herbaceous plant developing woody stem tissue.</p> <p>Upright growing to 10' – 15' tall.</p> <p>Stems: Green with purple splotching, have jointed segments about every 6-8", hollow (like bamboo).</p> <p>Leaves: Broadly ovate, 3-6" long by 2-4" wide and typically truncate at the base.</p> <p>Flowers: Small, whitish, forming panicles, August-September.</p> <p>Seeds: Brown, triangular.</p> <p>Habitat: Found in open spaces, ditches, roadsides, riverbanks woodland sites. Prefers moist, well-drained soils.</p> <p>Spread: Stem & root fragments, and by seed.</p> <p>Comments: Aggressive. Spreads quickly along surface waters and in right-of-ways.</p>	<p>Forms dense thickets along highway and roadway corridors. Releases allelopathic chemicals that displace native and/or desirable vegetation. Causes safety and sight distance issues, and structural damage to infrastructure.</p>



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Doug Cygan, NHDAMA

**Type II
Knotweed**
Forms dense thickets along highway corridors.



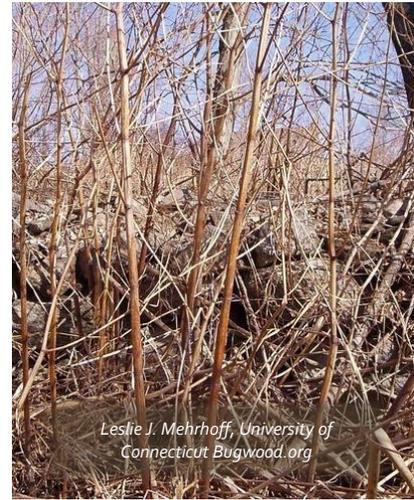
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Knotweed

Three species of knotweed are problematic in New Hampshire: Japanese, Giant, and Bohemian. All three species have similar characteristics and the same methods are used for control and disposal. The three species are grouped together in this manual in a general category as “knotweed”.

Knotweed was introduced to North America in the early 1800s for ornamental purposes. It is now found in natural ecosystems throughout North America where it has escaped cultivation.

Knotweed produces tall stems that are greenish in color with subtle purple splotches and smooth with prominent nodes where each leaf joins the stem. The leaves are ovate, almost heart shaped, and have rough edges. They vary in size, but are mostly around six inches long by three to four inches wide. The small 1/4” greenish-white flowers occur in pendulous droops in the summer, which produce small whitish winged fruits. The seeds are triangular, shiny, and are very small, about 1/10” long. The rhizome system can become very extensive allowing it to store large amounts of carbohydrates for overwintering and spring development. Some have roots that grow down thirty feet into the soil and run horizontally up to sixty feet in length. The roots have been known to grow under and break through asphalt. All rhizome fragments have the ability to produce new plants. Stem fragments possessing nodes also have the ability to regenerate into new plants. In the fall when the first hard frost hits the plants, they immediately turn brown.

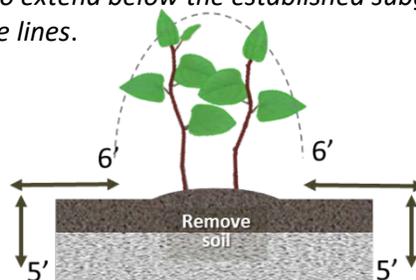


CONTROL – MECHANICAL

EXCAVATION

If areas containing knotweed plants must be excavated, remove plant material and associated soil within a six-foot radius beyond the lateral limit of the plant surface growth and to a depth of five feet .

Note: Excavation is not required to extend below the established subgrade in proposed roadway sections nor extend beyond the proposed slope lines.



Section III – NHDOT Type II Priority Invasive Plant Species

Knotweed

All excavated soil containing knotweed must conform to the following disposal methods:

1. Burial to a depth of at least five feet (5') below project finish ground surface, or
2. Transported to a designated disposal site in accordance with an Invasive Species Management Plan or approved work plan.

CUTTING

1. Avoid mowing knotweed.
2. Cut plants at ground level to avoid dispersal of plant fragments.
3. Render the plant material non-viable by bagging, burning, incineration, or other acceptable method until all of the matter is rendered non-viable.
4. Disposed of bagged material at a municipal landfill as allowed by municipality.
5. (See page 8 for additional information on bagging).

CONTROL - BIOLOGICAL

At this time, there are no biological treatments available

CONTROL - HERBICIDE TREATMENTS

This control method must be conducted by a NH licensed pesticide applicator in accordance with all state and federal rules and regulations.

For best results, cut the knotweed at the base of the stem around the first week of June. It is best, *but not essential*, to wait until September/October to apply the herbicide. This is because:

1. If the plants have been cut back in June, they are less likely to be flowering in the fall. Impacts to pollinators like honeybees, who like to forage on knotweed flowers, can be minimized when there are no flowers on the plant.
2. The waiting period between June and September allows the knotweed to re-sprout producing a shorter canopy. This improves accessibility for the applicator.
3. Autumn is the season when plants move nutrients stored in the leaves down into their roots for winter storage. If the herbicide is applied while the plant is moving nutrients, it will have a better chance of reaching the root where it can do maximum damage.
4. See Section V for use of the statewide herbicide contract.



Doug Cygan,
NHDAMF

Always consult the product label for use requirements and pollinator considerations.

Section III – NHDOT Type II Priority Invasive Plant Species

Purple Loosestrife, *Lythrum salicaria*

Appearance and Characteristics

Herbaceous perennial growing to 7' tall with spikey magenta (pink purplish) flowers. A single plant can produce between 2-4 million seeds per year. Seeds can be viable up to 10-years. The plant can also reproduce through root fragments.

It is commonly found in wet areas where it has the most potential to out compete native species.

Stems: 4-6 sided (suarish) turning woody in summer.

Leaves: Opposite to whorled, lanceolate, 2-4" long.

Flowers: Spiked raceme, purple to magenta, June to October.

Fruit: Capsule.

Habitat: Mostly found in wet area. Full to partial sun. Can also adapt to dryer areas.

Spread: Each plant can produce millions of seeds. Seeds are dispersed by water, wildlife, and humans.

Impact

Fast growing enabling it to shade out and out compete native wetland plants. Clogs drainage ditches resulting in decreased flood capacity and storm water conveyance. Invades wetlands suppressing native species and destroying wildlife habitat.

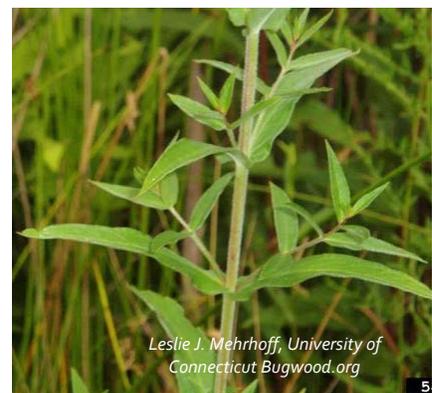
Note the square stems and the way the leaves are opposite each other along the stem.



Type II Purple Loosestrife

Generally found in wet areas.

Clogs drainage ditches.

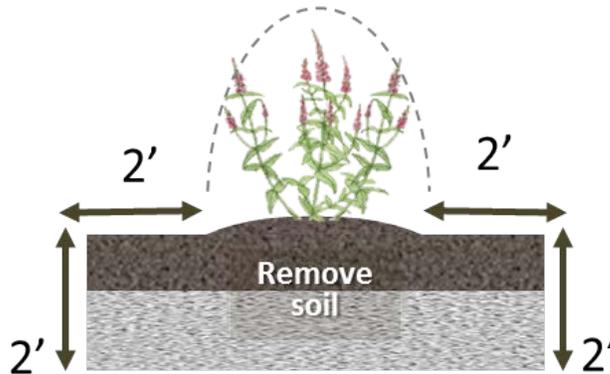


Purple Loosestrife, *Lythrum salicaria*

CONTROL - MECHANICAL

EXCAVATION

If areas containing purple loosestrife plants must be excavated, remove the plant material and associated soil within a two-foot (2') radius beyond the lateral limit of the plant surface growth and to a depth of two-feet (2').



Note: Excavation is not required to extend below the established subgrade in proposed roadway sections nor extend beyond the proposed slope lines.

For excavated soil containing purple loosestrife:

1. Bury it to a depth of at least 3' below project finish ground surface.
2. Transport it to a designated disposal site in accordance with an Invasive Species Management Plan or approved Work Plan.

CUTTING

1. Avoid mowing purple loosestrife.
2. Cut plants at ground level to avoid dispersal of plant fragments
3. Cut plants before flowering (before July 1) to avoid accidental dispersal of seeds.
4. Render plant matter non-viable by bagging, burning, incineration, or other acceptable method until all of the matter is non-viable.
5. Dispose of bagged plant material at a municipal landfill as allowed by the municipality.

Cutting
Purple Loosestrife

Bag
Burn or
Bury

CONTROL – BIOLOGICAL

NHDOT recommends using two beetles for biological control purple loosestrife: *Galerucella californiensis* and *G. pussila*. These are leaf-eating beetles that have proven to be the most effective.

Section III – NHDOT Type II Priority Invasive Plant Species

Purple Loosestrife, *Lythrum salicaria*

A beetle-release program was established in 1996 as a cooperative effort between NHDOT and NHDAMF. The effort resulted in beetle releases around the state making it likely that areas with purple loosestrife will have established beetle populations. Sites should be evaluated in the early stages of a project to determine if the beetles are present. The acquisition of *Galerucella sp.* beetles requires coordination with NHDAMF.

Note: Wetland permit conditions for mitigation sites may require long-term purple loosestrife management. Biological control is a highly feasible option but it requires long-term monitoring and management for success.

CONTROL - HERBICIDE TREATMENTS

This control method must be conducted by a NH licensed pesticide applicator in accordance with all state and federal rules and regulations.

1. Herbicide application must be done as a foliar treatment and can be conducted between the months of June through October.
2. Spraying should not be performed when the plants are in flower to avoid harming honeybees gathering nectar. Spraying may be resumed after the flowers have wilted, until the first hard frost has affected the vegetation.
3. Note that late applications, after August, do not affect seed production.

See Section V for use of the statewide herbicide contract.



Section III – NHDOT Type II Priority Invasive Plant Species

Common Reed, *Phragmites australis*

Appearance and Characteristics	Impact
<p>Tall erect perennial grass that can grow to 14' in height. Spread by seed and rhizomes and stolons. A single inflorescence can produce up to 2,000 viable seeds.</p> <p>Stems: Called 'culms' are large, hollow and grow up to 1" diameter.</p> <p>Leaves: Lanceolate, up to 24" long, bluish-green in color.</p> <p>Flowers: Panicles with many spikelets having seven small reddish flowers.</p> <p>Habitat: Mostly found in marshlands, but also grows in freshwater wetlands and aquatic systems, full to partial sun.</p> <p>Spread: Spreads primarily by rhizomes.</p> <p>Comments: Forms dense colonies that suppress native species and alter wildlife habitat.</p>	<p>Very aggressive clonal grass that clogs surface water drainage systems/structures. Chokes out native plant species in wetland mitigation sites.</p>



Section III – NHDOT Type II Priority Invasive Plant Species

Common Reed, *Phragmites australis*

CONTROL - MECHANICAL

EXCAVATION

If areas containing common reed plants must be excavated, the removal of plant material and associated soil within a five-foot (5') radius beyond the lateral limit of the plant surface growth and to a depth of three feet (3') is required.

Note: Excavation is not required to extend below the established subgrade in proposed roadway sections nor extend beyond the proposed slope lines.

All excavated soils containing common reed must conform to the following disposal methods:

1. Burial to a depth of at least 3' below project finish ground surface.
2. Transported to a designated disposal site in accordance with the Invasives Management Plan or approved Work Plan.

CUTTING

1. Avoid mowing *Phragmites*.
2. Cut plants at ground level to avoid dispersal of plant fragments.
3. The plant matter must be rendered non-viable by bagging, burning, incineration, or other acceptable method until all of the matter is rendered non-viable.
4. Bagged matter may be disposed of at a municipal landfill as allowed by municipality.

CONTROL - HERBICIDE TREATMENTS

This control method must be conducted by a NH licensed pesticide applicator in accordance with all state and federal rules and regulations.

Herbicide application must be done as a foliar treatment and can be conducted between the months of June through September.

See Section V for use of the statewide herbicide contract.

CONTROL - BIOLOGICAL

At this time, there are no biological treatments available



Common Reed
Just getting started. Now is a
good time to eradicate.

Chapter 1
Section IV
Noxious Plants

SECTION IV – Noxious Plants



POISON IVY grows in many types of environments – from dry to wet, poor soil to rich soil, low light to high light. It grows as an erect low growing shrub or as a vine. Sometimes it appears as a ground cover. As a vine, it produces aerial roots that allow it to grow on trees and other structures. It can reach 160' long and its main stem can grow to 6" in diameter. Fibrous roots grow out from long, creeping rhizomes. It can out compete other plants, overgrow drainage structures, and cause varying degrees of allergic reaction.

Poison ivy has compound leaves divided into three pointed shiny leaflets that are arranged alternately along the stem. Leaflets vary in size, color, and shape – from green and reddish in spring – to yellow, orange, and red in fall. Its flowers are yellow or green with five petals that bunch together in an inflorescence. Berries (drupes) are small and round, light yellow, in clusters.

If skin is exposed to poison ivy or sumac, it can cause a mild to severe rash. The rash is a nasty business with red, raised skin lesions that ooze and itch (note: scratching a poison ivy or sumac rash just makes the itching worse). The allergic reaction is caused by urushiol (pronounced you-ROO-shee-all) which is found in both poison ivy and poison sumac. Urushiol is a resinous oil present in all parts of the plants in all seasons.

NEVER BURN POISON IVY or POISON SUMAC. Burning these plants can release the oil into the air which can be carried to people via the smoke. Inhaling urushiol can cause very serious health issues.

NEVER BURN POISON IVY!

Urushiol is present in all parts of the plant in all seasons.

Poison ivy can be a tricky plant to identify. Generally, poison ivy has leaves that are divided into three green, shiny, pointed leaflets. However:

- The leaves may not always be shiny.
- The leaves may be green or red depending on the age of the leaflet and the season.
- The leaflet edges are typically smooth but occasionally appear with uneven edges, or may have a mitten shape (the leaflet may have a small notch that makes it look like a mitten).



Ohio State Weed Lab Archive, The Ohio State University, Bugwood.org.

- Even leaves on the same plant can look different!
- Poison ivy grows as a vine or shrub and can look like a ground cover. It can resemble other harmless plants.
- It attaches to vertical surfaces by producing many small reddish to brownish roots from its larger stems. These roots are visible in all seasons and are a visual sign to look for during the winter.

SECTION IV – Noxious Plants

CONTROL – MECHANICAL

1. Small plants can be carefully **pulled** by putting a plastic bag over the plant (use a new bag for each plant) and pulling the plant out.
 - a. If roots are visible in the ground, pick them out.
 - b. If feasible, cover the area where the poison ivy was pulled with a heavy mulch to prevent any remaining plant parts from getting started.
2. **Digging** out the plant is an alternative to pulling.
 - a. Put all plant parts into a heavy-duty plastic trash bag.
 - b. Tie it securely, label it, and dispose with other solid waste.
 - c. Check to make sure the solid waste contractor allows this type of waste. If not, plant parts can be buried.
 - d. DO NOT BURN or COMPOST.
3. **Starving** the poison ivy plants by repeatedly cutting back to the ground and re-working the surrounding soil is also effective but labor intensive.
 - a. Plant parts and dead material on the ground should be placed in a plastic bag and disposed. Remember that dead poison ivy can still cause an allergic reaction.
 - b. Strong vinegar can be applied to the soil around cut plants as a secondary measure to kill any remaining roots.
4. Never use a weed-wacker to cut poison ivy as it can release the urshiol into the air.

Always use PPE when working around poisonous plants!



Do not let poisonous plants touch your skin or eyes.



Dead poison ivy parts can still cause allergic reactions.



Review Noxious Plants Sub-Section on Exposure – Prevention and Control

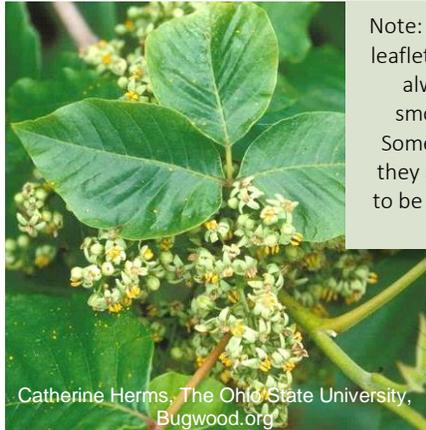
CONTROL - HERBICIDE TREATMENTS

1. Apply chemical controls directly to the plant (e.g., painting) to avoid damaging the surrounding vegetation.
2. If **guardrail** is being treated for poison ivy, it is not necessary to paint the plants – the chemicals can be sprayed in accordance with NHDAMF rules
3. For **large vines** clinging to trees, cut a four-inch section out of the stem and paint the chemical directly on the cut.



SECTION IV – Noxious Plants

Poison Ivy, *Toxicodendron radicans*



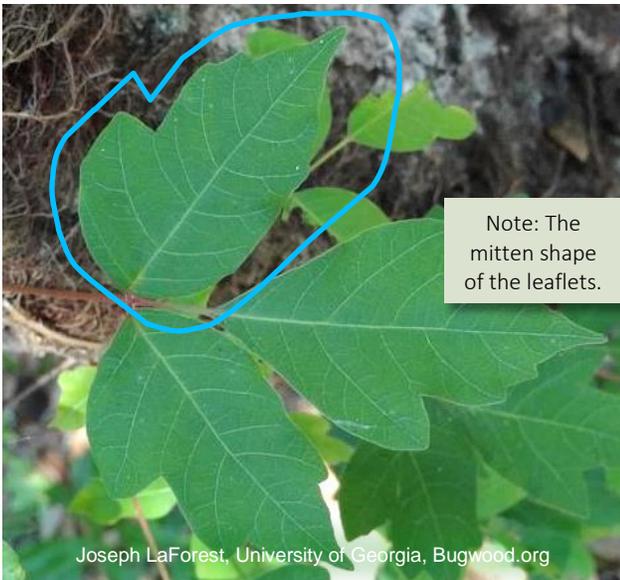
Note: Edge of leaflets are not always smooth. Sometimes they appear to be jagged.



Below: Poison ivy hiding in the grass....



Note below: The poison ivy appears wilted. One of its many looks.



The many faces of poison ivy
(The wily ivy)

SECTION IV – Noxious Plants

Plants That Look Like Poison Ivy

Are there more than three leaflets?
Not poison ivy

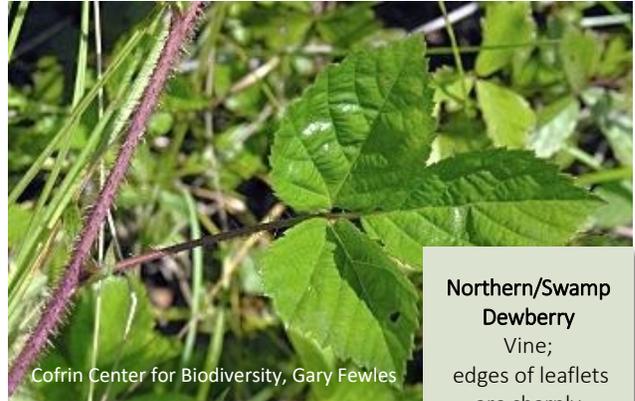


Virginia Creeper

Vine; compound palmate leaves with five saw-toothed leaflets



Does the stem have prickles? Not poison ivy. BUT, PI that is climbing may have aerial roots on the vine that look like prickles (see page 37).



Northern/Swamp Dewberry

Vine; edges of leaflets are sharply toothed. Prickles along stem. Leaves may turn reddish in fall and winter.



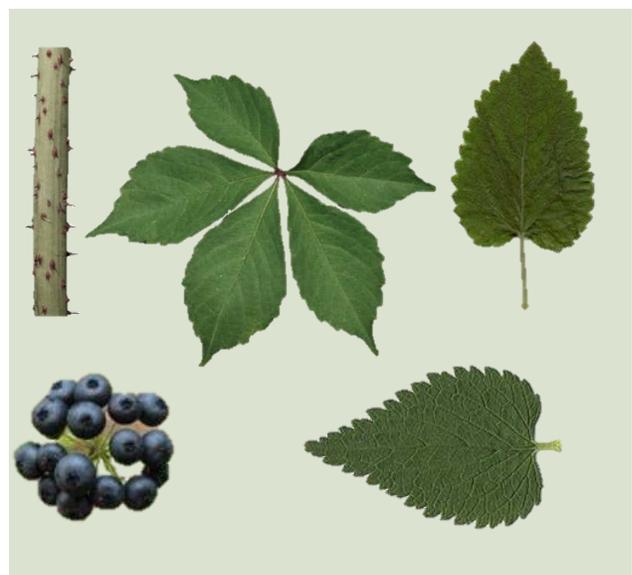
Hog Peanut

Three leaflets that are drop shaped. Purplish white flowers. Does not have a woody stem.



Wild Sarsaparilla

Compound leaves with 3-5 leaflets that are oval and pointed, not shiny.



Not poison ivy.

SECTION IV – Noxious Plants

Poison Sumac, *Toxicodendron vernix*

POISON SUMAC is rare in New Hampshire. Like poison ivy, it can be tricky to identify because it looks like other harmless plants. Here are some identifiers that will help:

- Poison sumac is a large shrub or small tree that grows in wetlands. It does not like dryer areas.
- Its leaves are separated into many leaflets that that:
 - ✓ Are opposite each other (in pairs) along the stem. Each leaf has *up to 13* leaflets.
 - ✓ Are smooth along their edges (not serrated)
 - ✓ Tend to fold up along the stem instead of folding down.
- The stems are generally reddish.
- The berries (drupes) are whitish/greyish/light greenish, not tightly compacted into one structure but hanging separately in a loose cluster.



CONTROL OF POISON SUMAC is best achieved by using an herbicide such as glyphosate.

1. Apply the herbicide while the plant is flowering.
2. The shrub should be cut back to roughly a foot above the ground and the herbicide applied to the cut. Repeated applications may be necessary to kill the plant.



Courtesy of the Smithsonian Institution
© William S. Justice



Courtesy of the Smithsonian Institution



Found in Wetlands



Amanda44



Staghorn Sumac (shown left)

Not poisonous
Serrated leaves
Hairy/fuzzy stems
Red berries in a tight cluster

SECTION IV – Noxious Plants

Giant Hogweed, *Heracleum mantegazzianum*

GIANT HOGWEED is rare in New Hampshire. It's a biennial that can grow up to 20 feet with very large leaves placed alternately along the stems. The stems are green with purplish splotches, hollow, and with bristles. The sap from this plant makes skin extremely sensitive to UV radiation and can cause blistering and burning. It can also cause blindness if the sap gets into the eyes. Hogweed is found in wooded or open spaces, roadside ditches, and along streams or rivers. **Do not handle this plant in any way.** If this plant is encountered, call your Environmental Coordinator who will contact NHDAMF.

Giant Hogweed

Roadside ditches and along streams and rivers. Large deeply incised leaves. Umbel shaped flowers can be up to 2.5' across.



Green and purplish/red stems with bristles



SECTION IV – Noxious Plants

Plants That Look Like Hogweed

On first glance, cow parsnip looks a lot like giant hogweed. Rather than trying to distinguish the difference between the two, the advice is **stay away from anything that looks like giant hogweed**. *Cow parsnip* is also *phototoxic* but not as strongly as giant hogweed.

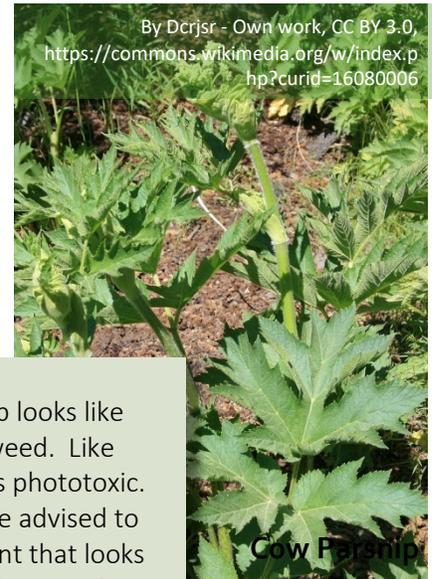
The flower of Queen Anne's Lace, also known as wild carrot, looks like the shape of the flower of hogweed but it is much smaller.

1. It is seen from early spring to fall, in upland fields, roadsides, and other open areas.
2. The flowers of Queen Anne's Lace have the same general shape of Hogweed, however, the flowers of Queen Anne's Lace are only 1-2 inches.
3. The plant only grows 1-2 feet tall
4. Leaves are finely divided and lacy.
5. Stems have fine hairs.

Cow parsnip looks like giant hogweed. Like hogweed, it is phototoxic. Personnel are advised to avoid any plant that looks like giant hogweed

Compare the lacy appearance of the small leaves on Queen Anne's Lace to the large incised leaves of Cow parsnip and Giant hogweed.

Queen Anne's Lace



SECTION IV – Noxious Plants



EXPOSURE – PREVENTION AND CONTROL

The best defense against poisonous plants is to avoid them. If they cannot be avoided, wear long sleeves, thick *rubber* gloves (not latex), long pants that reach the foot, socks, and footwear. The idea is to cover up all areas of the skin. In addition, use a poison ivy preventative preparation prior to working in areas that contain poison ivy. Carrying soap or other cleaners that are specifically designed to remove urushiol is strongly advised. Understand that if urushiol gets on clothing, the clothing must be handled with care. Do not rub your eyes if you were exposed to urushiol. Anything that comes into contact with a poisonous plant is contaminated. The following protocol for exposure to urushiol is adapted from the American Academy of Dermatology's website:

Source: Adapted from American Academy of Dermatology, Inc. <https://www.aad.org/public/diseases/itchy-skin/poison-ivy-oak-and-sumac#tips>

1. **Immediately rinse your skin with cool or lukewarm water.** Do not use hot water as it can open skin pores, as can some soaps. Cleaners made for poison ivy are best. If you can rinse your skin immediately after touching poison ivy, poison oak, or poison sumac, you may be able to rinse off some of the oil. If not washed off, the oil can spread from person to person and to other areas of your body. If you do not have soap available within 20 minutes of exposure, use the water that is available as long as it is not hot water.
2. **Wash your clothing.** Thoroughly wash all of the clothes you were wearing (including boots) when you were exposed to the poisonous plant. The oil can stick to clothing, and if the clothing touches your skin, it can cause a rash.
3. **Wash everything that may have the oil on its surface.** Besides clothing, the oil from poison ivy, poison oak, and poison sumac can stick to many surfaces, including gardening tools, golf clubs, leashes and even a pet's fur. Be sure to rinse your pet's fur, and wash tools and other objects with warm, soapy water.
4. **Do not scratch,** as scratching can cause an infection.
5. **Leave blisters alone.** If blisters open, do not remove the overlying skin, as the skin can protect the raw wound underneath and prevent infection.
6. **Take short, lukewarm baths.** To ease the itch, take short, lukewarm baths in a colloidal oatmeal preparation, which you can buy at your local drugstore. You can also draw a bath and add one cup of baking soda to the running water. Taking short, cool showers may also help.
7. **Consider calamine lotion or hydrocortisone cream.** Apply calamine lotion to skin that itches. If you have a mild case, a hydrocortisone cream or lotion may also help.
8. **Apply cool compresses** to the itchy skin. You can make a cool compress by wetting a clean washcloth with cold water and wringing it out so that it does not drip. Then, apply the cool cloth to the itchy skin.
9. **Consider taking antihistamine pills.** These pills can help reduce itching, however use with caution. *You should not apply an antihistamine to your skin,* as doing so can worsen the rash and the itch.
10. **If you have any of the following, seek medical attention:**
 - a. You have trouble breathing or swallowing
 - b. The rash covers most of your body
 - c. You have many rashes or blisters.
 - d. You experience swelling, especially if an eyelid swells shut.
 - e. The rash develops anywhere near your eyes or genitals.
11. If your rash is not improving after seven to 10 days, or you think your rash may be infected, see a physician. A dermatologist can treat your rash, any infection, and help relieve the itch.

Chapter 1
Section V
Use of the State Contractor for Herbicide
Application

SECTION V – Use of the Statewide Contract for Herbicide Application

USING THE STATE CONTRACTOR FOR HERBICIDING

Typically, the New Hampshire Department of Administrative Services (NHDAS) procures a statewide contract for herbicide application and treatment services. The contract generally includes spot application of herbicide to control invasive plants and poison ivy as needed. It also includes mechanical control.

Statewide Contract
The National Institute of Governmental Purchasing (NIGP) Commodity Code 988-8900 - Weed and Vegetation Control (including Aquatic Weed Control) is found on the NHDAS Procurement Webpage.

When the statewide contract is used, **NHDOT is responsible for:**

1. Reviewing and having the contractor sign the *Contractor and Supplier Safety and Environmental Checklist* prior to contractor mobilization.
2. Obtaining and maintaining applicable the Safety Data Sheets (SDS) for any chemicals used.
3. Performing inspections to document the results of the treatment area. This must be done within 60 days of the treatment and in the growing season.
 - a. NHDOT inspections should document, minimally, whether or not the work outlined in the contract was completed and whether or not the plants are dead or dying.
 - b. If the treatment area does not meet the control requirements, the contractor must apply, at their own expense, a remedial treatment to all of the remaining living foliage.

The contractor is responsible for all required permitting and reporting as outlined in the projects scope of work.

Below is the information, documentation, and required forms that apply when using the state contract.

The items in bold are required and typically included in the special permit application package:

DAS state wide Herbicide Contract

DM-EMS-EIP-6-Form 6b Contractor Compliance Checklist (For use by the Operations Division. Due prior to contractor mobilization)

- NHDOT Environmental Policy 501.01
- **SDS Sheets provided by the contractor and maintained by NHDOT**
- Application Report Due within 30 days of the initial application
- **Date/Time of application**
- **Names and license numbers of all applicators**
- **NH Pesticide Permit Application Package and Special Permit**
- **Applied chemical mixture data (chemical names, and adjuvants or surfactants)**
- **Concentration and target rate**
- **Weather information (temperature, wind conditions, coordinates of target areas)**
- **Target Species**

Chapter 1
Section VI
Contacts and Resources

CONTACTS

NH Department of Transportation, Bureau of Environment,

Marc Laurin, Senior Environmental Manager

Marc.laurin@dot.nh.gov

271-4044

Contact for information on: plant identification, best management practices, and control methods

NH Department of Transportation, Bureau of Highway Design, Roadside Development,

Barbara Rollins, Landscape Specialist Supervisor

barbara.rollins@dot.nh.gov

271-1611

Contact for information on: herbicides

NH Department of Agriculture, Markets, & Food

Doug Cygan, Invasive Species Coordinator

Douglas.cygan@agr.nh.gov

271-2561

Contact for information on: plant identification, control methods, herbicides

David Rousseau, Director, Division of Pesticide Control

david.rousseau@agr.nh.gov

Telephone: (603) 271-3550

Contact for information on Pesticide Permitting

WEBSITES

Invasive Plant Atlas of New England—photographs and information on habitat

https://www.eddmaps.org/ipane/ipanespecies/species_list.htm

US Forest Service—**fact sheets** on invasive plants in the northeastern United States

<https://www.fs.usda.gov/naspf/resources-and-publications>

The Global Invasive Species Initiative—photographs, management information

<https://www.invasive.org/gist/index.html>

National Invasive Species Information Center—**species profiles** with links to other resources

<http://www.invasivespeciesinfo.gov/plants/main.shtml>

NH Department of Agriculture—Information and publications on invasive plants including:

Guide to Invasive Upland Plant Species in New Hampshire

<https://www.agriculture.nh.gov/publications-forms/documents/upland-invasive-species.pdf>

Preventing the Spread of Japanese Knotweed, Best Management Practices

<https://www.agriculture.nh.gov/publications-forms/documents/japanese-knotweed-bmps.pdf>

Federal Highway Administration—Guide to Roadside Invasives—photographs grouped by flower color; includes many weeds that are not considered invasive in NH.
<http://www.fhwa.dot.gov/modiv/invasive.htm>

Poison Ivy websites:

<http://www.mortonarb.org/trees-plants/tree-and-plant-advice/horticulture-care/poison-ivy-control>
<https://www.extension.purdue.edu/extmedia/ho/ho-218-w.pdf>
<https://www.canada.ca/en/health-canada/services/home-garden-safety/poison-ivy.html>

www.poison-ivy.org

A site for answers about poison ivy, oak, sumac and the skin rashes they cause. Good identification tips.

PUBLICATIONS

Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Plants
USDA Forest Service (2005)
www.fs.fed.us/eng/pubs/

NH Department of Agriculture—*Guide to Invasive Upland Plant Species in New Hampshire*
<https://www.agriculture.nh.gov/publications-forms/documents/upland-invasive-species.pdf>

NH Department of Agriculture – *Preventing the Spread of Japanese Knotweed, Best Management Practices*
<https://www.agriculture.nh.gov/publications-forms/documents/japanese-knotweed-bmps.pdf>

Control of Invasive Species: A Synthesis of Highway Practice National Cooperative Highway Research Program - Synthesis 363 (2006)
<http://www.trb.org/main/blurbs/158498.aspx>

Dangerous Travelers: Controlling Invasive Plants Along America's Roadways
USDA Forest Service (Training Video)
www.fs.fed.us/invasivespecies/prevention/dangeroustravelers.shtml
Copies are available to borrow from the NHDOT Bureau of Environment

Roadside Weed Management

US Department of Transportation, Federal Highway Administration
Contact the NHDOT Bureau of Environment for a hardcopy

Glossary

Allelopathy	The chemical suppression of one plant (or other organism) by another, due to the release into the environment of substances acting as germination or growth inhibitors.
Annual	A plant that completes its life cycle in one year
Emergent	Having most vegetative growth above water
Eradication	Destroy completely, put an end to
Foliar	Of, relating to, or applied to leaves
Germination	Beginning of growth, as from a seed
Herb	A plant that does not produce woody, persistent tissue
Herbaceous	Having aboveground stems that are fleshy instead of woody
Infestation	The presence of an unusually large number of invasive plants in a place
Inflorescence	The complete flower head of a plant including stems, stalks, bracts, and flowers., the arrangement of the flowers on a plant
Invasive	Invasive plant species are species that are not native to a specific location (an introduced species), and that have a tendency to spread to a degree that excludes native plant species. These species can cause damage to the environment by disrupting native habitats and can also impact the economy.
Lanceolate	Shaped like the head of a lance, narrow, and tapering toward the apex or sometimes at the base. (See illustrations on page 36)
Lateral Limit	For the purposes of measuring the area of soil to be removed when excavating invasive plants, it is the edges of the foliar canopy.
Lenticel	A small opening (pore) in the bark of trees that allows the tree to exchange oxygen and carbon dioxide with the atmosphere
Native	Occurring naturally in a given range; not introduced by humans
Non-native	Introduced to areas outside of the species' natural geographic range.
Nonviable	Not capable of living or developing
Noxious	Harmful, poisonous, or very unpleasant.
Ovate	Having an oval outline or ovoid shape, like an egg. (See illustrations on page 36)
Panicle	A loose, branching cluster of flowers. (See illustrations on page 36)
Perennial	A plant that lives for two years or more
Petiole	The stalk that joins a leaf to a stem; leafstalk. (See illustrations on page 36)
Phototoxic	Rendering the skin susceptible to damage (such as burn or blisters) upon exposure to light and especially ultraviolet light
Prickle	A slender, sharp-pointed outgrowth on the bark or epidermis of a plant
Propagule	A structure with the capacity to create a new plant, for example a seed, a spore, or a part of the vegetative body capable of independent growth if detached from the parent.
Raceme	A flower cluster with the separate flowers attached by short equal stalks at equal distances along a central stem. The flowers at the base of the central stem develop first. (See illustrations on page 36)
Rhizome	A horizontal, underground stem that can produce roots and aboveground stems.
Serrated	Having a jagged edge, saw-like.
Stolon	A creeping horizontal plant stem or runner that takes root at points along its length to form new plants.
Twining	Capable of climbing to a greater or lesser height above the ground by twining their stems around a support
Vegetative Reproduction	Propagation by means other than seeds, including rhizomes, runners, stem cuttings, and root cuttings.
Viable	Capable of growing or developing

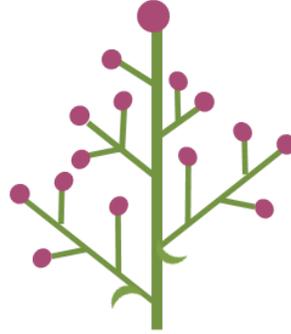
Inflorescence (Flower) Type Terms Used in this Manual



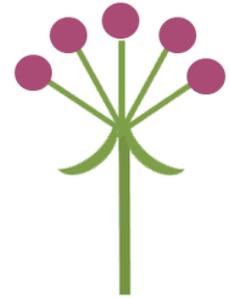
Spike



Raceme



Panicle



Umbel

Leaf Shape Terms Used in this Manual



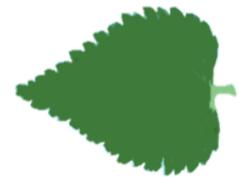
Oval
Shaped
Leaf



Lanceolate
Shaped Leaf

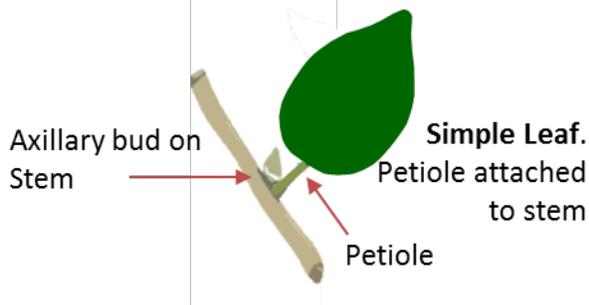


Palmate
Leaf



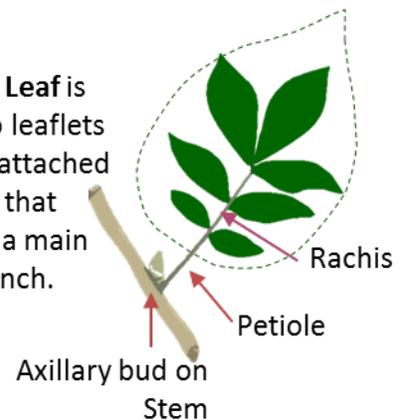
Serrated
Leaf

Leaves have axillary buds where they attach to the stem.



Leaflets do not have axillary buds on the rachis.

Compound Leaf is divided into leaflets on a rachis attached to a petiole that attaches to a main stem or branch.



Examples of plant aerial roots, prickles, and propagules:

Poison Ivy Aerial Roots



Plant Prickles



Types of Propagules



Common reed stolons reaching out across a marsh and sprouting more vegetation



Common reed rhizomes that can grow new plants

Quick Reference BMP's for Type I, Type II and Noxious Plants

<p style="text-align: center;">Type I ↓</p>	<p style="text-align: center;">Type II Priority ↓ Knotweed, Common Reed (Phragmites), Purple Loosestrife</p>	<p style="text-align: center;">Noxious Plants Poison Ivy, Poison Sumac, Giant Hogweed, Wild Parsnip ↓</p>
<ul style="list-style-type: none"> • Use native species for seeding and planting • Limit earth disturbance and stabilize disturbed soils as soon as possible • Inspect mulch and earth materials before use • Monitor work sites • Never use materials from areas of work sites where invasives are known to occur • Stockpile excavated material that contains seeds/fruits on an impervious surface • Use staging areas that are free of invasives • Move equipment <i>from</i> areas free of invasives to areas that are already infested • Cover soil and plant material during transport • Clean equipment daily and before transport <p style="text-align: center;">Controls:</p> <ul style="list-style-type: none"> • Cutting - Mow areas prior to seed maturation. Combine with another approved control method. • Smothering • Herbicide - Pollinator considerations. Applicator Permit needed • Drying (impervious surface) • Brush Piles (within the limits of infestation or on impervious surface) • Burying (3' below grade for plants with seed/fruit) • Chipping (before seeds/fruit appear) After seeds/fruit appear, burn in incinerator. • Burning (permits may be required) • Pulling - Small plant and limited area • Bagging 	<ul style="list-style-type: none"> ♦ Use native species for seeding and planting ♦ Limit earth disturbance and stabilize disturbed soils as soon as possible ♦ Inspect mulch and earthen materials before use ♦ Monitor work sites ♦ Never use materials from work sites where invasives are known to occur ♦ Stockpile excavated material that contains viable plant parts on an impervious surface ♦ Use staging areas that are free of invasives ♦ Move equipment <i>from</i> areas free of invasives to areas that are already infested ♦ Cover soil and plant material during transport ♦ Cut and properly dispose of all aboveground plant material. Transport to a designated disposal site in accordance with Invasives Management Plan. ♦ Cover infested areas not scheduled for excavation with Geotextile and one foot of earth material ♦ Clean all equipment and tools daily and before leaving the site (infested area) <p style="text-align: center;">Controls:</p> <ul style="list-style-type: none"> ▪ Biological Beetles for purple loosestrife ▪ Herbicide - Pollinator considerations. Applicator Permit needed ▪ Drying (impervious surface) ▪ Brush Piles (within the limits of infestation or impervious surface) <ul style="list-style-type: none"> ▪ No contact with moist soil ▪ Excavating- For purple loosestrife excavate 2' beyond the lateral limit of the plant surface growth and 2' down. <ul style="list-style-type: none"> ▪ Bury 3' deep ▪ Excavating - For knotweed excavate 6' beyond the lateral limit of the plant surface growth and 5' down. <ul style="list-style-type: none"> ▪ Bury 5' deep ▪ Excavating of Phragmites must be 5' from lateral limit of vegetation and 3' down. <ul style="list-style-type: none"> ▪ Bury 3' Deep ▪ Burning – Dried plant material. Permit may be required. ▪ Cutting - Do not mow. Cut to ground level, bag plant materials to render non-viable. Combine with another approved method. 	<ul style="list-style-type: none"> ♦ Never Burn ♦ Can cause severe skin rash and burns ♦ Use PPE ♦ Avoid Mowing <p style="text-align: center;">Controls:</p> <ul style="list-style-type: none"> ♦ Smothering ♦ Herbicide ♦ Drying ♦ Pulling (Poison Ivy) ♦ Digging (Poison Ivy) ♦ Starving (Poison Ivy) ♦ Use appropriate PPE

