Appendix B

Invasive and Noxious Species Management Plan





Invasive and Noxious Species Management Plan

Enbridge Energy, Limited Partnership • Line 3 Replacement Project

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ENBRIDGE®

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ACRONYMS AND ABBREVIATIONS

BMPs	best management practices
Enbridge	Enbridge Energy, Limited Partnership
EPP	Environmental Protection Plan
FDL	Fond du Lac Band of Lake Superior Chippewa
HDD	horizontal directional drill
INS	invasive and noxious species
L3R or Project	Line 3 Replacement Project
MDA	Minnesota Department of Agriculture
MDNR	Minnesota Department of Natural Resources
NDDA	North Dakota Department of Agriculture
Plan	Invasive and Noxious Species Management Plan
USDA	U.S. Department of Agriculture

1.0 INTRODUCTION

Enbridge Energy, Limited Partnership ("Enbridge") is committed to minimizing the spread of invasive and noxious species ("INS") as defined by law or regulation (Attachment A), including invasive and noxious terrestrial plants, invasive aquatic species, and tree pests, along the construction right-of-way and associated access roads and haul routes where improvements are needed due to construction of the Line 3 Replacement Project ("L3R" or "Project"). The L3R route extends approximately 330 miles across the state of Minnesota, and an additional 12 miles in North Dakota. As proposed, of the majority of the route is co-located with Enbridge's existing mainline system, foreign utilities, or transportation corridors (e.g., road, railroad).

1.1 PURPOSE OF THE PLAN

The goal of this Invasive and Noxious Species Management Plan ("Plan") is to outline the INS management strategies that will be used to minimize the spread of INS identified within the Project construction workspace [1], access roads, and improved haul routes in compliance with law or regulation. Management strategies will be implemented where applicable and appropriate prior to construction, and during Project construction, restoration, and post-construction monitoring phases. Existing INS occurrences will be documented throughout the construction workspace, access roads, and improved haul routes, through pre-construction surveys, publicly available datasets, or monitoring.

Management strategies for INS on the Project are outlined below by INS group: terrestrial plant species, aquatic species, and tree pests (including oak wilt).

2.0 TERRESTRIAL PLANT INVASIVE AND NOXIOUS SPECIES

This Plan defines terrestrial plant INS as any species that is listed by the U.S. Department of Agriculture ("USDA") as Noxious; or Minnesota Department of Agriculture ("MDA") as Prohibited Noxious Weeds; or North Dakota Department of Agriculture ("NDDA") and/or Pembina County, North Dakota as Noxious; or species otherwise determined to be invasive by the Minnesota Department of Natural Resources ("MDNR") on MDNR-Administered Lands or Fond du Lac Band of Lake Superior Chippewa ("FDL") within the exterior boundaries of the FDL Reservation (see Attachment B).

2.1 MINNESOTA REGULATIONS

In Minnesota, the management objectives for INS within the Project area are to minimize the spread of documented occurrences of terrestrial plant INS that are: 1) listed as Noxious by the

[1] The terms "construction right-of-way," "temporary construction right-of-way," "construction workspace," and "temporary construction workspace" define the primary mainline workspace area required for installation of L3R. For clarity, Enbridge will generically use "construction workspace" instead of "temporary construction right-of-way," temporary construction workspace," or "construction right-of-way" as the terminology for 1) the permanent right-of-way; and 2) the temporary construction area (which includes the following defined terms: Temporary Workspace and Additional Temporary Workspace). Additional Temporary Workspace is temporary construction workspace needed when encountering environmental features that require special construction methods. All construction equipment and vehicles will be confined to this approved construction workspace.

USDA; or 2) listed as "eradicate"[2] or "control"[3] (see Table 2.1-1) under the "Prohibited Noxious Weed" category by the MDA.

Table 2.1-1
Minnesota Department of Agriculture Prohibited Noxious Weeds

Eradicate List		Control List	
Species	**Common Name**	**Species**	**Common Name**
Amaranthus palmeri	Palmer Amaranth	*Berberis vulgaris*	Common Barberry
Celastrus orbiculatus	Oriental Bittersweet	*Cardamine impatiens*	Narrowleaf Bittercress
Centaurea diffusa	Diffuse Knapweed	*Carduus acanthoides* [a]	Plumeless Thistle
Centaurea jacea [a]	Brown Knapweed	*Centaurea stoebe* [a]	Spotted Knapweed
Centaurea solstitialis	Yellow Starthistle	*Cirsium arvense* [a]	Canada Thistle
Centaurea x moncktonii	Meadow Knapweed	*Euphorbia esula* [a]	Leafy Spurge
Conium maculatum	Poison Hemlock	*Lythrum salicaria* [a]	Purple Loosestrife
Cynanchum louiseae	Black Swallow-wort	*Pastinaca sativa* [a]	Wild Parsnip
Digitalis lanata	Grecian Foxglove	*Tanacetum vulgare* [a]	Common Tansy
Dipsacus fullonum	Common Teasel		
Dipsacus laciniatus	Cutleaf Teasel		
Heracleum mantegazzianum [b]	Giant Hogweed		
Humulus japonicus	Japanese Hops		
Linaria dalmatica	Dalmatian Toadflax		

Notes:
[a] Indicates species that have been documented in the Project area based on pre-construction surveys.
[b] This species is also listed as noxious by the USDA.

On MDNR-Administered Lands, the INS management objectives are to minimize the spread of documented occurrences of terrestrial plant INS that are: 1) listed as Noxious by the USDA; 2) listed as "Prohibited Noxious Weeds," "Restricted Noxious Weeds," or "Specially Regulated Plants" by the MDA; or 3) listed as invasive by MDNR Operational Order 113 (see Attachment B). In addition, Enbridge will adhere to the requirements set forth by the MDNR licenses and lease agreements.

On the FDL Reservation, the INS management objectives are to minimize the spread of documented occurrences of INS that are: 1) listed as Noxious by the USDA; 2) listed as "Prohibited Noxious Weeds," "Restricted Noxious Weeds," or "Specially Regulated Plants" by the MDA; 3) listed as invasive by MDNR Operational Order 113; or 4) listed as invasive by the Minnesota Invasive Species Advisory Council or the Minnesota Invasive Terrestrial Plants and Pests Center as requested by the FDL. Enbridge will coordinate with the FDL regarding ongoing terrestrial plant INS prevention and control efforts per the requirements of FDL permits.

[2] Prohibited noxious weeds placed on the noxious weed eradicate list are plants that are not currently known to be present in Minnesota or are not widely established. These species must be eradicated (Minnesota Statute §18.771 (b)(1)).

[3] Prohibited noxious weeds placed on the noxious weed control list are plants that are already established throughout Minnesota or regions of the state. Species on this list must be controlled (Minnesota Statute §18.771 (b)(1)).

2.2 NORTH DAKOTA REGULATIONS

In North Dakota, the INS management objectives are to minimize the spread of documented occurrences of terrestrial plant INS that are: 1) listed as Noxious by the USDA; or 2) listed as noxious (see Table 2.2-1) by the NDDA or Pembina County, North Dakota (NDDA, 2017; NDDA, 2019).

Table 2.2-1
North Dakota Department of Agriculture and Pembina County, North Dakota Noxious Weeds [a]

Species	Common Name
Amaranthus palmeri	Palmer Amaranth
Artemisia absinthium [b]	Absinth Wormwood
Bassia scoparia [b]	Kochia
Carduus nutans [b]	Musk Thistle
Centaurea diffusa	Diffuse Knapweed
Centaurea repens	Russian Knapweed
Centaurea stoebe [b]	Spotted Knapweed
Cirsium arvense [b]	Canada Thistle
Cynoglossum officinale	Houndstongue
Euphorbia esula [b]	Leafy spurge
Linaria dalmatica	Dalmatian Toadflax
Linaria vulgaris [b]	Yellow Toadflax
Lythrum salicaria [b]	Purple Loosestrife
Tamarisk spp.	Saltcedar
Tanacetum vulgare [b]	Common Tansy

Notes:
[a] NDDA, 2017; NDDA, 2019.
[b] Indicates species that have been documented in the Project area based on pre-construction surveys.

2.3 TERRESTRIAL PLANT INVASIVE AND NOXIOUS SPECIES SURVEYS

Enbridge conducted terrestrial INS plant surveys between 2015 to 2019 along a 50-foot-wide buffer on the construction workspace, and 30-foot-wide buffer on access roads and improved haul routes focused on MDNR-administered tracts and lands within the exterior boundaries of the FDL Reservation. Surveys have been completed on 100 percent of MDNR-administered lands and 80 percent of the entire Project construction workspace, access roads, and improved haul routes.

Enbridge survey crews identified 46 terrestrial plant INS and mapped their locations (see Attachment C). No USDA Noxious Weeds were observed. Brown knapweed (*Centaurea jacea*), a species that must be eradicated in Minnesota, was observed at three locations. The most commonly observed INS was Canada thistle (*Cirsium arvense*), a Prohibited Noxious Weed in Minnesota and North Dakota that must be controlled by all landowners. Tables 2.2-1 and 2.2-2 note MDA and NDDA species identified during surveys.

As described in Section 1.1 of the EPP, signs will be posted on the construction workspace or along access roads or improved haul routes to identify INS infestations.

2.4 STANDARD BEST MANAGEMENT PRACTICES

Enbridge has committed to several Best Management Practices ("BMPs") described in the Environmental Protection Plan ("EPP") that will limit the amount of disturbance associated with construction activities and assist with managing terrestrial INS infestations. These BMPs include:

- Reducing the width of the construction workspace in wetlands and near waterbodies as described in Appendix A of the EPP;
- Limiting grading and topsoil segregation to trench-line-only in wetlands and forested vegetation communities as described in Section 1.10.1 of the EPP;
- Installing construction mats for travel lanes in wetlands and other specific locations as described in Appendix A of the EPP, and Section 3.1 of the EPP;
- Utilizing certified weed-free mulch as described in Section 1.9.2 of the EPP;
- Removing accumulated sediment from silt fence when depth reaches one-third of height as described in Section 1.9 of the EPP;
- Stabilizing workspaces, including spoil piles, within 14 days after construction activities have ceased, and within 7 days in areas within 1 mile of special impaired waters as described in Section 1.9.1 of the EPP;
- Utilizing Minnesota Board of Water & Soil Resources native seed mixes and adapted restoration guidelines as described in Section 7.0 and Appendix C of the EPP;
- Decompacting subsoil as described in Sections 1.18 and 7.11 of the EPP; and
- Utilizing seed mixes labelled "Noxious Weeds: None Found" as required by regulations and will utilize yellow tag seed when available (Section 7.2 of the EPP).

Construction activities in agricultural lands will proceed as described in the Agricultural Protection Plan.

Enbridge has also prepared a Post-Construction Wetland and Waterbody Monitoring Plan that includes monitoring and performance standards for INS within these features. Similar monitoring and performance standards for MDNR-administered lands will be included in the Vegetation Management Plan (see Section 2.6).

2.5 ACTIVE MANAGEMENT STRATEGIES FOR TERRESTRIAL PLANT INVASIVE AND NOXIOUS SPECIES

This section outlines the active management strategies and BMPs that may be implemented by Enbridge to minimize the spread of documented occurrences of terrestrial plant INS. Active management practices will vary depending on the property administrator/owner (e.g., MDNR-Administered Lands, FDL Reservation), land use (e.g., organic farm), and will be selected based on the site-specific conditions, timing, and INS ecology.

Enbridge will implement active management strategies and BMPs during one or more of the following phases as appropriate:

- Prior to clearing: Where practicable and feasible, Enbridge will implement BMPs prior to initiating clearing of the construction workspace. However, the ability to implement BMPs is dependent upon the timing of the receipt of required permits and authorizations, landowner or land-managing agency permissions, seasonality, INS ecology (e.g., maturity of plant, aggressiveness), and the proposed treatment method, effectiveness, and frequency of application.

- During clearing or other construction activities: Should the implementation of certain BMPs not be feasible prior to clearing (e.g., herbicide treatment), alternative BMPs (e.g., cleaning stations) may be implemented during clearing or other construction activities to minimize the spread of INS.

- Restoration: Once construction activities are complete, and final grading and permanent seeding is complete as described in Sections 1.16, 3.9, and 7.3 of the EPP, Enbridge will continue to monitor and manage terrestrial INS until the revegetation performance standards have been met (refer to Section 2.6).

- Post-Construction Monitoring: Enbridge will perform post-construction monitoring at wetlands and waterbodies as described in Enbridge's Post-Construction Wetland and Waterbody Monitoring Plan. Enbridge will manage INS as described in this Plan until the performance standards described in the Post-Construction Wetland and Waterbody Monitoring Plan have been met. Enbridge will also establish performance standards for MDNR-administered lands in the Vegetation Management Plan.

As described in Sections 1.4 and 1.5 of the EPP, construction, restoration, and post-construction monitoring activities are restricted to the construction workspace and designated access roads and haul routes. Once restoration and/or post-construction monitoring activities are complete, terrestrial INS will be managed by Enbridge Operations within the 50-foot-wide permanent right-of-way easement.

Prior to construction, Enbridge will prioritize INS sites and select the appropriate management strategy, timing, and frequency of application to be applied at each INS site. For sites located on MDNR-administered lands, Enbridge will coordinate with the appropriate land-managing division and INS staff. Enbridge will work directly with the FDL Resource Management Department for lands within the external boundaries of the FDL Reservation.

2.5.1 Personnel Training

Enbridge will provide terrestrial plant INS awareness training that:

- Ensures that personnel conducting monitoring and terrestrial plant INS treatments are qualified to distinguish between INS and commonly mistaken native species. This may include, for example, documentation of personnel experience with control of the target INS and their INS control work in similar environments with sensitive resources.

- Require personnel that will work within the construction workspace, access roads, and improved haul routes to view the MDNR land-based prevention staff training video "Cleaning to Avoid Spreading Terrestrial Invasive Species."

- Require personnel that will work within the construction workspace, access roads and improved haul routes to review the Minnesota Department of Transportation "Minnesota Noxious Weeds" guide, or excerpts of this guide that highlight known INS in the Project area.

2.5.2 Pre-Treatment

Pre-treatment will be prioritized for INS listed by the MDA as Prohibited Noxious Weeds that must be eradicated or controlled in Minnesota (Table 2.1-1). Where possible, Enbridge will pre-treat known locations of terrestrial plant INS by spot mowing, mechanical removal (e.g., hand-pulling, digging), spot herbicide application, prescribed burning, spot propane weed torching, or an integrated management approach that combines one or more of these techniques prior to clearing. Any of these methods or combination thereof may also be used during construction, restoration, and/or post-construction monitoring as needed. The pre-treatment objective will be to reduce the observable aboveground vegetative growth and seed production by INS at known locations and reduce the likelihood that plants, seeds (observable on aboveground seed heads), and propagules are viable when clearing and ground-disturbing activities begin. Where possible, Enbridge will attempt to minimize the spread of INS by first managing the outlying populations, and then working toward the center of an infestation. The chosen method(s) will be species-specific and will consider the timing of implementation, quality of the surrounding vegetation, proximity to water resources, and other considerations as noted below. Pre-treatment will commence when all necessary permits and authorizations, and the necessary landowner or land-managing agency permissions are in place and will continue until the start of clearing or other construction activities.

Attachments D and E provide potential treatment methods for each of the 46 species identified during INS surveys. A treatment method or combination of methods will be selected based on several considerations, including MDA status (i.e., eradicate or control) and/or land-managing agency specifications, biological characteristics, and season, and will be based on consultation with the appropriate state and local agencies. Specific site factors such as topography, soil types and condition, water table level, open bodies of water, domestic water wells, and precipitation rates must also be taken into consideration when deciding the appropriate treatment option for a site. Additional important ecological and local land use factors that will be considered in designing and implementing treatment methods will include:

- Aquatic or wetland environments;
- Presence of federal or state-listed species or species of concern;
- Desirable existing vegetation community;
- Areas used for wildlife habitat or grazing;
- Recreation areas (e.g., campsite or picnic areas); and
- Residences.

Pre-treatment strategies and methods, while taking into account all of the considerations noted above, are generally prescribed in Attachment D. Treatment implementation plans will include a decision-making process for personnel conducting treatments to prescribe the most effective and efficient methods for adapting to site-specific and species-specific circumstances and responses.

Pesticide Use and Application

Enbridge will only utilize those pesticides (including herbicides) and methods of application approved by the MDA, MDNR, and the U.S. Environmental Protection Agency in the state of Minnesota. For proposed use of herbicides on MDNR-administered lands, Enbridge will prepare a Pre-Treatment Plan for review and approval by the appropriate MDNR land-managing division and INS staff prior to implementation. Selective foliage or basal application will be used when practicable. All pesticides will be applied in a safe and cautious manner so as not to damage adjacent properties including crops, orchards, tree farms, apiaries, or gardens, and sensitive environmental resources. Enbridge will obtain necessary permits and/or certifications for the use of the applicable herbicides, will be responsible to limit off-right-of-way overspray, and will comply with state laws regarding the use of those herbicides.

Enbridge will contact the landowner or designee to obtain approval for the use of pesticide (including herbicides) at least 14 days prior to any application on their property. The landowner may request that there be no application of pesticides on any part of the site within the landowner's property. Enbridge will provide notice of pesticide application to affected landowners and known beekeepers operating apiaries within 3 miles of the site at least 14 days prior to such application. If the landowner or land-managing agency does not approve the use of pesticides, an alternative treatment method will be selected. Enbridge will keep proper documentation of the locations where pesticides have been used.

The following best management practices will be considered for herbicide use:

- Integrate biological controls instead of, or to complement, herbicide use, if available;
- Select spot treatments over broadcast applications when practicable to minimize potential impacts on pollinators and associated nectar or host plants;
- Products should be selected to be the most target-specific and applied on the smallest area practical to meet management objectives;
- The type of herbicide and treatment method will be selected to minimize impacts to wildlife (e.g., spot treatment, herbicides appropriate for application near aquatic resources); and
- Follow herbicide label instructions and industry standard practices to minimize non-target damage.

Cut stump or basal treatments may be used within the 75-foot vegetative buffer zone of aquatic resources. If herbicide treatment is necessary near rare species or rare natural communities or in or near aquatic resources, the herbicide must be designed for such use as designated by manufacturer’s specifications and federal and state regulations. Additional restrictions will be followed for INS control as required by federal, Tribal, and state permits or other environmental plans.

If herbicide treatment is limited due to landowner restrictions, or proximity to sensitive resources, an alternative treatment method may be selected.

2.5.3 Alternative Best Management Practices

In areas where pre-treatment cannot be implemented prior to clearing, a combination of the following BMPs may be implemented, where appropriate and as determined prior to construction.

Full Construction Workspace Topsoil Segregation

Enbridge may implement full construction workspace topsoil segregation to minimize the spread of INS and to allow equipment to work through the area after topsoil has been stripped, as long as equipment stays on the subsoil (clearing, grading, and restoration equipment will still be cleaned as described in the "Cleaning Stations" section).

Stored topsoil in heavily infested areas will be covered or sprayed with tackifier or mulch to reduce the viability of INS seeds and rootstock prior to the restoration phase and prevent transport by wind. Weed-infested stockpiles will be marked with clearly visible signage until the restoration phase. During restoration, Enbridge will return topsoil and vegetative material from infestation sites to the areas from which they were stripped and will not move soil and/or vegetative matter outside of the identified and marked noxious weed infestation areas.

Installation of Construction Mats

In areas of the construction workspace where pre-treatment of the INS population or full construction workspace topsoil segregation is not feasible, Enbridge will install and work off of construction mats or equivalent to cover the INS source. Construction mats will then be cleaned before use at another non-infested site as described in the "Cleaning Stations" section. Enbridge will also consider the use of construction mats in pre-treated areas with heavy infestations of INS.

Access Roads and Improved Haul Routes

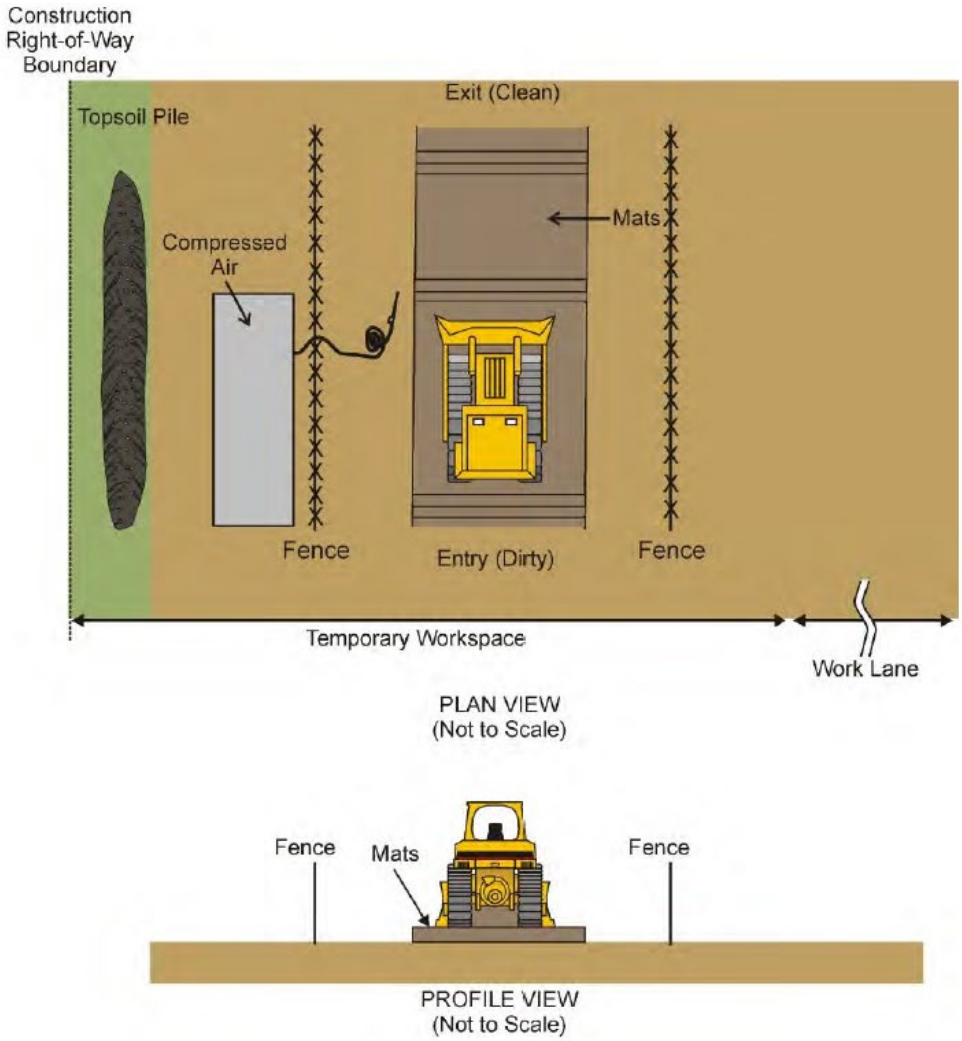
Enbridge does not propose to implement additional BMPs for INS that have been identified adjacent to existing access roads or improved haul routes. Enbridge will either add fill or construction mats to widen existing access roads or haul routes, which will prevent spread of existing infestations in those areas. Where construction mats are used, Enbridge will clean the construction mats before use at another non-infested site as described in the "Cleaning Stations" section.

Cleaning Stations

In areas where pre-treatment of terrestrial plant INS has not been implemented prior to clearing, Enbridge may establish cleaning stations to remove visible dirt and plant material from equipment and mats when exiting a known terrestrial INS infestation area along the construction workspace. Cleaning stations may also be implemented at select sites during construction, restoration, or post-construction monitoring, as needed. Construction mats utilized in an INS site will either be cleaned at designated cleaning stations or will be transported to constructions yards for storage and/or cleaning prior to re-use. Construction mats will be stored on top of plastic tarps or geotextile fabric to prevent the spread of seeds. Removal of dirt and plant material will be documented in a cleaning log (see Attachment F). See Figure 2.5-1 for a typical drawing of a cleaning station.

Mechanical means (initial scrape down followed by blow down) will be the primary method used to remove dirt and plant materials from vehicles, equipment, and construction mats at the cleaning stations or construction yards. Enbridge does not propose the use of high-pressure wash stations due the need for additional water and space, and the challenges with containing and disposing of the cleaning water.

Figure 2.5-1 Typical Compressed Air Cleaning Station



Representation Only

2.6 PERFORMANCE STANDARDS

Enbridge proposes the following performance standards for terrestrial INS in uplands as determined during restoration:

- Absolute percent cover of INS within the construction workspace is similar to absolute percent cover in adjacent undisturbed areas outside of the construction workspace within the same community type.

The INS performance standards in wetlands and riparian areas are described in the Post-Construction Wetland and Waterbody Monitoring Plan. Additional INS performance criteria for MDNR-administered lands will be described in the Vegetation Management Plan.

3.0 INVASIVE AQUATIC SPECIES

The MDNR regulates non-native and invasive aquatic plants and wild animals and designates infested waters. Non-native invasive aquatic species present in the Project area, include the zebra mussel (*Dreissena polymorpha*), faucet snail (*Bithynia tentaculata*), and Eurasian watermilfoil (*Myriophyllum spicatum*). A guide to aquatic invasive species identification is provided in Attachment G.

Aquatic invasive species are typically spread via movement of equipment used in infested waters, such boats, docks, and other equipment. Faucet snail can close their shell with their operculum and survive out of water for multiple days (MDNR, 2019b). Adult zebra mussels can survive out of the water up to 21 days in wet conditions. The larvae of the zebra mussel are microscopic and may spread in any water-containing device (MDNR, 2019c). Eurasian watermilfoil spreads primarily through vegetative fragmentation whereby a fragment from the plant breaks off, grows roots, and establishes a new plant; it looks similar to and may hybridize with native beneficial watermilfoils, including the northern watermilfoil (MDNR, 2019d).

The L3R crosses over 200 waterbodies in the state of Minnesota and will appropriate from water sources to support horizontal directional drills ("HDDs"), hydrostatic testing, and fugitive dust control. Most equipment and construction activities will be in the water (either for crossing or water appropriation) for 24 hours or less. Equipment exposed to water for longer periods of time[4] incudes HDD equipment (refer to the Summary of Construction Methods and Procedures in Appendix A of the EPP for a complete description), and in-stream bridge supports. HDD installation can take several weeks to complete, and in-stream bridge supports may remain in the water through restoration (see Section 2.6.3 of the EPP).

Enbridge has reviewed MDNR's list of designated infested waters (MDNR, 2019a) and has removed designated infested waters as water sources where practical in an effort to reduce the potential risk of spread of these species. Based on the MDNR's list of infested waters (MDNR, 2019a), only one of the water sources currently proposed as a primary source for use has aquatic INS (see Table 3.0-1); the other three sources are contingency sources that would only be used if there is inadequate water flow at the primary source. In all cases, Enbridge will discharge back to the source water or infiltrate the discharge to control potential spread of INS (see Section 3.1.1).

[4] Higher risk equipment is defined as equipment that is in the water for longer periods; the longer period of exposure the higher the risk (Zook and Phillips, 2012).

Further, none of the currently designated infested waters will be crossed using trenching methods that require in-water work.

Table 3.0-1
Line 3 Replacement Proposed Infested Water Sources

Milepost	County	Water Name	Crossing Method	Infestation Species	Appropriation Purpose	Proposed Discharge Method
801.8	Kittson	Red River	HDD	Zebra mussel	HDD and Mainline Hydrostatic Test Appropriation	Back to source or infiltration
991.2	Wadena	Shell River	HDD	Faucet snail	HDD (winter contingency only)	Back to source
993.3	Wadena	Crow Wing River	HDD	Faucet snail	HDD (winter contingency only)	Back to source
1120.3	Carlton	Chub Lake	N/A	Eurasian water-milfoil	Mainline Hydrostatic Test Appropriation (contingency only)	Back to source

3.1 MANAGEMENT STRATEGIES FOR INVASIVE AQUATIC SPECIES

To minimize the spread of invasive aquatic species in Minnesota and North Dakota, Enbridge will implement the following procedures when working in waterbodies in compliance with Minnesota Statute 84D.10 Subd. 4, and consistent with the *Recommended Uniform Minimum Protocols and Standards for Water Craft Interception Programs for Dreissenid Mussels in the Western United States* (Zook and Phillips, 2012 as cited by Minnesota Statutes 84D.01), and MDNR and North Dakota Game and Fish recommendations (MDNR, 2019e; North Dakota Game and Fish, 2016). As described in Section 1.1 of the EPP, Enbridge will post signs at designated infested waters.

3.1.1 Procedures at Any State Watercourse

- Equipment intended for use at the Project site will be free of invasive species prior to being transported to the worksite. Equipment (e.g., hoe stick and bucket, pumps, hoses) used in any state watercourses, regardless of designated infestation status, will be inspected for invasive aquatic species prior to and following in-water work.

- Pumps, hoses, and other equipment with water intakes will be drained of water after use. Enbridge will remove plants, mud, debris, and organisms from the exterior of the equipment (e.g., hoe stick and bucket).

- If aquatic invasive species are identified during inspection of the equipment, Enbridge will implement one or more of the following decontamination procedures[5] before use in another waterbody:

    - clean with heated (to at least 140 degrees Fahrenheit) high-pressure washer;

    - rinse with water above 140 degrees Fahrenheit for at least 10 seconds (e.g., pumps); or

    - dry for 5 days prior to using at another waterbody.

[5] https://www.dnr.state.mn.us/invasives/preventspread_watercraft.html and https://files.dnr.state.mn.us/natural_resources/invasives/protect-waters.pdf.

- Decontamination water will be allowed to infiltrate in an upland area at least 300 feet from any watercourse, or within 300 feet of the aquatic invasive species source in accordance with applicable permits.

- Felt-soled waders will not be allowed for use in any state watercourse because felt can easily trap, and thus potentially transport, invasive species.

3.1.2 Designated Infested Waters

- If equipment has been used in a designated infested water, Enbridge will implement one or more of the following decontamination procedures[5] before use in another waterbody:

    - clean with heated (to at least 140 degrees Fahrenheit) high-pressure washer; or

    - rinse with water above 140 degrees Fahrenheit for at least 10 seconds (e.g., pumps); or

    - dry for 5 days prior to using at another waterbody.

- Decontamination water will be allowed to infiltrate in an upland area at least 300 feet from any watercourse, or within 300 feet of the aquatic invasive species source in accordance with applicable permits.

- If personnel enter infested waterbodies, personnel will scrub clothes, waders, boots, and other personal gear with a stiff brush to remove debris.

3.1.3 Public Watercourses,[6] Sensitive Non-Public Watercourses, and Surface Water Appropriation Sites[7]

- Enbridge will implement the procedures described in Section 3.1.2 at public watercourses, the non-public watercourses identified in Table 3.1-1, and surface water appropriation sites for in-water construction activities and for the equipment used at HDD installations.

[6] Public water or public waters means those waters of the state identified under Minnesota Statutes, section 103G.005, subdivision 15 or 15a, or 103G.201, as shown on the public water inventory maps.

[7] Surface water appropriation sites submitted to the MDNR as part of the Water Appropriation Permit Application for HDD and Hydrostatic Testing Activities (MPARS Reference No. 2018-3690).

Table 3.1-1
Line 3 Replacement Non-Public Sensitive Watercourses

Approximate Milepost	County	Waterbody Survey ID	Waterbody Name
867.4	Red Lake	s-152n43w4-a	Unnamed Ditch
893.9	Polk	s-150n39w19-d	Unnamed Ditch
894.2	Polk	s-150n39w30-a	County Ditch No. 89
894.8	Polk	s-150n39w29-a	Unnamed Ditch
894.8	Polk	s-150n39w29-b	Unnamed Ditch
894.9	Polk	s-150n39w29-c	Unnamed Ditch
999.6	Cass	CAC5006aWB	Unnamed Ditch
1081.5	Aitkin	s-51n22w22-a	Unnamed Stream
1084.4	Aitkin	s-51n22w24-a	Unnamed Stream
1108.3	Carlton	s-49n18w18-b	Unnamed Tributary to Stoney Brook

- Enbridge will discharge appropriated water for HDD and hydrostatic testing activities[8] either back to source or infiltrate in an upland area at least 300 feet from any watercourse and in accordance with applicable permits.

4.0 INVASIVE TREE PESTS

Invasive tree pests occur in the Project area as well, including the native eastern larch beetle (*Dendroctonus simplex*) and non-native emerald ash borer (*Agrilus planipennis*). Eastern larch beetle infests tamarack trees (eastern larch or *Larix laricina*). Adults of the eastern larch beetle emerge in the spring from infected wood; removal of infected tamaracks prior to spring can reduce the spread of the disease (Seybold et al., 2002). Emerald ash borer larvae feed on all species of ash trees. Most of the species' life cycle occurs underneath the bark; early indications of infestation are bark removal or flecking from woodpeckers that eat the larvae (MDNR, 2019f).

As described in Sections 1.8 and 3.2 of the EPP, Enbridge would clear vegetation in upland and wetland areas and would generally dispose of non-merchantable timber and slash by mowing, chipping, grinding and/or hauling off site to an approved disposal facility. Merchantable timber would be disposed of in accordance with Enbridge contract specifications and applicable permits and licenses. The Project does not cross any existing quarantine areas for tree pests[8]; therefore, no special management strategies have been proposed. Enbridge Environmental will monitor quarantine notifications during construction; should any portion of the Project come under quarantine during construction, Enbridge would consult with applicable agencies to identify the appropriate management procedures.

4.1 OAK WILT

In the event that a healthy oak tree adjacent to the construction workspace is damaged or wounded during construction activities in counties where the oak wilt fungus is present, Enbridge will treat the cut surface with water-based paint, a pruning/wound sealer, or shellac to prevent further spread of the disease. Treated trees will be inspected by the Environmental Inspector.

[8] https://www.mda.state.mn.us/plants-insects/pest-regulations.

5.0 REFERENCES

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Attachment A

Noxious and Invasive Species Regulations

Attachment A NOXIOUS AND INVASIVE SPECIES REGULATIONS			
Region	**Regulatory Category**	**Agency [a]**	**Reference**
Federal	Federal Noxious Weeds (aquatic and terrestrial plants)	USDA-APHIS	https://plants.usda.gov/java/noxious?rptType=Federal
	Federal Seed Act	USDA-AMS	https://www.ams.usda.gov/rules-regulations/fsa
	All-States Noxious Weed Seed List	USDA-AMS	https://www.ams.usda.gov/sites/default/files/media/StateNoxiousWeedsSeedList.pdf
	Federal Plant Pest Protection Act	USDA-APHIS	https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases
	Interstate Regulations: Pest movement restriction	USDA-APHIS	https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs
North Dakota	State Aquatic Nuisance Species	NDGFD	https://gf.nd.gov/ans/species
	State Noxious Weeds	NDDA	https://www.nd.gov/ndda/plant-industries/noxious-weeds
	County/City Noxious Weeds	Defining County/City	https://www.nd.gov/ndda/sites/default/files/resource/2018%20Feb%20-%20City%20County%20Noxious%20Weeds%20List.pdf
Minnesota	State Prohibited, Regulated, Unregulated Nonnative, and Unlisted Nonnative Invasive Species (wild animals and aquatic plants)	MDNR	https://www.dnr.state.mn.us/invasives/laws.html
	State Prohibited, Restricted, and Specially Regulated Noxious Weeds (terrestrial plants)	MDA	https://www.mda.state.mn.us/plants-insects/minnesota-noxious-weed-list
	County Noxious Weeds	MDA	https://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist/countynoxiousweeds
	Seed Regulations	MDA	https://www.mda.state.mn.us/plants-insects/buying-and-selling-seed-minnesota
	State Plant Pest Act (insects and terrestrial plants)	MDA	http://www.mda.state.mn.us/plants/pestmanagement/invasivesunit/pestindex.aspx
	State ballast water regulations (aquatic organisms)	MPCA	https://www.pca.state.mn.us/water/vessel-discharge

[a] APHIS: Animal Plant Health Inspection Service MDA: Minnesota Department of Agriculture
MDNR: Minnesota Department of Natural Resources MPCA: Minnesota Pollution Control Agency
NDDA: North Dakota Department of Agriculture NDGFD: North Dakota Game and Fish Department USDA: United States Department of Agriculture

Attachment B

Terrestrial Invasive and Noxious Plant Species List

Attachment B - Terrestrial Invasive and Noxious Plant List			
Species	**Common Name**	**List Source[1]**	**MISAC Status**
Acer ginnala	Maple, Amur	*MISAC; MDA (S); Op Order 113*	Moderate/Established
Acer platanoides	Maple, Norway	*MISAC; MITPPC (71.85); Op Order 113*	Severe/Established
Aegopodium podagraria	Goutweed	*MISAC*	Minimal/Established
Ailanthus altissima	Tree of Heaven	*MISAC; MDA (R); Op Order 113*	Not likely to establish
Albizia julibrissin	Mimosa	*MISAC*	Not likely to establish
Allaria petiolaria	Garlic Mustard	*MISAC; MITPPC (76.38); MDA (R); Op Order 113*	Severe/Established
Alnus glutinosa	Black Alder	*MISAC*	Considered/not ranked
Amaranthus palmeri	Palmer Amaranth	*MITPPC (73.72); MDA (E); Op Order 113; NDDA*	NA
Ampelopsis brevipedunculata	Porcelain Berry	*MISAC; MDA (R); Op Order 113*	Watch/Unknown
Anchusa arvensis	Common Bugloss	*MISAC*	Minimal/Established
Arctium minus	Burdock, Common	*MISAC*	Minimal/Established
Arctium nemorosum	Burdock, Woodland	*MISAC*	Watch/Unknown
Artemisia absinthium	Absinth Wormwood	*NDDA*	NA
Berberis thunbergii	Japanese Barberry	*MISAC; MITPPC (74.87); MDA (C); Op Order 113*	Moderate/Established
Berberis vulgaris	European or Common Barberry	*MISAC; MITPPC (72.84); MDA (R); Op Order 113*	Severe/Established
Berteroa incana	Alyssum, hoary	*MISAC; MITPPC (69.09)*	Severe/Established
Campanula rapunculoides	Creeping Bellflower	*MISAC*	Minimal/Established
Cannabis sativa	Hemp	*MISAC*	Minimal/Established
Caragana arborescens	Siberean Peashrub	*MITPPC (57.16); Op Order 113*	NA
Cardamine impatiens	Narrowleaf Bittercress	*MITPPC (57.73); MDA (C); Op Order 113*	NA
Carduus acanthoides	Thistle, plumeless	*MISAC; MITPPC (77.39); MDA (C); Op Order 113*	Severe/Established
Carduus nutans	Thistle, musk	*MISAC; NDDA*	Severe/Established
Celastrus orbiculatus	Oriental Bittersweet	*MISAC; MITPPC (74.87); MDA (E); Op Order 113*	Severe/Not in state
Centaurea debeauxii	Meadow Knapweed	*MITPPC (71.69)*	NA
Centaurea diffusa	Diffuse Knapweed	*MDA (E); Op Order 113; NDDA*	NA
Centaurea jacea	Brown Knapweed	*MDA (E); Op Order 113*	NA
Centaurea repens	Russian Knapweed	*NDDA*	NA
Centaurea solstitialis	Yellow Star Thistle	*MITPPC (71.46); MDA (E); Op Order 113*	NA
Centaurea stoebe (Syn. Centaurea maculosa)	Spotted Knapweed	*MISAC; MITPPC (93.35); MDA (E); Op Order 113; NDDA*	Severe/Established
Centaurea x moncktonii	Meadow Knapweed	*MDA (C); Op Order 113*	NA
Chelidonium majus	Celandine	*MISAC*	Watch/Unknown
Chicorium intybus	Chicory	*MISAC*	Watch/Unknown
Cirsium arvense	Thistle, Canada	*MISAC; MITPPC (82.76); MDA (C); Op Order 113; NDDA*	Severe/Established
Cirsium palustre	Thistle, marsh	*MISAC*	Severe/Not in state
Cirsium vulgare	Thistle, bull	*MISAC*	Minimal/Established
Conium maculatum	Poison Hemlock	*MITPPC (54.15); MDA (E)*	NA
Convallaria majalis	Lily-of-the-Valley	*MISAC*	Moderate/Established
Convoluvus arvensis	Field bindweed	*MISAC*	Moderate/Established
Cuscuta spp.	Dodder	*USDA*	NA
Cynanchum louiseae (Syn. Vincetoxicum nigrum)	Black Swallow-wort	*MISAC; MITPPC (74.16); MDA (E); Op Order 113*	Severe/Not in state
Cynoglossum officinale	Houndstongue	*MITPPC (69.68); NDDA*	NA
Daucus carota	Carrot, wild	*MISAC; MITPPC (52.84); MDA (R); Op Order 113*	Moderate/Established
Digitalis lanata	Foxglove, Grecian	*MISAC; MITPPC (56.00); MDA (E); Op Order 113*	Severe/Established
Digitalis purpurea	Foxglove, Garden	*MISAC*	Watch/Unknown
Dioscorea oppositifolia	Chinese Yam	*MISAC*	Not likely to establish
Dipsacus fullonum (Syn. Dipsacus sylvestris)	Teasel, common	*MISAC; MITPPC (55.59); MDA (E); Op Order 113*	Moderate/Not in state
Dipsacus laciniatus	Teasel, cut leaf	*MISAC; MDA (E); Op Order 113*	Moderate/Established
Echinochloa crusgalli	Barnyard grass	*MISAC*	Minimal/Established
Echinops sphaerocephalus	Globe Thistle	*MISAC*	Moderate/Not in state
Elaeagnus angustifolia	Russian Olive	*MISAC*	Minimal/Established
Elaeagnus umbellata	Autumn Olive	*MISAC; Op Order 113*	Severe/Established
Elytrigia repens	Quackgrass	*MISAC*	Moderate/Established
Epipactis helleborine	Helleborine	*MISAC*	Minimal/Established
Euonymus alatus	Burning Bush, Winged Euonymus	*MISAC; MITPPC (56.39)*	Watch/Unknown
Euphorbia cyparissias	Spurge, Cypress	*MISAC*	Moderate/Established
Euphorbia esula	Spurge, Leafy	*MISAC; MITPPC (79.05); MDA (C); Op Order 113; NDDA*	Severe/Established

Attachment B - Terrestrial Invasive and Noxious Plant List			
Species	**Common Name**	**List Source[1]**	**MISAC Status**
Filipendula ulmaria	Queen of the meadow	*MISAC*	Watch/Unknown
Frangula alnus	Buckthorn, glossy (all cultivar)	*MISAC; MITPPC (86.73); MDA (R); Op Order 113*	Severe/Established
Galium odoratum	Sweet Woodruff	*MISAC*	Considered/not ranked
Glechoma hederacea	Creeping Charlie	*MISAC*	Moderate/Established
Gypsophila paniculata	Baby's-breath	*MISAC*	Watch/Unknown
Hedera Helix	English Ivy	*MISAC*	Watch/Unknown
Hemerocallis fulva	Orange Day Lily	*MISAC*	Moderate/Established
Heracleum mantegazzianum	Giant Hogweed	*MISAC; MITPPC (64.95); MDA (E); Op Order 113*	Severe/Not in state
Hesperis matronalis	Dame's Rocket	*MISAC*	Moderate/Established
Hieracium auranticum	Orange Hawkweed	*MITPPC (60.52)*	NA
Hieracium caespitosum	Meadow Hawkweed	*MITPPC (60.46)*	NA
Humulus japonicus	Japanese Hops	*MISAC; MITPPC (70.09); MDA (E); Op Order 113*	Watch/Unknown
Hypericum perforatum	St. Johns'swort	*MISAC*	Moderate/Established
Inula britannica	Elecampane	*MISAC*	Moderate/Established
Kochia scoparia	Mexican Fireweed	*MITPPC (71.30); NDDA*	NA
Lathyrus latifolius	Everlasting Pea	*MISAC*	Watch/Unknown
Leonurus cardiaca	Motherwort	*MISAC*	Minimal/Established
Lespedeza cuneata	Lespedeza, Chinese	*MISAC*	Severe/Not in state
Leucanthemum lacustre	Daisy, Portuguese	*MISAC*	Watch/Unknown
Leucanthemum vulgare	Daisy, oxeye	*MISAC*	Moderate/Established
Linaria dalmatica	Dalmation Toadflax	*MISAC; MITPPC (71.58); MDA (E); Op Order 113; NDDA*	Moderate/Established
Linaria vulgaris	Butter-and-eggs	*MISAC; NDDA*	Minimal/Established
Lonicera japonica	Japanese Honeysuckle	*MISAC*	Watch/Unknown
Lonicera maackii	Honeysuckle, Amur	*MISAC; MDA (R); Op Order 113*	Severe/Not in state
Lonicera morrowii	Honeysuckle, Morrow's	*MISAC; MITPPC (89.55); MDA (R); Op Order 114*	Severe/Established
Lonicera tatarica	Tartarian Honeysuckle	*MISAC; MITPPC (85.14); MDA (R); Op Order 115*	Severe/Established
Lonicera x bella	Honeysuckle, Bela	*MISAC; MDA (R); Op Order 116*	Severe/Established
Lotus corniculatus	Bird's-foot trefoil	*MISAC; MITPPC (68.72); Op Order 113*	Severe/Established
Lupinus polyphyllus	Big-leaf Lupine	*MISAC*	Minimal/Established
Lythrum salicaria	Purple Loosestrife	*MISAC; MDA (C); Op Order 113; NDDA*	Severe/Established
Maclura pomifera	Osage Orange	*MISAC*	Considered/not ranked
Medicago lupulina	Black medic	*MISAC*	Minimal/Established
Melilotus alba	White Sweetclover	*MITPPC (70.33)*	NA
Melilotus officinalis	Yellow Sweetclover	*MITPPC (71.49)*	NA
Microstegium vimineum	Japanese Stilt Grass	*MISAC*	Not likely to establish
Morus alba	Mulberry, White	*MISAC*	Moderate/Established
Pastinaca sativa	Wild Parsnip	*MITPPC (78.86); MDA (C); Op Order 113*	NA
Paulownia tomentosa	Princess Tree	*MISAC*	Watch/Unknown
Phalaris arundinacea	Reed canary grass	*MISAC; MITPPC (78.18); Op Order 113*	Severe/Established
Phellodendron amurense	Japanese Cork Tree	*MISAC*	Watch/Unknown
Phleum pratense	Timothy	*MISAC*	Watch/Unknown
Phragmites australis	Common Reed - Non-native subspecies	*MITPPC (86.32); MDA (R); Op Order 113*	NA
Polygonum cuspidatum (Syn. Polygonum japonica)	Japanese Knotweed	*MISAC; MITPPC (78.28); MDA (S); Op Order 113*	Severe/Established
Polygonum sachalinense	Giant Knotweed	*MISAC; MITPPC (74.47); MDA (S); Op Order 113*	Severe/Established
Populus alba	Poplar, White	*MISAC*	Minimal/Established
Populus nigra	Lombardy Poplar	*MISAC*	Considered/not ranked
Potentilla argentea	Cinquefoil, Silver	*MISAC*	Considered/not ranked
Potentilla recta	Cinquefoil, Sulphur	*MISAC*	Considered/not ranked
Pueraria montana	Kudzu	*MISAC*	Not likely to establish
Quercus acutissima	Sawtooth Oak	*MISAC*	Watch/Unknown
Ranunculus acris	Buttercup, tall	*MISAC*	Moderate/Established
Rhamnus cathartica	Buckthorn, common or European	*MISAC; MITPPC (84.38); MDA (R); Op Order 113*	Severe/Established
Robinia hispida	Locust Bristly	*MISAC*	Watch/Unknown
Robinia pseudocacia	Locust, black	*MISAC; MDA (R); Op Order 113*	Severe/Established
Robinia viscosa	Locust, clammy	*MISAC*	Watch/Unknown
Rosa multiflora	Multiflora Rose	*MISAC; MITPPC (69.26); MDA (R); Op Order 113*	Severe/Established
Rosa rugosa	Rugosa Rose	*MISAC*	Watch/Unknown

Attachment B - Terrestrial Invasive and Noxious Plant List			
Species	**Common Name**	**List Source[1]**	**MISAC Status**
Salix alba	Willow, White	*MISAC*	Minimal/Established
Salix fragilis	Willow, Crack	*MISAC*	Minimal/Established
Salix x rubens	Willow, Hybrid	*MISAC*	Moderate/Established
Saponaria offinalis	Bouncing Bet	*MISAC*	Minimal/Established
Securigera varia (Syn. Coronilla varia)	Crown Vetch	*MISAC; MITPPC (77.32); MDA (R); Op Order 113*	Severe/Established
Silene latifolia	Campion, White	*MISAC*	Minimal/Established
Silene vulgaris	Campion, Bladder	*MISAC*	Minimal/Established
Silybum marianum	thistle, milk	*MISAC*	Severe/Not in state
Solanum dulcamara	Bittersweet Nightshade	*MISAC*	Minimal/Established
Sonchus arvensis	Sowthistle, perennial	*MISAC*	Moderate/Established
Sorbus aucuparia	European Mountain-ash	*MISAC*	Minimal/Established
Tamarisk spp.	Saltcedar	*NDDA*	NA
Tanacetum vulgare	Tansy	*MISAC; MITPPC (91.39); MDA (C); Op Order 113; Pembina*	Severe/Established
Torilis japonica	Japanese Hedge-parsley	*MITPPC (48.01)*	NA
Toxicodendron radicans	Poison Ivy	*MDA (S)*	NA
Trifolium hybridum	Clover, Alsike	*MISAC*	Considered/not ranked
Trifolium pratense	Clover, Red	*MISAC*	Minimal/Established
Trifolium repens	Clover, White	*MISAC*	Moderate/Established
Ulmus pumila	Siberian Elm	*Op Order 113*	NA
Verbascum thaspus	Mullein	*MISAC*	Minimal/Established
Viburnum opulus	Europ. Highbush Cranberry	*MISAC*	Moderate/Established

[1] MDA-Minnesota Department of Agriculture (E-Eradicate, C-Control, S- Special); Op Order 113-Minnesota Department of Natural Resources Operational Order 113; MISAC-Minnesota Invasive Species Advisory Council; MITPPC-Minnesota Invasive Terrestrial Plants and Pests Center; NDDA-North Dakota Department of Agriculture; Pembina-Pembina County, North Dakota

Attachment C

Terrestrial Plant Invasive and Noxious Species Survey Results

Attachment C INS Documented from 2015-2019 within the L3R Construction Right-of-Way [a]							
County	**Scientific Name**	**Common Name**	**Listing [b]**	**Land Owner / Administrator**			**Total**
				FDL [c]	**MDNR [c]**	**Other [d]**	
Aitkin	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	3	-	**3**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	3	-	**3**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	24	10	**34**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	-	17	1	**18**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	-	28	3	**31**
	Phragmites australis	Common Reed	MITPPC (86.32); MDA (R); Op Order 113	-	6	-	**6**
	Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	-	18	2	**20**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	37	6	**43**
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	12	2	**14**
Carlton	*Arctium minus*	Common Burdock	MISAC	3	-	-	**3**
	Berteroa incana	Hoary Alyssum	MISAC; MITPPC (69.09)	21	-	-	**21**
	Campanula rapunculoides	Creeping Bellflower	MISAC	5	-	-	**5**
	Caragana arborescens	Siberian Peashrub	MITPPC (57.16); Op Order 113	1	-	-	**1**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	26	-	6	**32**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	79	12	15	**106**
	Cirsium vulgare	Bull Thistle	MISAC	36	-	-	**36**
	Convolvulus arvensis	Field bindweed	MISAC	3	-	-	**3**
	Daucus carota	Wild Carrot	MISAC; MITPPC (52.84); MDA (R); Op Order 113	16	-	-	**16**
	Echinochloa crusgalli	Barnyard Grass	MISAC	11	-	-	**11**
	Elytrigia repens	Quackgrass	MISAC	26	-	-	**26**
	Euphorbia esula	Leafy Spurge	MISAC; MITPPC (79.05); MDA (C); Op Order 113	3	-	-	**3**
	Glechoma hederacea	Creeping Charlie	MISAC	1	-	-	**1**
	Hemerocallis fulva	Orange Day Lily	MISAC	1	-	-	**1**
	Hieracium spp.	Hawkweed	MITPPC (60.52/60.46)	63	-	-	**63**
	Hypericum perforatum	St. John's Wort	MISAC	3	-	-	**3**
	Leucanthemum vulgare	Oxeye Daisy	MISAC	45	-	-	**45**
	Linaria vulgaris	Butter-and-Eggs	MISAC	7	-	-	**7**
	Lonicera x bella	Bell's Honeysuckle	MISAC; MDA (R); Op Order 113	6	-	-	**6**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	55	-	-	**55**
	Lupinus polyphyllus	Big-leaf Lupine	MISAC	3	-	-	**3**
	Lythrum salicaria	Purple Loosestrife	MISAC; MDA (C); Op Order 113	2	-	-	**2**
	Medicago lupulina	Black Medic	MISAC	14	-	-	**14**

Attachment C INS Documented from 2015-2019 within the L3R Construction Right-of-Way [a]							
County	**Scientific Name**	**Common Name**	**Listing [b]**	**Land Owner / Administrator**			**Total**
				FDL [c]	**MDNR [c]**	**Other [d]**	
	Melilotus spp.	Sweetclover	MITPPC (70.33/71.49)	20	-	-	**20**
	Pastinaca sativa	Wild Parsnip	MITPPC (78.86); MDA (C); Op Order 113	15	-	-	**15**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	79	1	-	**80**
	Phleum pratense	Timothy	MISAC	62	-	-	**62**
	Potentilla argentea	Silver Cinquefoil	MISAC	14	-	-	**14**
	Potentilla recta	Sulphur Cinquefoil	MISAC	15	-	-	**15**
	Ranunculus acris	Tall Buttercup	MISAC	16	-	-	**16**
	Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	1	-	-	**1**
	Silene latifolia	White Campion	MISAC	27	-	-	**27**
	Solanum dulcamara	Bittersweet Nightshade	MISAC	1	-	-	**1**
	Sonchus arvensis	Perennial Sowthistle	MISAC	11	-	-	**11**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	144	18	43	**205**
	Trifolium spp.	Clover	MISAC	57	-	-	**57**
	Verbascum thaspus	Common Mullein	MISAC	3	-	-	**3**
	Viburnum opulus	Highbush Cranberry	MISAC	1	-	-	**1**
Cass	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	-	2	**2**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	2	8	**10**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	1	38	**39**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	-	2	-	**2**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	-	3	-	**3**
	Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	-	3	-	**3**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	5	9	**14**
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	2	-	**2**
Clearwater	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	2	85	**87**
	Carduus nutans	Musk Thistle	MISAC	-	-	2	**2**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	7	112	**119**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	5	129	**134**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	-	2	-	**2**
	Lythrum salicaria	Purple Loosestrife	MISAC; MDA (C); Op Order 113	-	-	2	**2**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	-	2	-	**2**
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	-	11	**11**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	6	39	**45**

Attachment C INS Documented from 2015-2019 within the L3R Construction Right-of-Way [a]							
County	**Scientific Name**	**Common Name**	**Listing [b]**	**Land Owner / Administrator**			**Total**
				FDL [c]	**MDNR [c]**	**Other [d]**	
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	3	-	**3**
Hubbard	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	2	87	**89**
	Centaurea jacea	Brown Knapweed	MDA (E); Op Order 113	-	-	1	**1**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	2	120	**122**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	1	87	**88**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	-	-	2	**2**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	-	2	1	**3**
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	-	1	**1**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	2	64	**66**
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	2	1	**3**
Kittson	*Cirsium arvense*	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	-	20	**20**
Marshall	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	-	1	**1**
	Centaurea jacea	Brown Knapweed	MDA (E); Op Order 113	-	-	2	**2**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	-	74	**74**
	Pastinaca sativa	Wild Parsnip	MITPPC (78.86); MDA (C); Op Order 113	-	-	3	**3**
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	-	9	**9**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	-	3	**3**
Pembina	*Bassia scoparia*	Kochia	NDDA	-	-	2	**2**
	Cirsium arvense	Canada Thistle	NDDA	-	-	29	**29**
	Euphorbia esula	Leafy Spurge	NDDA	-	-	2	**2**
	Tanacetum vulgare	Common Tansy	NDDA	-	-	2	**2**
Pennington	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	-	1	**1**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	-	1	**1**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	7	47	**54**
	Pastinaca sativa	Wild Parsnip	MITPPC (78.86); MDA (C); Op Order 113	-	-	1	**1**
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	4	7	**11**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	2	2	**4**
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	-	1	**1**
Polk	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	-	22	**22**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	-	21	**21**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	-	23	**23**
	Phragmites australis	Common Reed	MITPPC (86.32); MDA (R); Op Order 113	-	-	1	**1**

Attachment C INS Documented from 2015-2019 within the L3R Construction Right-of-Way [a]							
County	**Scientific Name**	**Common Name**	**Listing [b]**	**Land Owner / Administrator**			**Total**
				FDL [c]	**MDNR [c]**	**Other [d]**	
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	-	2	**2**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	-	5	**5**
Red Lake	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	-	6	**6**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	-	3	**3**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	-	32	**32**
	Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	-	-	4	**4**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	-	-	1	**1**
St. Louis	*Berteroa incana*	Hoary Alyssum	MISAC; MITPPC (69.09)	1	-	-	**1**
	Campanula rapunculoides	Creeping Bellflower	MISAC	2	-	-	**2**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	16	-	-	**16**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	6	-	-	**6**
	Cirsium vulgare	Bull Thistle	MISAC	7	-	-	**7**
	Daucus carota	Wild Carrot	MISAC; MITPPC (52.84); MDA (R); Op Order 113	2	-	-	**2**
	Echinochloa crusgalli	Barnyard Grass	MISAC	7	-	-	**7**
	Elytrigia repens	Quackgrass	MISAC	3	-	-	**3**
	Hieracium spp.	Hawkweed	MITPPC (60.52/60.46)	8	-	-	**8**
	Hypericum perforatum	St. John‘s Wort	MISAC	4	-	-	**4**
	Leucanthemum vulgare	Oxeye Daisy	MISAC	14	-	-	**14**
	Lonicera x bella	Bell's Honeysuckle	MISAC; MDA (R); Op Order 113	2	-	-	**2**
	Lotus corniculatus	Bird‘s-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	68	2	-	**70**
	Lythrum salicaria	Purple Loosestrife	MISAC; MDA (C); Op Order 113	2	-	-	**2**
	Medicago lupulina	Black Medic	MISAC	6	-	-	**6**
	Melilotus spp.	Sweetclover	MITPPC (70.33/71.49)	16	-	-	**16**
	Pastinaca sativa	Wild Parsnip	MITPPC (78.86); MDA (C); Op Order 113	9	-	-	**9**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	9	1	-	**10**
	Phleum pratense	Timothy	MISAC	67	-	-	**67**
	Potentilla argentea	Silver Cinquefoil	MISAC	1	-	-	**1**
	Potentilla recta	Sulphur Cinquefoil	MISAC	1	-	-	**1**
	Ranunculus acris	Tall Buttercup	MISAC	7	-	-	**7**
	Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	-	2	-	**2**
	Sonchus arvensis	Perennial Sowthistle	MISAC	4	-	-	**4**
	Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113	142	3	-	**145**

Attachment C
INS Documented from 2015-2019 within the L3R Construction Right-of-Way [a]

County	Scientific Name	Common Name	Listing [b]	Land Owner / Administrator			Total
				FDL [c]	MDNR [c]	Other [d]	
	Trifolium spp.	Clover	MISAC	66	-	-	**66**
Wadena	*Carduus acanthoides*	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	-	6	1	**7**
	Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	-	1	2	**3**
	Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113	-	7	6	**13**
	Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	-	1	-	**1**
	Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	-	3	-	**3**
	Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	-	5	2	**7**
	Toxicodendron radicans	Poison Ivy	MDA (S)	-	3	1	**4**
Total				**1,366**	**282**	**1,228**	**2,876**

[a] Includes Permanent Right-of-Way, Temporary Workspace, Additional Temporary Workspace, and Access Roads.

[b] MISAC - Minnesota Invasive Species Advisory Council; MITPPC - Minnesota Invasive Terrestrial Plants and Pests Center; MDA - Minnesota Department of Agriculture (E-Eradicate, C-Control, S-Special); Op Order 113 - Minnesota Department of Natural Resources Operational Order 113; NDDA – North Dakota Department of Agriculture.

[c] Three MDNR-administered properties overlap with the FDL reservation; therefore, observed occurrences within the overlapping boundaries are counted under both the FDL and MDNR categories.

[d] "Other" includes private land and public land that is not administered by the MDNR.

Attachment D

Treatment Methods for the Terrestrial Plant Invasive and Noxious Species

Attachment D
Treatment Methods for the INS Plant Species Identified within the L3R Construction Right-of-Way and Access Roads

Species	Common Name	List Source [a]	Characteristics [b]	Growing Season Management [b]
Arctium minus	Common Burdock	MISAC	• Biennial, herbaceous • Dry - mesic soils, disturbed sites - roadsides, ditch banks, old field, pasture • Seed propagation •First year rosette of large, heart-shaped, hairy leaves; Second year upright stem, 3' - 10' tall with broad, wooly leaves and purple flowers, burs	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application to first year rosette Oct. - Nov.
Artemisia absinthium	Absinth Wormwood	NDDA	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - pasture, old field, roadsides • Seed propagation • woody upright stem, 3' - 5' tall with deeply lobed leaves and many yellow flower heads	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application June - Sept.
Bassia scoparia	Kochia	NDDA	• Annual, herbaceous • Dry soils, disturbed sites - cropland, pastures, fields, roadsides • Seed propagation • Multiple upright stems, 1' - 6' tall with 2" lance-shaped leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Sept.
Berteroa incana	Hoary Alyssum	MISAC; MITPPC (69.09)	• Annual, herbaceous • Dry soils, disturbed sites - roadsides, trail sides, gravelly stream banks, pastures, fields • Seed propagation • Multiple upright stems, 7" - 30" tall with small white flowers and seed pods	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June
Campanula rapunculoides	Creeping Bellflower	MISAC	• Perennial, herbaceous • Dry soils - fields, stream banks, woodlands, prairies, roadsides, oak savannas, urban areas • Propagation through seeds and rhizomes • Upright stem, 1' - 3' tall with purple bell-shaped flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Sept.
Caragana arborescens	Siberian Peashrub	MITPPC (57.16); Op Order 113	• Perennial, shrub • Dry -mesic soils - coniferous forest, hardwood forest, forest edge, rights-of-way, trail sides • Seed propagation • Multi-stemmed, up to 18' tall with tubular yellow flowers and 1" - 2" log seed pods	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide cut stem / basal bark application year-round
Carduus acanthoides	Plumeless Thistle	MISAC; MITPPC (77.39); MDA (C); Op Order 113	• Biennial, herbaceous • Dy - mesic soils - pastures, woodlands, waste areas, roadsides, ditches, stream banks • Seed propagation - development of large seed bank in short period of time • Upright stem, 1' - 4' tall with pink - purple terminal flowers and winged, spiny leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June and Oct. - Nov. • **See Attachment E for details**
Carduus nutans	Musk Thistle	MISAC	• Biennial, herbaceous • Dry to mesic soils - woodland, waste areas, roadsides, ditches, stream banks • Propagation through seed and tap root regeneration • First year basal rosette. Second year singular, upright stem, 1' - 7' tall with pink - purple terminal flowers and spiny wings from leaf bases	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June and Oct. - Nov. • **See Attachment E for details**
Centaurea jacea	Brown Knapweed	MDA (E); Op Order 113	• Perennial, herbaceous • Cool, mesic soils - wet meadow, ditches, woodlands • Seed propagation • Multi-branched, 8" - 32" tall with pink - purple terminal disk flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Nov. • **See Attachment E for details**
Centaurea stoebe	Spotted Knapweed	MISAC; MITPPC (93.35); MDA (E); Op Order 113	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - old field, rail / road rights-of-way, gravel pits • Seed propagation • Multi-branched, 8" - 32" tall with pinkish - cream terminal disk flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Nov. • **See Attachment E for details**
Cirsium arvense	Canada Thistle	MISAC; MITPPC (82.76); MDA (C); Op Order 113; NDDA	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - old field, roadsides, open woodland, prairie, wet meadow • Propagation through seed, root cuttings, rhizomes • Hairy, upright stem, 2' - 6' tall with purple terminal flowers and spiny edged leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct. • Herbicide cut stem application May - June • **See Attachment E for details**
Cirsium vulgare	Bull Thistle	MISAC	• Biennial, herbaceous • Dry - mesic soils, disturbed sites - pasture, roadsides, ditch banks • Seed propagation • Singular upright stem, 3' - 6' tall with purple disk shaped terminal flowers and spine tipped leaf lobes	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application to first year rosette Oct. - Nov.
Daucus carota	Wild Carrot	MISAC; MITPPC (52.84); MDA (R); Op Order 113	• Biennial, herbaceous • Dry to mesic soils, disturbed sites • Propagation through seed and tap root regeneration • First year basal rosette. Second year singular, upright stem, 3' - 4' tall with flat-top compound umbel of small white flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application to first year rosette June - Sept. • **See Attachment E for details**
Echinochloa crusgalli	Barnyard Grass	MISAC	• Annual, herbaceous grass • Mesic soils, disturbed sites - cropland, roadsides, river banks, lawns, old fields • Seed propagation • Sprawling stems, up to 5' tall with dense clusters of knot-like flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Elytrigia repens	Quackgrass	MISAC	• Perennial, herbaceous grass • Dry - mesic soils, disturbed sites - cropland, roadsides, river banks, lawns, old fields • Propagation through seed and rhizomes • Upright stems, 1' - 4' tall with .25" wide leaf blades	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Euphorbia esula	Leafy Spurge	MISAC; MITPPC (79.05); MDA (C); Op Order 113; NDDA	• Perennial, herbaceous • Dry - mesic soils • Seed propagation • Upright stem, 1' - 3' tall with small yellowish-green flowers and a milky sap	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct. • **See Attachment E for details**

Attachment D
Treatment Methods for the INS Plant Species Identified within the L3R Construction Right-of-Way and Access Roads

Species	Common Name	List Source [a]	Characteristics [b]	Growing Season Management [b]
Glechoma hederacea	Creeping Charlie	MISAC	• Perennial, herbaceous • Mesic soils, degraded/disturbed sites - semi-shaded to shaded • Propagation through seeds and stolons • Creeping square stems, 2' long with blue - purple flowers and palmate leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application Oct. - Nov. • **See Attachment E for details**
Hemerocallis fulva	Orange Day Lily	MISAC	• Perennial, herbaceous • Dry - mesic soils - roadsides, fields, stream banks • Propagation through seed and root segments • Upright stem, 2' - 5' tall with large orange flowers and sword=like leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application early spring
Hieracium spp.	Hawkweed	MITPPC (60.46)	• Perennial, herbaceous • Dry soils, disturbed sites - old field, pasture, roadsides • Propagation through seeds and rhizomes • Upright stem, 10" - 20" tall with dense clusters of orange - yellow flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June
Hypericum perforatum	St. John's Wort	MISAC	• Perennial, herbaceous • Dry soils, disturbed sites - fields, pastures, waste areas, forest edges • Propagation through seeds and rhizomes • Branched, upright stem, 1' - 5' tall with yellow terminal flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June
Leucanthemum vulgare	Oxeye Daisy	MISAC	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - old field, pasture • Propagation through seeds and rhizomes • Upright stem, 1' - 2' tall with terminal flowers of white petals with a central yellow disc	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - June
Linaria vulgaris	Butter-and-Eggs	MISAC	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - old field, pasture, railroad yards, roadsides, waste places • Propagation through seeds and segmented roots • Upright stem, up to 4' tall with bright yellow flowers with a long spur arranged in clusters along the stem	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct. • **See Attachment E for details (*Linaria dalmatica*)**
Lonicera spp.	Honeysuckle	MISAC; MITPPC (89.55); MDA (R); Op Order 113	• Perennial, shrub • Forest edges, disturbed sites, open upland, roadsides, old field/pasture • Propagation through seed and vegetative sprouting • Multi-stemmed, 6' - 15' tall with fragrant white, pink, red or yellow flowers or red/purple to orange berries	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application June - Oct. • Herbicide cut stem / basal bark application year-round • **See Attachment E for details**
Lotus corniculatus	Bird's-foot Trefoil	MISAC; MITPPC (68.72); Op Order 113	• Perennial, herbaceous • Dry soils, disturbed sites - roadsides, old fields, prairies • Propagation through seeds and rhizomes • Sprawling stems, 12" - 24" tall with bright yellow, pea-like flowers pinnately compound leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - June
Lupinus polyphyllus	Big-leaf Lupine	MISAC	• Perennial, Herbaceous • Dry - mesic soils, disturbed sites - fields, roadsides • Propagation through seeds, rhizomes • Upright stem, 2' - 4' tall with pea-shaped purple flowers on spike-like racemes	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - June
Lythrum salicaria	Purple Loosestrife	MISAC; MDA (C); Op Order 113	• Perennial, herbaceous • Mesic - wet soil, aquatic habitats/wetlands - ditches, wet meadow, stream banks, marshes • Propagation through seed and rhizomes • Upright, wood-like stem, 4' - 7' tall with spikes of pinkish - purple flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Oct. • Herbicide cut stem application June - July • **See Attachment E for details**
Medicago lupulina	Black Medic	MISAC	• Annual, herbaceous • Dry - mesic soils, disturbed sites - roadsides, fields, lawns, waste areas • Seed propagation • Sprawling stem, 2" - 30" tall with small pea-like yellow flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - Oct.
Melilotus spp.	Sweetclover	MITPPC (71.49)	• Biennial, herbaceous • Dry soil - prairies, savannas, dunes, roadsides, old fields • Seed propagation • First year tri-lobed leaflets; Second year branched, upright stems, 3' - 5' tall with dense racemes of small white flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application early spring
Pastinaca sativa	Wild Parsnip	MITPPC (78.86); MDA (C); Op Order 113	• Monocarpic biennial, herbaceous • Dry - mesic soils, disturbed sites - old field, roadsides, abandoned lots • Seed propagation • First year basal rosette; Second year upright stem, 4' - 6' tall with flat umbels of small yellow flowers	• Herbicide foliar application to first year rosette May - June and Sept. - Oct. • **See Attachment E for details**
Phalaris arundinacea	Reed Canary Grass	MISAC; MITPPC (78.18); Op Order 113	• Perennial, herbaceous • Mesic - wet soil, aquatic habitats/wetlands - ditches, wet meadow, stream banks, marshes • Propagation through seed and rhizomes • Upright grass, 2' - 6' tall with 0.5" wide leaf blade and up to 0.5" long ligule	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Phleum pratense	Timothy	MISAC	• Perennial, herbaceous grass • Dry soils, deturbed sites - fields, woodland edges, roadsides, embankments, vacant los • Seed propagation • Upright stem, 12" - 40" with .33" wide leaf blades and a terminal 2" - 4" terminal spike	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Phragmites australis	Common Reed	MITPPC (86.32); MDA (R); Op Order 113	• Perennial, herbaceous grass • Shorelines of rivers/lakes, pond edges, marshes, roadside ditches • Propagation through seed, root fragments, rhizomes • Grass stems, up to 15' tall form dense clusters	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar / cut stem application Aug. - Oct. (after flower) • **See Attachment E for details**

Attachment D
Treatment Methods for the INS Plant Species Identified within the L3R Construction Right-of-Way and Access Roads

Species	Common Name	List Source [a]	Characteristics [b]	Growing Season Management [b]
Potentilla argentea	Silver Cinquefoil	MISAC	• Perennial, herbaceous • Dry soil - fields, prairies, roadsides • Propagation through seed and root segment • Sprawling stem, 1" - 20" tall with palmately compound leaves and yellow flowers at top of stem	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Potentilla recta	Sulphur Cinquefoil	MISAC	• Perennial, herbaceous • Dry soil - fields, prairies, roadsides • Propagation through seed and root segment • Upright stem, 12" - 30" tall with palmately compound leaves and pale yellow flowers at top of stem	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Ranunculus acris	Tall Buttercup	MISAC	• Perennial herbaceous • Mesic soils, disturbed areas - old field, field edges, woodland edges, roadsides • Seed propagation • Upright stem, 1' - 3' tall with yellow terminal flowers on long stalks	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Rhamnus cathartica	Common Buckthorn	MISAC; MITPPC (84.38); MDA (R); Op Order 113	• Perennial, woody shrub • Forest edges, woodland understory • Propagation through seed and vegetative sprouting • Singular stem, 20' - 26' tall with small green flowers or purplish-black berries	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application June - Oct. • Herbicide cut stem / basal bark application year-round • **See Attachment E for details**
Securigera varia	Crown Vetch	MISAC; MITPPC (77.32); MDA (R); Op Order 113	• Perennial, herbaceous • Old field/pastures, roadsides • Propagation through seed and rhizomes • Reclining, dense masses of 2' - 6' stems with umbels of small pinkish flowers and pinnate leaves	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Oct. • **See Attachment E for details**
Silene latifolia	White Campion	MISAC	• Annual, herbaceous • Dry soils, disturbed sites - cropland, field edges, roadsides, shorelines, waste areas • Propagation through seeds and root segments • Upright stem, 1' - 4' tall with downy foliage and showy white flower	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide resistant • Regular mowing and cultivation prior to going to seed
Solanum dulcamara	Bittersweet Nightshade	MISAC	• Perennial, herbaceous • Mesic soils - thickets, woodland, waste areas • Propagation through seeds and rhizomes • Vine, 2' - 8' long with flowers of purple petals and yellow stamens; Red berries	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct.
Sonchus arvensis	Perennial Sowthistle	MISAC	• Perennial, herbaceous • Dry - mesic soils, disturbed sites - cultivated fields, pastures, woodlands, roadsides, gardens • Propagation through seed and root segments • Upright stem, 2' - 5' tall with bright yellow terminal flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct.
Tanacetum vulgare	Common Tansy	MISAC; MITPPC (91.39); MDA (C); Op Order 113; NDDA	• Perennial, herbaceous • Dry -mesic, well drained soil, disturbed areas - trails edges, roadsides, pastures, old field, stream banks • Propagation through seed, root cuttings, rhizomes • Upright, woody-like stem, 2' - 5' tall with flat clusters of yellow, button-like flowers	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - Nov. • **See Attachment E for details**
Toxicodendron radicans	Poison Ivy	MDA (S)	• Perennial, shrub • Prairie, woodland, disturbed sites - roadsides, trail sides, fencerows, parks • Propagation through seed and rhizomes • Dense shrub, 1' - 2' tall with three shiny leaves, small green flowers, tannish berries	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application May - July • Herbicide cut stem application Aug. - Nov. • **See Attachment E for details**
Trifolium spp.	Clover	MISAC	Perennial, herbaceous Mesic soils - open woodland, roadsides, lawns, fields Propagation through seeds and stoloniferous stems Upright stem, 3" - 6" tall with round flower head	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May
Verbascum thaspus	Common Mullein	MISAC	• Biennial, herbaceous • Dry soils, disturbed areas - pasture, old field, wastelands • Seed propagation • First year thick-, fuzzy-leaved rosette; Second year upright stem, 2' - 6' tall with long wooly leaves and small yellow flowers on terminal spikes	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application April - May and Sept. - Oct.
Viburnum opulus	Highbush Cranberry	MISAC	• Perennial, shrub • Mesic soil - Forest edges, disturbed sites, open upland, roadsides, old field/pasture • Propagation through seed and vegetative sprouting • Multi-stemmed, 10' tall with white flowers or red berries	• In sensitive areas, mechanical means of control will be implemented (e.g. mowing, hand pulling, or digging) • Herbicide foliar application June - Oct. • Herbicide cut stem / basal bark application year-round

Attachment D
Treatment Methods for the INS Plant Species Identified within the L3R Construction Right-of-Way and Access Roads

Species	Common Name	List Source [a]	Characteristics [b]	Growing Season Management [b]

[a] MISAC - Minnesota Invasive Species Advisory Council; MITPPC - Minnesota Invasive Terrestrial Plants and Pests Center; MDA - Minnesota Department of Agriculture (E-Eradicate, C-Control, S-Special, R-Restricted); Op Order 113 - Minnesota Department of Natural Resources Operational Order 113; NDDA - North Dakota Department of Agriculture.

[b] Plant characteristics and management methods provided are generalized. Additional technical instruction is necessary from herbicide manufacturers or agencies prior to implementation. Provided characteristics and methodologies are derived from:

Minnesota Department of Transportation. Minnesota Noxious Weeds. 2018. http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf

Ohio State University. Pocket Gardner. https://hvp.osu.edu/pocketgardener/source/index.html

Wisconsin Department of Natural Resources. Terrestrial Invasive Species. 2015. https://dnr.wi.gov/topic/Invasives/species.asp?filterBy=Terrestrial&filterVal=Y

University of California. Statewide Integrated Pest Management Program. http://ipm.ucanr.edu/

Ohio State University. Ohio Perennial and Biennial Weed Guide. http://www.oardc.ohio-state.edu/weedguide/index.php

Minnesota Department of Natural Resources. Invasive Terrestrial Plants. https://www.dnr.state.mn.us/invasives/terrestrialplants/index.html

North Dakota State University. Identification and Control of Invasive and Troublesome Weeds in North Dakota. 2018. https://www.ag.ndsu.edu/publications/crops/identification-and-control-of-invasive-and-troublesome-weeds-in-north-Dakota

University of California. Weed Research and Information Center. Weed Control in Natural Areas in the Western United States. 2013. https://wric.ucdavis.edu/information/natural%20areas/natural_areas_common_A-B.htm

Washington State, King County. Weed Identification photos - Index for identification and control of noxious weeds. 2019. https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/weed-identification.aspx

U.S. Forest Service. Invasive Species Program - Species Profiles. 2016. https://www.fs.fed.us/invasivespecies/speciesprofiles/index.shtml

Minnesota Wildflowers. A Field Guide to the Flora of Minnesota. https://www.minnesotawildflowers.info/

PennState Extension. Weed Identification and Control. https://extension.psu.edu/pests-and-diseases/pest-disease-and-weed-identification/weed-identification-and-control

Texas A&M Agrilife Extension. AquaPlant. https://aquaplant.tamu.edu/plant-identification/category-emergent-plants/

Pacific Northwest Extension. Pest Management Handbooks. Weed Management Handbook. https://pnwhandbooks.org/weed

Attachment E

Minnesota Department of Transportation
Minnesota Noxious Weeds Guide

Minnesota Noxious Weeds

Includes Native and Nonnative Look-alike Species for Comparison

DEPARTMENT OF TRANSPORTATION

Oriental bittersweet, *Prohibited: Eradicate*

2017-10-26

Minnesota State Listed Noxious Weeds

	Page	Common Name	Scientific Name	Family
Prohibited: Eradicate	4	Black swallow-wort	*Cynanchum louiseae* Kartesz & Gandhi	Asclepiadaceae
	5-6	Common / cutleaf teasel	*Dipsacus fullonum* L. and *D. laciniatus* L.	Dipsacaceae
	7	Dalmatian toadflax	*Linaria dalmatica* (L.) Mill.	Scrophulariaceae
	8	Giant hogweed	*Heracleum mantegazzianum* Sommier & Levier	Apiaceae
	9	Grecian foxglove	*Digitalis lanata* Ehrh.	Scrophulariaceae
	10	Japanese hops	*Humulus japonicus* Siebold & Zucc.	Cannabaceae
	11	Oriental bittersweet	*Celastrus orbiculatus* Thunb.	Celastraceae
	12	Palmer amaranth	*Amaranthus palmeri* S. Watson	Amaranthaceae
	13	Poison hemlock	*Conium maculatum* L.	Apiaceae
	14	Yellow starthistle	*Centaurea solstitialis* L.	Asteraceae
	15-16	Brown knapweed	*Centaurea jacea* L.	Asteraceae
		Meadow knapweed	*Centaurea* x *moncktonii* C.E. Britton [*jacea* × *nigra*]	Asteraceae
		Diffuse knapweed	*Centaurea diffusa* Lam.	Asteraceae
Prohibited: Control	17	Spotted knapweed	*Centaurea stoebe* L. subsp. *micranthos* (Gugler) Hayek	Asteraceae
	18	Barberry, common	*Berberis vulgaris* L.	Berberidaceae
	19	Canada thistle	*Cirsium arvense* (L.) Scop.	Asteraceae
	20	Plumeless thistle	*Carduus acanthoides* L.	Asteraceae
	21	Leafy spurge	*Euphorbia esula* L.	Euphorbiaceae
	22	Narrowleaf bittercress	*Cardamine impatiens* L.	Brassicaceae
	23	Purple loosestrife	*Lythrum salicaria* L. and *Lythrum virgatum* L.	Lythraceae
	24	Common tansy	*Tanacetum vulgare* L.	Asteraceae
	25	Wild parsnip	*Pastinaca sativa* L.	Apiaceae
Restricted Noxious Weeds	26	Asian bush honeysuckles	*Lonicera* spp.	Caprifoliaceae
	27	Black locust	*Robinia pseudoacacia* L.	Fabaceae
	28	Crown Vetch	*Securigera varia* (L.) Lassen	Fabaceae
	29	Common buckthorn	*Rhamnus cathartica* L.	Rhamnaceae
	30	Glossy buckthorn	*Frangula alnus* Mill.	Rhamnaceae
	31	Garlic mustard	*Alliaria petiolata* (M. Bieb.) Cavara & Grande	Brassicaceae
	32-33	Japanese barberries	*Berberis thunbergii* DC. and listed hybrids and cultivars.	Berberidaceae
	34	Multiflora rose	*Rosa multiflora* Thunb.	Rosaceae
	35	Nonnative phragmites	*Phragmites australis* (Cav.) Trin. Ex Steud. subsp. *Australis*	Poaceae
	36	Porcelain berry	*Ampelopsis brevipedunculata* (Maxim) Trautv.	Vitaceae
	37	Tree-of-heaven	*Ailanthus altissima* (Mill.) Swingle	Simaroubaceae
	38	Wild carrot	*Daucus carota* L.	Apiaceae
Specially Regulated	39	Amur maple	*Acer ginnala* Maxim.	Aceraceae
	40-41	Knotweed, Japanese	*Polygonum cuspidatum* Siebold & Zucc.	Polygonaceae
		Knotweed, giant	*Polygonum sachalinense* F. Schmidt ex Maxim.	Polygonaceae
	42	Poison ivy - western	*Toxicodendron rydbergii* (Small) Green	Anacardiaceae
		Poison ivy - common	*T. radicans* (L.) Kuntze subsp. *negundo* (Greene) Gillis	Anacardiaceae

Each Specially Regulated species is subject to unique restrictions. See notes on page 74

Scientific names (genus and species) were sourced from : USDA Plants Database

Dalmatian toadflax

Japanese hops

Garlic mustard

Plant descriptions provided for comparison: nonnative and native Minnesota plants.

Following are plants, commonly misidentified as a species on the noxious weed list. It is important to identify and protect the native plants, while at the same time managing the State listed noxious weeds.

As for the nonnatives listed here, while these plants may be aggressive on some sites, management is usually not a high priority.

Nonnative Plants Provided for comparison

Page	Common Name	Scientific Name	Family
43	Alfalfa	*Medicago sativa* L.	Fabaceae
	Hairy vetch	*Vicia villosa* Roth	Fabaceae
44	Balkan catchfly	*Silene csereii* Baumgarten	Caryophyllaceae
45	Carrot look-alikes	Various genus and species of the carrot family	Apiaceae
46	Chervil, wild	*Anthriscus sylvestris* (L.) Hoffm.	Apiaceae
47	Musk or nodding thistle	*Carduus nutans* L.	Asteraceae
48	Yellow rocket	*Barbarea vulgaris* W.T. Aiton	Brassicaceae

Minnesota Native Plants Provided for comparison

Page	Common Name	Scientific Name	Family
49	American bittersweet	*Celastrus scandens* L.	Celastraceae
50	American vetch	*Vicia americana* Muhl. Ex Willd.	Fabaceae
	Canadian milkvetch	*Astragalus canadensis* L.	Fabaceae
51	Cherries / wild plum	*Prunus* spp.	Rosaceae
52	Common hops	*Humulus lupulus* L.	Cannabaceae
53	Cow-parsnip	*Heracleum maximum* W. Bartram	Apiaceae
54	Cucumber, wild and bur	*Echinocystis lobata* Michx. and *Sicyos angulatus* L.	Cucurbitaceae
55	Fireweed	*Chamerion angustifolium* (L.) Holub subsp. *angustifolium*	Onagraceae
56	Golden alexanders	*Zizia* spp.	Apiaceae
57	Goldenrods	*Solidago* spp.	Asteraceae
58	Grape, riverbank	*Vitis riparia* Michx.	Vitaceae
59	Honeysuckles, native	*Diervilla lonicera* and *Lonicera* spp.	Caprifoliaceae
60	Native phragmites	*Phragmites australis* subsp. *americanus* Saltonstall	Poaceae
61	Sumacs	*Rhus typhina* L. and *R. glabra* L.	Anacardiaceae
62	Swamp thistle	*Cirsium muticum* Michx.	Asteraceae
63	Virginia creeper / Woodbine	*Parthenocissus quinquefolia* (L.) Planch. *P. vitacea* (Knerr) Hitch.	Vitaceae
64	Water hemlock	*Cicuta maculata* L.	Apiaceae
65	Yarrow, Common	*Achillea millefolium* L.	Asteraceae

Field thistle (native)

Cow parsnip (native)

Stiff goldenrod (native)

Prohibited: Eradicate

Black swallow-wort : *Cynanchum louiseae* Kartesz & Gandhi

Identification: Synonyms: *C. nigrum* (L.) Pers., non Cav.; *Vincetoxicum nigrum* (L.) Moench

Plant: A perennial, herbaceous vine with a twining habit reaching heights of 3-8 feet. Only milkweed family member in Minnesota that vines. Also, plants have clear sap, not milky.
Leaves: Opposite, shiny and dark green foliage has a smooth (toothless) edge terminated by a pointed tip. Leaves are somewhat oval at 3-4 inches long by 2-3 inches wide.
Flower: Clustered, small (1/4 inch) dark purple flowers with five downy, thickened petals.

Bloom time is June to July.

Fruit and seed: Slender pods, taper to a point at about 1½-3 inches. Pods are described as milkweed-like and at maturity split open to release flattened seeds carried on the wind by downy, filamentous fibers.

Life History: Herbaceous vine that dies back to the ground every winter. Below ground rhizomes sprout to create a group of stems. With more stems, plants in full sun will produce more flowers and set more seed (up to 2,000/meter square). Long distance wind dispersal of seeds can begin in late July. Seeds contain one to four embryos which helps to ensure germination. Seed viability is potentially 5 years.

Habitat: Prefers full sun in upland soils. Disturbances, natural or human caused, provide an opening in which black swallow-wort can gain a foothold. Old fields, grasslands, road or rail corridors, quarries and other disturbed areas provide excellent habitat.

Management: Goals should be to control seed production and stimulate competitive plant cover. **Manual** removal and destruction of plants and root crowns will meet these goals.

Repeated mowing or **cutting** can impact plants, but will not eradicate a population. After early season mowing or cutting, plans must be in place to monitor and repeat the process as necessary. Black swallow-wort if cut early in the season can still produce seed that year and the goal of cutting is to eliminate seed production. If seeds are present, clean equipment before moving offsite.

Prescribed fire can be used in conjunction with other management efforts to encourage stands of native grasses that will compete with black swallow-wort for resources. Monitoring will be necessary to control resprouting and seedlings that germinate after burns are completed.

Herbicide applications should target plants at or beyond flowering stage. As plants reach maturity, foliar applications of glyphosate or triclopyr ester cover enough surface area to potentially deliver a lethal dose to the root system. Timing the application prior to pod formation may limit the production of viable seed that season. Applying herbicide to early emerging plants with limited foliar area will likely result in roots remaining viable and plants resprouting.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar				Treat actively growing plants - once flowering has begun. Treat plants having enough foliage to carry a lethal dose to the root system.					
	Cut stem									
	Mow									
	Don't mow				Follow-up mowing to control seed production.					
Flowering Period										

Prohibited: Eradicate

Common teasel : *Dipsacus fullonum* L.

Above: Bracts may be longer than flower head

Image right: common teasel (L), cutleaf teasel (R).

Identification: *Compare to Cutleaf teasel (next page) flower bracts and leaves.*

Plant: Herbaceous, monocarpic perennial (plant dies after bearing fruit), first identifiable as a basal rosette. At maturity 2-7 feet tall with erect, ridged and prickly stems.

Leaves: On upright stems - opposite, stalkless (sessile), cup-forming, up to 12 inches long by 3 inches wide, hairless, yellowish to reddish-green, *lance-shaped with a wavy edged margin*. Central leaf vein forms a whitish line on top with stout prickles below.

Flower: Many irregular, 4-parted and white to lavender flowers. Dense, cylindrically clustered heads up to 4 inches tall and 1½ inches wide.

Stiff and spiny flower bracts are very narrow (linear) and may be taller than flower clusters.

Bloom time is June to October.

Fruit and seed: Each floret or small flower produces one capsule containing a grayish-brown, slightly hairy seed.

Life History: During the rosette stage, which may extend beyond one season, the plant creates a substantial tap root, up to 24 inches long by 1 inch wide at the crown.

Each flower head can produce upwards of 2000 seeds with germination success of 30-80%. Seed on immature heads may still ripen. Seed is viable for approximately two years with typical dispersal up to 50 feet. Seed may be transported longer distances via water.

Habitat: Disturbed, open sunny site with moist to dry soils. Common on roadsides and disturbed areas.

Management:

Cutting of roots below ground and removal of as much as possible will limit sprouting. Accomplish cutting and removal of either life stage with tools such as dandelion pullers or a sharp shovel.

Mowing of the rosette stage does not kill the plant, however mowing of the flowering stalks can disrupt seed production. After mowing or cutting of flowering plants monitor for new flower heads. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.

Prescribed fire can be used to increase competition from native warm season grasses, if they are present. Fire can also be used in combination with follow-up herbicide treatments. Keep in mind, high density infestations (large numbers of plants) will not burn well.

Herbicides such as metsulfuron methyl, clopyralid, triclopyr or 2,4-D amine are broadleaf specific herbicides that work on teasel at the rosette stage. Glyphosate is applicable but care must be exercised since it is not broadleaf specific.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Burn									
	Foliar									
	Cut stem	Not applicable.								
	Mow		Mowing is not recommended: mowing does not kill the plant and flowering may still occur. Seed dispersal can occur if mature plants are mowed. Mower scalping creates a good seed bed.							
	Don't mow									
Flowering Period										

Prohibited: Eradicate

Cutleaf teasel : *Dipsacus laciniatus* L.

Identification: *Compare to common teasel (previous page) flower bracts and leaf shape.*

Plant: Herbaceous, monocarpic perennial (plant dies after bearing fruit), first identifiable as a basal rosette. Matures to 2-7 feet tall with erect, ridged and prickly stems.

Leaves: On upright stems - opposite, stalkless (sessile), cup-forming, up to 12 inches long by 3 inches wide, hairless, *lance-shaped, lobed with sinuses cut almost to the midrib*. Prominent leaf vein with stout prickles below.

Flower: Many irregular, 4-parted and white to lavender flowers. Dense, cylindrically clustered heads up to 4 inches tall and 1½ inches wide.
Spiny, stiff flower bracts are not taller than flower cluster and are wider than cut-leaf teasel.

Bloom time is July to September.

Fruit and seed: Each floret or small flower produces one capsule containing a grayish-brown, slightly hairy seed.

Life History: During the rosette stage, which may extend beyond one season, the plant creates a substantial tap root, up to 24 inches long by 1 inch wide at the crown.

Each flower head can produce upwards of 2000 seeds with germination success of 30-80%. Seed on immature heads may reach viability. Seed is viable for approximately 2 years with typical dispersal up to 50 feet. Seed may be transported longer distances via water.

Habitat: Disturbed, open sunny site with moist to dry soils. Common on roadsides and disturbed areas.

Management:

Cutting of roots below ground and removal of as much as possible will limit sprouting. Accomplish cutting and removal of either life stage with tools such as dandelion pullers or a sharp shovel.

Mowing of the rosette stage does not kill the plant, however mowing of the flowering stalks can disrupt seed production. After mowing or cutting of flowering plants monitor for new flower heads. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.

Prescribed fire can be used to increase competition from native warm season grasses, if they are present. Fire can also be used in combination with follow-up herbicide treatments. Keep in mind, high density infestations (large numbers of plants) will not burn well.

Herbicides such as metsulfuron methyl, clopyralid, triclopyr or 2,4-D amine are broadleaf specific herbicides that work on teasel at the rosette stage. Glyphosate is applicable but care must be exercised since it is a non-selective herbicide.

Left: teasel flowering on short stems after being mowed.

Right: Prickles underside of leaf.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Burn									
	Foliar									
	Cut stem	Not applicable.								
	Mow		Mowing is not recommended: mowing does not kill the plant and flowering may still occur. Seed dispersal can occur if mature plants are mowed. Mower scalping creates a good seed bed.							
	Don't mow									
Flowering Period										

Prohibited: Eradicate

Dalmatian toadflax : *Linaria dalmatica* (L.) Mill.

Identification: *Compare to introduced Balkan catchfly (Silene csereii). See page 44.*

Plant: A short-lived herbaceous perennial up to 4 feet tall. Base may be woody and plant is often branched. Waxy stems and leaves have a bluish-gray color.

Leaves: Alternate leaves 1-3 inch in length clasp stems, are wider and more heart-shaped than similarly flowered butter-and-eggs (*Linaria vulgaris*).

Flower: Erect, spike-like racemes of yellow flowers with orangey center markings. Flowers are 1-1½ inches long with slender spurs extending downward from the back.

Bloom time is May to September.

Fruit and Seed: On average 140-250 seeds are contained in ½ inch long pods. Seeds are dark in color, flattened, angular and 3-edged with a slight, narrow wing on each edge. Mature plants produce up to 500,000 seeds with soil viability up to 10 years.

Life History: Reproduction is primarily by seed that is viable in the seedbank up to 10 years, but the plant also forms colonies via vegetative reproduction from roots.

Habitat: Rapidly colonizes disturbed sites such as roadsides, rail right-of-way, and other locations including cultivated ground. Prefers a drier site in coarse, well-drained soils.

Management: Recommendation - identify and treat early.

Eradication is the goal in Minnesota; therefore, biological control is not a compatible option at this time.

Prescribed fire can set plants back and drain some energy while **mowing** can prevent or delay seed production. However, both stimulate vegetative reproduction, thus potentially increasing stem counts. Monitor the infestation and consider follow-up treatments of periodic mowing and / or herbicide treatments.

Manual methods including, **cutting**, **hand pulling** or **tillage** if done repeatedly and in conjunction with other treatments may control infestations. **Grazers** eat the flowers, but may also carry the seeds.

Herbicide formulations of chlorsulfuron, dicamba, imazapic or picloram have had reported success. Also, combinations of picloram and chlorsulfuron or imazapic and chlorsulfuron or diflufenzopyr and picloram and chlorsulfuron are being used in some areas. Re-treatment is likely necessary.

Below center: early season regrowth.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn	Fire does not kill rhizomes. Result is likely an increased stem count.								
Herbicide	Foliar	■	■				■	■		
	Cut stem									
	Mow	Mowing can prevent seed production, but forces vegetative reproduction.								
	Don't mow	Therefore, after mowing, monitoring and repeating the process is likely necessary.								
Flowering Period			■	■	■	■	■			

Prohibited: Eradicate

Giant hogweed : *Heracleum mantegazzianum* Sommier & Levier

Identification: *Compare to native cow-parsnip (Heracleum lanatum). See page 53.*

Plant: Herbaceous, biennial giant at 10-15 feet tall (potentially 20 feet). When flowering the second year, 2-4 inch diameter hollow stalks are mottled reddish-purple with sturdy bristles.

Leaves: Alternate, up to 5 feet across, compound leaves with 3 deeply incised (cut) leaflets which may be further divided. The spotted leaf stalks, underside of leaves and stems are covered with coarse white hairs.

Flower: Large, flat umbels of small white florets create massive displays up to 2½ feet in diameter. Bloom time is June to July.

Fruit and Seed: Seed is large, flattened, with visible brown resin canals.

Life History: A single flower head can produce upwards of 1500 seeds. First season basal rosette foliage can be 1-5 feet across with flower stalks typically appearing in the second season. When plants die a large bare patch of soil results which creates a good seed bed and potential erosion problems.

Habitat: Moist soils of woodlands and riparian zones with partial shade as found on woodland edges.

Management: Caution! Use protective clothing, goggles or face mask. Caution!
Phytophotodermatitis,
contact with bristles (stiff hairs) or sap of plants (i.e., phyto)
when combined with exposure to sunlight (i.e., photo)
can cause severe blistering and swelling (i.e., dermatitis).

Manual methods including cutting and removal by hand are effective on small infestations. The focus of this method is to prevent seed production. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.

Root systems can be weakened by repeated cutting but consider removal for best results. After cutting, monitor sites for follow-up treatment needs.

Herbicide applications of triclopyr or glyphosate are effective when applied early season to basal rosettes. If manual methods such as cutting are used early in the season, plan on returning to chemically treat re-sprouts.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar	Before the plant flowers.						Treat rosettes		
	Cut stem									
	Mow					Cut and remove roots and				
	Don't mow					or seeds by hand for disposal.				
Flowering Period										

Prohibited: Eradicate

Grecian foxglove : *Digitalis lanata* Ehrh.

Identification:

Plant: Herbaceous, perennial beginning its first year as a basal rosette with a single flowering stalk from 2-5 feet tall in subsequent years.

Leaves: Alternate, smooth, stalk-less upper leaves with toothless edges are narrow (lance-shaped). Basal leaves are more oval with rounded tips and are densely woolly.

Flower: Many tubular flowers attached to a central stalk (raceme) with bloom progression from the bottom to the top of the stalk. Flowers have a brown or purple veined upper hood and a creamy-white, elongated lower lip.

Bloom time is June to July.

Fruit and seed: Seed capsules are 2-parted and split to release tiny reddish-brown seed with 3-4 year viability. The hook (stiff, persistent style of the flower) on the seed pods are easily caught on clothing or fur and transported to new locations.

Life History: A perennial plant that blooms following its first year as a basal rosette. Each flower produces numerous seeds that are viable for up to 4 years. Small wingless seeds are easily transported by birds, animals, human activity as well as wind and water.

Habitat: Minnesota sites are in full sun to partial shade along roads, woodland edges and in open fields.

Management: Caution! Grecian foxglove contains toxins (cardiac glycosides) that potentially can be absorbed through the skin. These compounds are harmful to livestock and humans. Do not pull or handle this plant without protective clothing, in particular, rubber gloves and long sleeves are required.

Repeated mowing or **cutting** to prevent flowering throughout the year and over several years can drain plants of energy and help control an infestation. Since flowering can occur on mowed, short stems follow-up treatments with herbicide may be necessary.

Prescribed fire, there is no research information available at this time.

Herbicide applications in May and again in July are beneficial to knock down plants before flowering can occur. A fall application is also recommended to kill basal rosettes that were missed earlier or that developed during the season. Metsulfuron-methyl formulations are recommended for good control.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Eradicate | Japanese hops : *Humulus japonicus* Siebold & Zucc.

Below left: Male flower structure.
Below right: Female flower structure.

Identification: *Compare to native common hops (Humulus lupulus). See page 52.*
Compare to native cucumbers, wild and bur (Echinocystis lobata and *Sicyos angulatus). See page 54.*
Compare to native Virginia creeper/woodbine (Parthenocissus spp.*). See page 63.*

Plant: Herbaceous, annual vine trailing on the ground or climbing vegetation and infrastructure. Stems are covered with downward pointing prickles.

Leaves: Opposite, 2-5 inches long and almost as wide, with 5-7 (maybe 9) palmate lobes. *Compare to common hops: typically 3-lobed occasionally 5.* Japanese hops leaves are rough and edges are toothed. Two bracts (stipules) are at leaf stalk bases and the leaf stalks (petioles) are as long or longer than the leaves.

Flower: Male flowers and female flowers are on separate plants (dioecious). Flowers are small and greenish to reddish, not showy. Male flowers are branched clusters (panicles) while the female flowers are drooping structures that are rather plump and composed of overlapping reddish bracts or scales (hops).

Bloom time is July into August.

Fruit and Seed: Single flattened seeds from each female flower. Each inflorescence produces several seeds that mature in September.

Life History: An annual plant germinating early spring and growing quickly as summer progresses. Vines quickly cover small trees and shrubs weighing them down to the point of breakage and limiting their sunlight. Japanese hops flower in July-August, seeds mature in September. Soon after a killing frost, fragile vines fall apart dispersing their seed.

Habitat: Tolerant of disturbed roadside conditions if there is moist soil. Species prefers conditions found in riparian areas including full sunlight and exposed soils that are moist and rich.

Management: Caution! Stem prickles are known to irritate the skin, long clothing and gloves are recommended.

Manual methods including **cutting** and **pulling**, while labor intensive, can be successful on small infestations. Efforts should be focused on early season work when plants are small and limited entanglement with surrounding vegetation or structures has occurred.

If the area is accessible to **mowers** and vines have limited structure for climbing, such as trees and fences, then **mowing** is an effective method to control maturity and seed production.

Herbicides include pre-emergent and post-emergent applications. Both are useful since this is an annual plant with prolific seed production capabilities. Pre-emergent should be applied prior to the growing season beginning in late March or early April. Once germination has occurred a switch to foliar applications should be made in an effort to keep plants from maturing and producing seed.

Below: Stem prickles

Prohibited: Eradicate | Oriental bittersweet : *Celastrus orbiculatus* Thunb.

Above: location of fruit is in leaf axils (where leaves attach to stem).

Identification: *Compare to native American bittersweet (Celastrus scandens). See page 49.*

Plant: Woody, twining, perennial vines up to 60 feet long, reaches tree tops and covers fences. Stem diameters of 4 inches documented in Minnesota.

Leaves: Alternate, fine rounded teeth on the leaf edge, dark green and shiny turning yellow in autumn. Typically, elliptical with a blunt leaf tip and nearly as wide as long at 2-5 inches.

Flower: Female flowers are small, inconspicuous, greenish clumped (3-7) in leaf axils along stems. Dioecious species, male and female flowers on separate plants. Male flowers are also axial but may be terminal. Compare white pollen on male flowers to *yellowish pollen on American bittersweet flowers*. *Also, American bittersweet flowers are similar in size and color but are found* ***only terminal*** *on vine branches (on the ends).*

Bloom time is May to June.

Fruit and Seed: Along the vine in leaf axils are potentially 3-7 yellowish, 3-parted capsules enclosing reddish-colored, 3-parted, berry-like arils. Each part contains 1-2 seeds; therefore, potential total of 3-6 seeds per fruit. Dioecious, separate fruiting (female) and non-fruiting (male) plants. *American bittersweet's 3-parted fruit is more red, the 3-parted capsules more orange and fruits are terminal on the vine branches (on the ends).*

Life History: Vegetative reproduction occurs from below-ground rhizomes, above-ground stolons and suckering of roots. Birds will eat the fruits (arils) during the winter and disperse the seeds. Seeds germinate late spring.

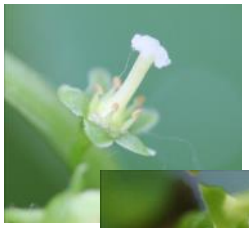
Habitat: Readily invades disturbed, open, sunny sites, yet Oriental bittersweet is moderately tolerant of shade allowing it to grow in open woodlands.

Management:

Prescribed fire research has shown that basal sprouting is stimulated and stand density increases dramatically.

Cutting of stems can be used to kill above ground portions of plants especially if the infestation is covering large areas or is climbing high into forest canopy. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal. Combine with herbicide applications for best results.

Herbicides that act systemically such as formulations of triclopyr or glyphosate can be applied as foliar, basal bark or cut stem applications. Foliar applications are reserved for easy to reach foliage, re-sprouting or along fence lines. Once foliage is out of reach, application to cut stems or basal bark will yield the best results.



Left above: greenish, female flower.
Left below: greenish male flower, note white pollen grains on anthers of the upper flower.

Right: Light brown seeds. Each structure is 3 parted and each part contains 1-2 seeds. Image shows 5 seeds from a single fruit.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn		Burning is not recommended							
Herbicide	Basal Bark									
	Foliar									
	Cut stem									
	Mow		Mowing is not recommended.							
	Don't mow									
Flowering Period										

Prohibited: Eradicate | Palmer amaranth : *Amaranthus palmeri* S. Watson

Above: male plants have soft flower spikes, female flower spikes have sharp bracts (below - upper right).

Below: poinsettia-like foliage, white V-shaped markings (inset), and thick stems.

Identification: Palmer amaranth is one of several native pigweeds and is native to southwestern deserts of the United States. Link: Pigweed Identification, a pictorial guide.

Plant: Herbaceous, annual plant, a potential growth rate of 2-3 inches per day. Plants attain heights of 6-8 feet, potentially 10 feet. Stems are stout, up to 2 inches thick and without hairs (smooth). Top-view of plants as foliage develops resembles a poinsettia.

Leaves: Alternate, green color, some plants with white V-shaped markings on leaves. Elliptical to diamond-shaped leaf blades terminated by a small spine. Petioles up to 2-3 times longer than leaves, image at right.

White petiole bent back over a green leaf blade.

Flower: Plants are dioecious with male and female flowers on separate plants. Flowers are not showy, but flower spikes are significant and useful in positive identification.

Bloom time is June to Sept. Flowers can occur 8 weeks post-emergence to end of season.

Fruit and seed: Seeds are dark colored and extremely small. Research shows pigweeds including palmer amaranth can produce upwards of 250,000 or more seeds per plant.

Life History: Seedling emergence can occur throughout the growing season; thus, flowering and seed set can persist late into the season. **Monitoring** is a necessary activity for control efforts. Seeds germinate in spring if within an inch of soil surface. Research on pigweeds suggests if seed is buried deeper than 3 inches viability is decreased annually with a potential longevity of approximately 3 years. Research on redroot pigweed (*A. retroflexus*) and waterhemp (*A. rudis*) suggests longevity can be as short as 3-4 years in Mississippi/Illinois or as long as 12 years in Nebraska.

Habitat: Native habitat is desert climate, species performs well during heat of summer. Pigweeds are shade intolerant.

Management: Preventing establishment is key. Proper identification and frequent scouting to limit seed production. **Repeated mowing** or **cutting** are not effective at controlling Palmer amaranth infestations. Continue monitoring and consider alternative methods such as cultivation, manual methods like hand-pulling or herbicide applications.

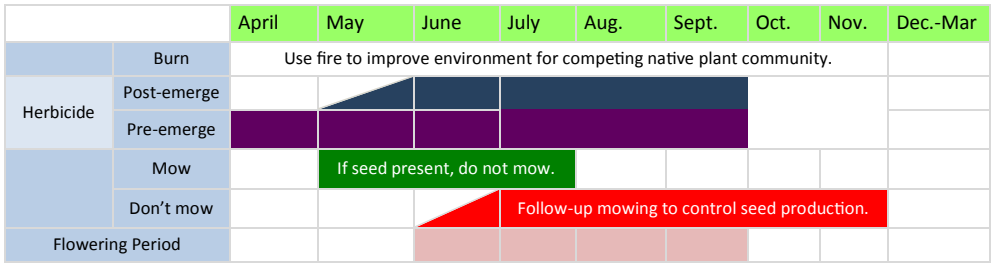
Prescribed fire has the potential to kill seedlings and drain energy from maturing plants, but fire should be considered as a tool to strengthen the health and competitive advantage of the desirable plant community.

Biotypes have shown resistance to **herbicides** in groups 2, 3, 5, 9 and 27 (Group number - check herbicide labels). Yet, **herbicide** applications both pre- and post- emergent are possible. Roger Becker (Univ. of MN, Agronomist) provided the following comment: "There are many products that will control the pigweed group across the different labeled sites, but the challenge will be knowing what the resistance of the particular biotype is that gets here (Minnesota), if at all. Many of the standard ROW (right-of-way) broadleaf materials will control non-resistant palmer."

Useful herbicides in group 4 include 2,4-D, aminocyclopyrachlor, aminopyralid, clopyralid, and dicamba. Group 2 herbicides include imazapyr, imazapic, metsulfuron and sulfometuron. Nonselective glyphosate, group 9 and glufosinate, group 10 can be used depending on crop tolerance traits or desired vegetation outcomes for non-cropland sites.

For best results, treat plants when they are small, under 1 foot tall.

As plants mature, use approved higher rates of herbicides.



Prohibited: Eradicate

Poison Hemlock : *Conium maculatum* L.

Caution All plant parts are ***poisonous to humans*** and livestock. Caution

It is reported that toxin can be absorbed through bare skin! Wear appropriate PPE.

Identification: *Compare to wild carrot and native water hemlock on pages 38 and 64. Also compare to carrot look-alikes, wild chervil and common yarrow on pages 45, 46 and 65.*

Plant: Herbaceous, biennial, first year as a basal rosette and second year poison hemlock is a branched, 3-7 feet tall, robust plant. Stems are smooth (no hairs), hollow, appear ridged due to veins and are light green, mottled (spotted) with purplish spots.

Leaves: Alternate, generally triangular in form. Doubly or triply pinnately compound up to 18 inches long by 12 inches wide. Leaflets are fern-like, deeply divided and typically twice as long (2 inches) as wide (1 inch). Basal leaves tend to be larger and have longer petioles than upper stem leaves. Petiole to stem attachments are covered by a sheath.

Flower: Flat or slightly dome-shaped open compound umbels of 3-16 umbellets with 12-25 five-petaled, white florets. There are small ovate-lanceolate bracts with elongated tips under main umbels. Bracts are also present under umbellets.

Bloom time is variable - June to August.

Fruit and Seed: Paired seeds are ⅛ inch tall schizocarps, these split at maturity becoming two carpels . Each carpel is a seed, flattened on 1 side and lined vertically by broken ridges described as wavy ribs. There are no hairs.

Habitat: Partial shade is tolerated but preference is full sun with moist fertile soils. Often found near water or in riparian zones. Can tolerate drier conditions.

Management:

If performed frequently **cutting** or **mowing** are effective control methods to prevent seed production. Same is true for hand pulling, however roots and root fragments remaining in soil may resprout. Monitor and plan additional treatments.

Prescribed fire as a tool should be used to improve the health of surrounding native vegetation. Fire will kill seedlings and top kill other plants; however, after the fire healthy root systems will likely resprout.

Foliar herbicide applications to plants at rosette stage or during active growth (before flowering). Herbicide formulations with 2,4-D or 2,4-D including dicamba or triclopyr have produced good results. Nonselective herbicides such as glyphosate (concentration of 41% or greater) formulations can also produce results.

Other potential choices are formulations including aminopyralid, chlorsulfuron, clopyralid, dicamba, imazapic, imazapyr, metsulfuron-methyl or 2,4-D plus picloram.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn		Stimulate surrounding vegetation							
Herbicide	Foliar			Target pre-flower.						
					Target rosette					
	Mow		Mowing must be repeated to prevent flowering							
	Don't mow				When seed is present					
Flowering Period										

Prohibited: Eradicate

Yellow starthistle : *Centaurea solstitialis* L.

A member of the knapweeds, genus *Centaurea*.

Identification:

Plant: Herbaceous, annual with heights of 6 to 36 inches. Plants start as a biennial or winter annual with a basal rosette the first season. Mature plants are described as bushy with a grayish or bluish cast to otherwise green color.

Leaves: Basal leaves are lobed, dandelion-like at about 8 inches. Basal leaves may not persist as plants bolt to flower. Stem leaves are alternate, narrow to oblong and an extended leaf attachment provides a winged appearance to stems.

Flower: Approximately 1 inch long flowers with substantial ¾ inch yellowish spines emanating from bracts beneath flowers. Flowers are terminal and solitary on stems.

Bloom time is June to August.

Fruit and Seed: Each terminal flower produces between 35 to 80 plumeless or plumed seeds.

Life History: Yellow starthistle is a strong invader. Due to a lack of tufting on some seeds, reliance is on animals and humans for movement any distance from parent plants.

Habitat: Periods of summer drought favor infestations on disturbed sites such as roadsides. Also an invader of prairies, fields, woodlands and pastures where spines can cause injury to grazing animals.

Management: Caution! Gloves and long sleeves are recommended. Knapweeds have chemical and in some species physical defenses. These are known skin irritants.

Limit movement of seed on grazing animals, mowing equipment and vehicles.

Eradication is the goal in Minnesota; therefore, biological control is not a compatible option at this time.

Mowing, monitor infestations and time mowing at early flowering stages, soon after spine development.

Herbicide formulations of aminopyralid, clopyralid or picloram applied as foliar applications early in the growing season appear to be most effective.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Eradicate

Knapweed complex : *Centaurea* spp.

Top: Brown Knapweed, images Bugwood.org
Middle: Meadow knapweed, images T. Jacobson
Below: *Spotted* (left), Diffuse (center), *Russian* (right) Image: Bugwood.org.

Prohibited: Eradicate Brown knapweed: *Centaurea jacea* L.
Prohibited: Eradicate Diffuse knapweed: *Centaurea diffusa* Lam.
Prohibited: Eradicate Meadow knapweed: *Centaurea* x *moncktonii* C. E. Britton [*jacea* × *nigra*]
Not listed *Russian knapweed*: *Acroptilon repens* (L.) DC. - synonym: *Centaurea repens* L.
Prohibited: Control *Spotted knapweed*: *Centaurea stoebe* L. ssp. *micranthos* (Gugler)

Advice, spotted knapweed is established in Minnesota. Learn to identify it and recognize when something is different. Please report infestations that are not easily identified as spotted knapweed to Early Detection and Distribution Mapping System EDDMaps or Minnesota Department of Agricultures Arrest the Pest.

Compare knapweeds on pages 15, 16 and 17. Compare to thistles (pages 19, 20, 47 and 62) and alfalfa / vetches (pages 43 and 50).

Identification:

Species / Characteristic	Brown	Diffuse	Meadow	*Russian* (Not Listed in Minnesota)	*Spotted* (Prohibited: Control)
Root Types	Short-lived perennial,	Short-lived perennial, tap root	Short-lived perennial,	*Long-lived perennial, creeping perennial, root spread horizontal.*	*Short-lived perennial, tap root.*
Bracts	Brown , with a tan papery tip (edge)	Rigid, spine-like tips	Long fringed (insect-like) Coppery, shiny (mature).	*Rounded bracts, smooth papery transparent tips*	*Darkened tip, short fringe.*
Flowers	Rose to Purplish, 1-1¼ inch wide.	Variable - white to rose Occasionally purplish	Rose to purplish ¾ inch wide.	*Pink to lavender ⅜ to ½ inch*	*Pinkish, cream is rare Approximately 1 inch*
Leaves	Not as deeply lobed as spotted knapweed	Basal leaves deeply and finely, divided with wide lobes.	Basal leaves mostly unlobed, smooth.	*Basal leaves are seldom divided, roughly fuzzy.*	*Gray-green, Deeply lobed leaves, roughly fuzzy*
Habitats	Prefers moist cooler soils.	Dry soils, disturbed sites	Moist soils, wet prairies	*Dry to moist soils, saline soils, disturbed sites*	*Dry to moist soils, disturbed sites*

Table adapted from sources: http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Brochures/knapweed.pdf
http://bugwoodcloud.org/mura/mipn/assets/File/KnapweedBrochure072814WEB.pdf

Plants: Herbaceous, typically short-lived perennials or biennial. Knapweeds ascend from woody root crowns and reach heights of 8 to 32 inches. Typically, multi branched with solitary, terminal disk flowers.
Leaves: Simple, alternate, green foliage. *Spotted* knapweed has foliage with fine hairs and a blue-gray color, while *meadow* knapweeds foliage is smooth and a green color. Some species are deeply lobed (*spotted*) while others like *brown knapweed* may not be lobed. In all species, basal leaves tend to be larger than the lance-shaped leaves above.
Flower: Flower colors varying from white to purplish make color a less reliable species identifier. Typically flowers are solitary, terminal to branches, purplish disk flowers that are surrounded by 5-petaled florets. Bracts that cover the bulb-like bases of flowers are 2-parted and the bract characteristics are diagnostic to species, especially the bract tips. Refer to the table above for comparison.

Prohibited: Eradicate

Knapweed complex : *Centaurea* spp.

Top: Brown knapweed
Images: Bugwood.org

Middle: Meadow knapweed
Images: Tom Jacobson, MnDOT.

Bottom left: Diffuse knapweed
Image: Bugwood.org

Bloom time is June to September.

Fruit and seed: Small (less than ⅛ inch) (2-3 mm), some have short, bristly hairs (pappus) at the top. A typical achene (seed) of the Aster family but pappus is limited and wind will not carry seeds.
Life History: Reproduction is by seed which can be moved by water, animals, and birds. Human activities are significant transporters of seed in products like mulch, soil or hay and straw. Seed is also potentially moved on construction or farm equipment, recreational vehicles, as well as on personal automobiles, clothes and recreational gear. Depending on species, seed viability can be up to eight years.

Currently unlisted and not known to be in Minnesota, Russian knapweed is a long-lived perennial with deep roots, potentially to 20 feet. Its roots are dark colored and scaley. Russian knapweeds foliage is blue-gray and has fine hairs, similar to spotted knapweed. It is reported that seed production of Russian knapweed is 'limited' but infestations spread aggressively by roots.

Habitat: *Brown and Meadow knapweeds* prefer moist soil types found along water, wet grasslands or meadows, irrigation ditches, roadsides and openings in woodlands. In contrast, other knapweeds tolerate drier sites such as old fields, road and rail right-of ways, gravel pits or similar disturbed areas.
All prefer full sun locations with the exception of *brown knapweed being tolerant of partial shade*.

Threat to Minnesota: potential development of hybrids that can take advantage of intermediate niches.

Management: Caution! When handling knapweed plants gloves and long sleeves are recommended since knapweeds have defenses that are known skin irritants.

Hand pulling or **digging** while time consuming can be an effective step when coupled with chemical treatments. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.
Repeated mowing or **cutting** can reduce seed production, but sites must be monitored and applications likely repeated or followed up with herbicide treatments.
Prescribed fire can be used to encourage stands of native grasses that will compete with knapweeds. However, monitoring is needed to check for knapweed germination in bare soil soon after burns are completed.

Herbicide foliar applications with formulations including aminopyralid, clopyralid, or picloram have proven effective in controlling knapweeds.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar		Foliar treatments target rosettes.							
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Spotted knapweed : *Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek

Identification: *Compare to knapweed complex members. See pages 15 and 16.*
Compare to nonnatives alfalfa and hairy vetch. See page 43.
Advice, spotted knapweed is established in Minnesota. Learn to identify it and recognize when something is different.

Compare flower similarities to Canada thistle, page 19.

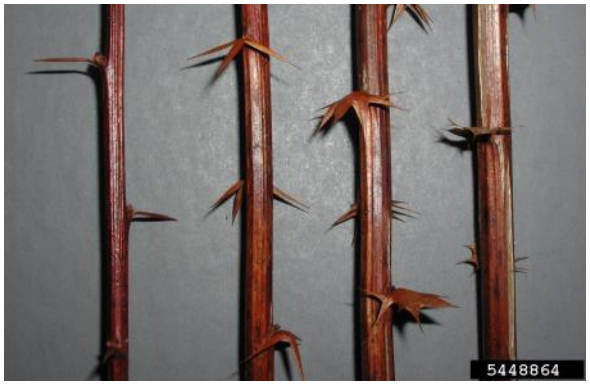
Plant: Herbaceous, short-lived perennial living 1-4 years. Initial stage is a rosette before the plant produces 1-6 stems ranging from 1-4 feet tall.
Leaves: Simple, alternate, grayish-green basal rosette leaves up to 6 inches long have deep sinuses. Alternate leaves on mature stems vary from smaller, 1-3 inch, versions of the basal leaves to very small linear leaves near the top.
Key difference: *meadow / brown knapweed - green leaves, lacking lobes.*
Flower: Strongly resemble the flowers of thistles in their pink to purple color (rarely white) and multi-parted texture. Below the petals, flowers are held together by bracts that are stiff and tipped with darkened hairs (see image above).
Compare *bract tips; brown - brown, tan papery edge; diffuse - rigid, sharp spines - terminal spine can be ⅛ inch long; meadow - long fringed; Russian - rounded, opaque with transparent tips; and spotted - dark tip, short fringe.*
Bloom time is July to September.
Fruits and Seed: Small (⅛ inch long), brownish, tufted, seeds.
Life History: Allelopathic properties (chemicals exuded by the plant) can suppress the germination of seeds of other plants nearby. Plant removal can lead to bare patches of soil subject to erosion.
Seeds are the primary means of reproduction and a mature plant produces thousands of seeds that may remain viable for up to 5 years. Wind disperses seeds short distances while animal and human activity disperse it far and wide.
Habitat: In contrast to meadow knapweed's preference to moist sites, spotted knapweed prefers disturbed sites with gravely or sandy dry soils. Roadsides, abandoned lots, old fields and gravel pits are habitat that support infestations.
Management: Caution! Knapweeds are known skin irritants, therefore; if handling knapweed plants gloves and long sleeves are recommended.
Biological controls approved for use in Minnesota are seedhead weevils (*Larinus minutus* and *L.* obtusus) and a root-boring weevil (*Cyphocleonus achates).* Weevils are collected July through September and released on infestation sites larger than 1/3 acre. When a combination of seedhead and root boring weevils work together, infestations can be reduced over a number of years.
While **cutting, mowing** and **prescribed fire** can encourage competition from native grasses and help reduce the extent of an infestation they will likely not eradicate it. Early spring prescribed fire is compatible with biological control.
Herbicide formulations including aminopyralid, clopyralid, glyphosate, imazapyr, aminocyclopyrachlor or picloram have demonstrated control with foliar applications.

Above: basal rosette, Middle right: basal foliage, Middle Left: linear foliage near top of plant, Bottom right: flowers.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar		Foliar treatments target rosettes.							
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Common Barberry : *Berberis vulgaris* L.



Above: common barberry spine variations.

Above: common barberry leaf variations.

Identification: *Compare to Japanese barberry on pages 32-33 and Korean barberry on page 33.*

Plant: Deciduous shrub reaching 8-10 feet in height and up to 6 feet in width. Slender branches are straight between nodes, strongly grooved and common barberry may have single or multi-branched spines, usually 3-branched possibly 5.

Bark on second year stems is gray as opposed to reddish second year branches of Korean barberry.

Key difference - *Japanese barberry spines, usually single maybe 3-branched. Korean has 1-5 (7), often 3, flat spines.*

Leaves: Alternate, but clustered not appearing alternate, simple leaves are ovate, narrow near the base, toothed on the edges, described as finely serrate, as few as 8, often 16 to 30 spiny teeth. In particular, young shoots have spiny leaves.

Key difference - *Japanese barberry leaves have smooth edges (no teeth). Korean barberry has toothed leaf edges.*

Flower: Drooping, 1-2 inch long clusters (racemes) of 10-20 yellow, ½ inch long flowers. Flowers are somewhat showy, however; fragrance is not described as pleasant.

Key difference - *Japanese barberry has 1-4 flowers hanging in loose clusters. Korean barberry has 10-25 flowers.*

Bloom time is May to June.

Fruit and Seed: Fruit is an oblong berry, up to ½ inch long, bright red and fleshy. Berries persist into and through winter. Each fruit contains 1-3 seeds. Based on studies in Minnesota and North Dakota the US Forest Service fire effects database indicates seed viability of 7-9 years in soil.

Key difference - *Japanese barberry berries are ¼ to ⅜ inch long with dry flesh. Korean barberry has ¼ inch fleshy berries and fruits are more rounded - not as oblong.*

Life History: Most propagation is by seed dispersal. Birds are a primary disperser. Vegetative reproduction is important to persistence. Mainly through sprouting from rhizomes and lower branches may root at points of ground contact.

Habitat: Typically, found in open or lightly shaded woods. Also found in pastures, fencerows and roadsides in full sun.

Management:

Cutting or **mowing** can be effective once mature shrubs are removed. Follow-up with frequent mowing to control regeneration or utilize other treatments as needed.

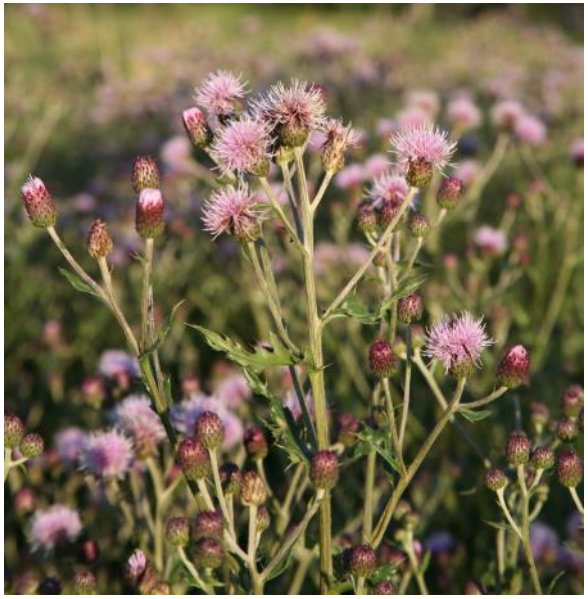
Repeated **prescribed fire** can damage above ground parts and drain energy from shrubs; however, resprouting will likely occur. Monitor after fire and follow up as necessary with additional treatments.

As with most woody species, there are several methods to apply **herbicide. Foliar** applications should be made when plants are fully leafed out and for best effect while plants are fruiting. Active ingredients include dicamba + 2,4-D, glyphosate, metsulfuron-methyl and triclopyr. **Cut stump** treatments using glyphosate or triclopyr will likely be successful and **basal bark** treatments with triclopyr or imazapyr formulations are also effective.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out and when in fruit.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Prohibited: Control

Canada thistle : *Cirsium arvense* (L.) Scop.



Identification: *Compare to native swamp thistle (Cirsium muticum). See page 62.*
Compare to nonnative musk thistle (Carduus nutans). See page 47.
Compare to nonnatives alfalfa and hairy vetch. See page 43.
Compare flower similarities to spotted knapweed, page 17.

Plant: Herbaceous, perennial with grooved, non-spiny, hairy and typically upright stems to a height of 2-6+ feet tall.

Leaves: Alternate, simple, pinnately lobed leaves that are generally lance-shaped. The leaves are irregularly lobed, with toothed, spiny edges. The leaves are stalkless (sessile) and at maturity are downy or hairy on the underside.

Flower: Male and female (dioecious) ¾ inch flowers occur singly on the end of branches. The disk or composite inflorescence is comprised of numerous purple to pinkish small florets. Bracts below the inflorescence do not have spines on the tips.

Bloom time is June to October.

Fruit and Seed: Tufted light brown seeds are easily dispersed by wind. Do not mow after seed has developed as this strongly aids seed dispersal.

Life History: Reproduction can occur from seed, root cuttings and from rhizomes. Clonal stands are common and spread significant from roots that can grow horizontally 10-12 feet per year.

Habitat: A successful inhabitant of disturbed areas such as roadsides and old fields but will also move into open woodlands and prairies. This species is also found where water levels fluctuate such as in wet meadows, along stream banks and ditches.

Management:

A **biological control** is under investigation, stem-mining weevil (*Ceutorhynchus litura*). This insect is available from commercial vendors and is acceptable for distribution in Minnesota.

Cutting or **mowing** should target plants that are approximately 3 inches tall and the process must be repeated throughout the season to maintain the plants at 3 inches or less in height. Continuing this approach for several years can drain the plants of reserves.

Repeated **prescribed fire** can be used to encourage stands of native grasses that will outcompete thistle. However, monitoring is needed to check for thistle that germinates in bare soil soon after burns are completed.

Herbicide foliar sprays with formulations of clopyralid, aminopyralid, or metsulfuron-methyl. These foliar applications are made as the plants bolt, prior to flower set, or in late summer/early autumn to rosettes.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Plumeless thistle : *Carduus acanthoides* L.

Identification: *Compare to native swamp thistle (Cirsium muticum). See page 62.*
Compare to nonnative musk thistle (Carduus nutans). See page 47.
Compare to nonnatives alfalfa and hairy vetch. See page 43.

Plant: Herbaceous, biennial reaching heights of 1-4 feet. Unlike native thistles, the stems of plumeless thistle are winged and spiny.
Leaves: Edges of rosette leaves are wavy with yellowish spines. Stem leaves are alternate, attached directly to stems and typically have hairs on bottoms along mid-veins.
Flower: Numerous stem branches support terminal, single, composite flowers that are ½ to 1½ inches wide. Linear or narrow bracts with short spines are found immediately below pink to purple flowers.

Bloom time is July to October.

Fruit and Seed: Small seeds approximately 1/16 inch long described as straw colored and tufted with fibers on the terminal end. The fibers aid in wind dispersal.
Life History: Reproduction is by seed and seeding is prolific building a large seed bank in a short period of time. Thus, control measures should focus on eliminating seed production and exhaustion of seed banks. Movement is greatly increased by animal and/or human activities such as mowing or haying.
It is reported that musk thistle (*Carduus nutans*) and plumeless thistle hybridize.
Habitat: Found on dry to moist soils in pastures, woodlands, waste areas, along roadsides, ditches and stream banks.
Management:

Cutting taproots 1-2 inches below ground is effective but time consuming for large numbers of plants. **Mowing** should be timed at flower bud stage to prevent seed production and should be repeated 2-3 times per season to be effective. Avoid spreading seed with hay or straw and with mowing and vehicle movement through infestations.

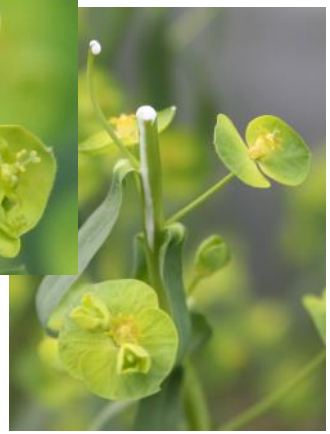
Prescribed fire can be used to encourage stands of native grasses that will outcompete thistle. However, monitoring is needed to check for thistle that germinates in bare soil soon after burns are completed.

Herbicide applications timed at the early bolting phase are foliar applications of 2,4-D ester or dicamba formulations. For foliar applications at the budding to flower stage or fall applications to basal rosettes turn to formulations of aminopyralid, clopyralid, metsulfuron-methyl or triclopyr.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Leafy spurge : *Euphorbia esula* L.



Above: Flower and bracts.
Right: Cut stem exuding white latex.

Squares = ¼ inch.

Identification: *Similar to invasive cypress spurge (E. cyparissias). Due to bloom period overlap confused with introduced yellow rocket (Barbarea vulgaris). Compare to yellow rocket, page 48.*

Plant: Herbaceous, perennial to 3 feet tall. *Cypress spurge is 8-14 inches tall.* Broken stems of many *Euphorbia* spp. produce a milky sap (latex) that is a good identification characteristic.

Leaves: Alternate, linear to lance-like, bluish-green and 1-4 inches in length. *Cypress spurge leaves are approximately 1 inch in length, alternate or whorled and narrower than leafy spurge leaves.*

Flower: There are no petals or sepals on the small yellowish-green flowers. Upper stem leaves or bracts develop just below flowers and are yellow-green in color providing the appearance of yellowish petaled flowers. The bracts develop before the true flowers.

Bloom time is May to August.

Left: Leafy spurge
Right: Cypress spurge.

Fruit and Seed: Three-celled capsules that expel seeds up to 20 feet. Each cell contains a seed.

Life History: Leafy and cypress spurge reproduction can be vegetative from buds on roots, rhizomes and root cuttings. The ability to reproduce vegetatively makes these plants difficult to control. Deep roots to 21 feet and extensive horizontal roots allow plants to store vast reserves providing the ability to recover after removal attempts. Seed production is significant with plants producing on average 140 seeds per stem. Seeds can remain viable in the soil up to 8 years.

Habitat: Leafy and cypress spurge readily invade dry sites in full sun, but tolerance of a range of conditions allows them to invade moist, rich soils as well.

Management: Caution! Some people are sensitive to the sap of spurges and develop skin rashes after pulling or handling plants, so gloves and long clothing are recommended. The milky sap is toxic to cattle and horses.

Biological controls are available for controlling leafy spurge. Flea beetles (*Aphthona lacertosa*) are widely used in Minnesota. Flea beetles are collected late May to early June and released on infested sites larger than 1/3 acre. Additionally in Minnesota, stem and root boring beetles (*Oberea erythrocephala*) provide some control. Early spring prescribed fire is compatible with biological control on this plant species.

Cutting or **mowing** if timed before flower development can reduce or limit seed production. Grazing goats and sheep can effectively limit the spread of infestations.

Prescribed fire is another tool that helps drain plants of reserve energy. Control of spurges typically requires a multi-tactic approach - eliminate or reduce seeding, exhaust seed banks, and drain reserves of existing plants while attempting to encourage native plants for competitive cover. So, consider spring mowing or fire with a fall application of imazapic.

Herbicide controls are applied as foliar applications and usually involve formulations of aminocyclopyrachlor, picloram, 2,4-D, glyphosate, dicamba, or imazapic. Repeated applications are likely necessary.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control | Narrowleaf bittercress : *Cardamine impatiens* L.

Identification:

Plant: Herbaceous, annual or biennial starting its first season as a basal rosette and in the second season sending up a smooth flower stem to approximately two feet in height.

Leaves: Basal rosette leaves are pinnately compound with 3-11 round lobed leaflets. Alternate leaves on flowering stems, while still pinnately compound, likely will not have rounded lobes but 6-20 lance or arrowhead shaped leaflets. Edges of flowering stem leaves may be smooth or sharply toothed.

An important differentiation from other plants can be found at the point where leaves attach to stems, look for narrow pointed ears or auricles that grasp and may extend beyond stems.

Flower: Small (0.1 inch), white 4-parted flowers. White petals may not be present.

Bloom time is May to August.

Fruit and Seed: Similar to other mustard family members, seed pods are long (0.6 - 0.8 inch) and slender. Seed ripens from May to September and is dispersed short distances from plants.

Life History: Reproduction is by seed. Seed pods average 10-24 seeds and individual plants can produce thousands of seeds. Movement of seeds is aided by water, animals and human activities.

Habitat: Moist woodlands, forested areas and on margins of thickets. River bottom sites, streambanks and other moist areas are very good habitat and provide avenues for dispersal. This species can tolerate a variety of conditions and has been reported in areas such as roadsides, vacant lots, as well as yards and gardens.

Management: Recommendations at this time focus on hand pulling infestations.

Good advice from the Minnesota Department of Agriculture in reference to controlling narrowleaf bittercress;

"Following guidelines for controlling other biennial mustards such as garlic mustard, *Alliaria petiolata*, may be helpful."

Hand pulling timed to prevent flower and/or seed production is recommended. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal. Subsequent re-treatments will be required due to germination and recruitment from the seedbank. If infestations are large or dense, consider the need for ground cover to prevent erosion and to provide competing vegetation.

Prescribed fire in spring to top-kill basal rosettes and seedlings. Follow-up treatment with **herbicide** is imperative after seedling germination to further slow growth of infestations.

Herbicide applications to foliage with formulations of triclopyr, metsulfuron-methyl, or imazapic.
Use glyphosate or 2,4-D after native plants have entered dormancy and narrowleaf bittercress is still active.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Purple loosestrife : *Lythrum salicaria* L.

Listing includes European wand loosestrife (*Lythrum virgatum* L.).

Identification: *Compare to native fireweed (Chamerion angustifolium). See page 55.*

Plant: Herbaceous, wetland perennial, 4-7 feet tall with a 4 to 6 sided wood-like stem.

Leaves: Opposite, sometimes whorled, lance-shaped, and downy with a slightly wavy yet smooth edge. Leaf pairs are positioned at right angles to the leaf pairs above and below.

Flower: Each plant can have from one to many spikes of pinkish-purple flowers. Center of the flower is yellowish and surrounded by 5-7 petals that have a wrinkled appearance.

Bloom time is July to September.

Fruit and seed: Tiny seeds are released from 2-parted capsules.

Life History: Reproduction by seeds and rhizomes produce large monoculture infestations.

Habitat: Purple loosestrife can be found on upland sites but is best known as an invader of wetlands or aquatic habitats such as ditches, wet meadows, ponds, marshes, river and stream banks as well as lake shores. Purple loosestrife disrupts aquatic habitats as it displaces wetland emergent species.

Management:

Biological controls in the form of two leaf feeding beetles of the same genus (*Galerucella calmariensis* and *G. pusilla*) have been very effective in Minnesota.

Mowing is seldom an option due to wet environments. **Cutting** of flower spikes can be an effective control of seed production. **Hand pulling** or **digging** of plants can also be effective but care should be taken to remove entire root systems if possible. Resprouting can occur from roots and root segments left in the ground or on the site. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.

Herbicide formulations labeled for use on rights-of-way and near water; 2,4-D, glyphosate, imazamox, metsulfuron-methyl+aminopyralid, triclopyr, imazapyr and aminocyclopyrachlor.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Common tansy : *Tanacetum vulgare* L.

Identification: *Compare to native goldenrods (Solidago* spp.*). See page 57.*

Plant: Herbaceous, perennial reaching 2-5 feet in height. Stems appear woody, are slightly hairy to smooth and at the base are purplish-red.

Leaves: Alternate, pinnately divided, toothed on edges and 2-12 inches long, typically smaller near the top of plants. Leaves are strongly aromatic when crushed.

Flower: Single stems support multi-branched, flat clusters of bright yellow button-like flowers. Each ¼-½ inch wide button is comprised of many small florets and the flower heads, like the leaves, are strongly aromatic.

Key difference - *Note the lack of ray petals surrounding the flower heads. Compare to goldenrods which have ray petals.*

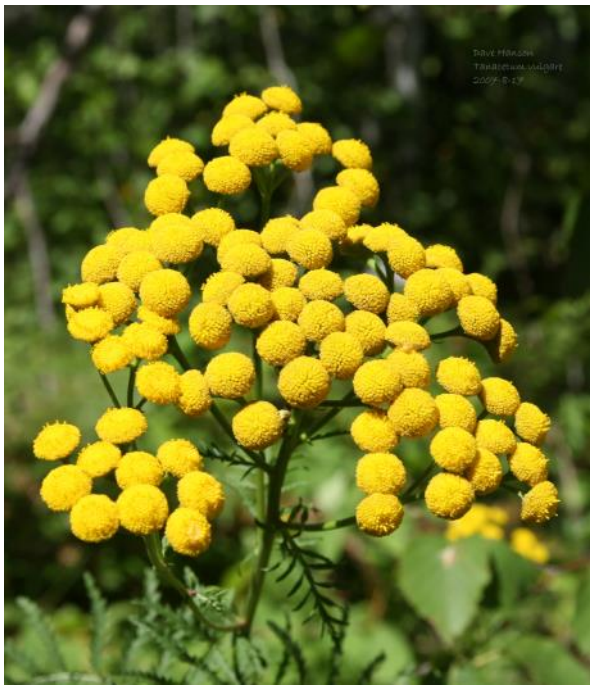
Bloom time is July to October.

Fruit and seed: Small, yellowish-brown, dry, 5-toothed crowned seeds.

Life History: Reproduction is both vegetative from rhizomes and root fragments or by seed. Seeds are dispersed by wind, water and human activities such as vehicle traffic and mowing.

Habitat: Found most often in open, disturbed areas typical of stream and river banks, trail edges, roadsides, gravel pits and old farmsteads or pastures. Can be found in riparian areas, but most often in dry, well drained soils in full sun.

Management: Caution! The alkaloids contained in common tansy are toxic to livestock and humans if consumed in quantity. Toxins can potentially be absorbed through skin, gloves are recommended when handling or pulling this plant.



Mechanical methods like **tilling** can spread common tansy by spreading small root segments. **Pulling** also may leave root segments in the ground which may resprout.

Cutting or **mowing** to prevent seed production can be effective and should be timed just prior to flowering.

Prescribed fire can eliminate competition and create favorable conditions for common tansy by opening the canopy and preparing bare soil. Thus, fire can make an infestation worse; however, fire can be used to remove dead material to improve follow-up herbicide application providing better contact and potentially better control.

Herbicide formulations of metsulfuron-methyl, imazapyr, glyphosate or 2,4-D provide good control when applied as foliar applications in spring.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Burn									
	Foliar		Foliar treatments target rosettes.							
	Cut stem									
Mow	Mow									
	Don't mow									
Flowering Period										

Prohibited: Control

Wild parsnip : *Pastinaca sativa* L.

Identification: *Compare to golden alexanders (Zizia aurea) and heart-leaved golden alexanders (Z. aptera), both native. See page 56.*

Plant: Herbaceous, classed as a monocarpic perennial (plant dies after bearing fruit). Early life form is a basal rosette with mature stems developing a hollow, grooved flowering stalk potentially reaching 5 feet.

Leaves: Basal rosette leaves can be 6 inches in height and are pinnately compound with 5-15 leaflets. Flowering stalk leaves are alternate, 2-5 leaflets that become smaller near the top of the stem. Leaflets are coarsely toothed, sinuses cut to varying depths creating lobes of various sizes. The base of the leaf stalks wrap or clasp the grooved stem.

Flower: 12-35, 5-petaled, small yellow flowers on wide, flat umbels of 15-25 umbellets approximately 2 to 6 inches across.

Bloom time is June to July.

Fruit and Seed: Flattened, yet ridged, oval seeds.

Life History: Typical life span is two years, first year a basal rosette. At this stage, it is one of the first plants to green up in the spring and one of the last to brown down in autumn providing good opportunities for scouting and treating. Mid to late summer, mature second-year plants will bolt, flower and set dozens of seed per plant. Seeds are moved off infested sites by animal and human activity or wind and water movement. Seed is reported to be viable in soil for up to 4 years.

Habitat: Disturbed sites such as roadsides and abandoned fields or lots. Can occur in wet meadows but dry to mesic soils are more typical. Full to partial sun is a must for this species.

Management: Caution! Use protective clothing, goggles or face mask. Contact with the sap of the plant (i.e., phyto) when combined with exposure to sunlight (i.e., photo) can cause severe blistering and swelling (i.e., dermatitis) - phytophotodermatitis.

If **cutting** or **mowing** after seed set, clean equipment to leave seeds on the infested site. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal. If a site is mowed early in the season it must be monitored as plants will likely re-sprout, bolt and flower.

Prescribed fire can be used to encourage stands of native grasses for competition. However, follow-up treatments (herbicide or cutting) are still required to prevent seed production.

Herbicide controls include foliar applications of 2,4-D or metsulfuron-methyl to the rosette stage during May and June and again in September or October. If glyphosate is to be applied to rosettes, it is recommended to hold off until late fall to prevent damage to desirable plants that should then be dormant.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Burn									
	Foliar		■	■			■	■		
	Cut stem									
Mow	Mow		■	■						
	Don't mow				■	■	■	■	■	
Flowering Period				▪	▪					

Restricted

Asian bush honeysuckles : *Lonicera* spp.

Top: Honeysuckle in sunlight, on the forest edge.
Center: Honeysuckle leaf and flower color variations.
Bottom: Fruit - Tatarian, Bella or Morrow's and Amur.

Tatarian honeysuckle (*L. tatarica* L.),
Morrow's honeysuckle (*L. morrowii* Gray),
Bell's or 'Bella' honeysuckle (*L.* × *bella* Zabel [*morrowii* × *tatarica*]),
Amur honeysuckle (*L. maackii* [Rupr.] Herder) - not known to be in Minnesota.

Identification: *Compare to native honeysuckles. See page 59.*
Plant: Perennial woody shrubs, multi-stemmed and ranging in heights of 6-15 feet tall (Bell's to 20 feet, Amur to 30 feet). All nonnative bush honeysuckles have hollow stems with a brownish pith (image upper right).
Leaves: Opposite, egg-shaped to lanceolate (*Amur has lance-shaped with drawn out tips*). Other species have rounded to acute leaf tips with tapered, straight or heart-shaped leaf bases. Surfaces range from smooth and hairless on Tatarian to pubescent (hairy) on Amur and Morrow's. Leaf lengths are 1 to 2½ inches.
Flower: Fragrant pairs of tubular flowers approximately ¾ to 1 inch across. Color ranges from cream to white (Amur and Morrow's) or pink (Bell's) fading to yellow. Tatarian produces white, pink or red to crimson not fading to yellow.
Bloom time is mid May to early June.
Fruit and Seed: Most species bright red, Tatarian red to orange. The ¼ inch berries are in clusters of 2-4, mature in late summer and are readily eaten by birds that then disperse the oval, flattened seeds. *Amur honeysuckle fruit can be dark red to purplish, persists into winter and is held on stalks (peduncles) shorter than the leaf stalks (petioles).*
Life History: Vegetative sprouting aids renewal of shrubs. As mentioned above, seed dispersal is mainly by birds.
Habitat: Shade-intolerant plants often found along the forest edges (image upper left). Also found in disturbed, open upland sites such as roadsides, and abandoned pastures or fields.

Management: **Prescribed fire** can be useful to kill seedlings, and drain energy from mature plants . **Mowing (cutting)** can prevent or delay seed production but typically is not considered an eradication method. Monitor the infestation and utilize follow-up treatments of additional mowing and/or herbicide.
For small numbers of plants, **manual methods** including **cutting, digging, or hand pulling** if done repeatedly **and in conjunction** with other treatments can control infestations. Monitor and consider supplemental herbicide treatments. When pulling and digging suspend roots above ground to ensure they dry out. Plants should be disposed of onsite or contained (e.g., bagged) and removed to an approved facility.
Foliar herbicide treatments with formulations of metsulfuron, dicamba, picloram + 2,4-D, triclopyr + 2,4-D , imazapyr or glyphosate at full leaf out during the active growing season.
Cut stem or basal bark applications at any time with 2,4-D, imazapyr, or triclopyr formulations. Additionally, for **cut stem** options include picloram or glyphosate and for **basal bark** treatments options also include aminopyralid.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn				Follow-up with other treatments as necessary.					
Herbicide	Foliar			When fully leafed out and when in fruit.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings. Monitor for follow-up.							
	Don't mow									
Flowering Period										

Restricted

Black Locust : *Robinia pseudoacacia* L.

Identification:

A native of eastern US, an aggressive, introduced invader in Minnesota.

Plant: Woody perennial, large trees attaining heights ranging from 40-60 feet tall (potentially 80 feet). Bark is dark gray-brown with deep furrows between flat-topped ridges. Vigorous sprouts and young shoots are green-ish-colored and have paired spines up to 1 inch long at the base of leaves.

Leaves: Alternate, pinnately compound with 11-19 leaflets creating leaves 3-8 inches long. Oblong leaflets about ¾ to 2¼ inches long by ¼ to 1¼ inches wide. Leaf surfaces are dull dark green to blue-green and paler beneath.

Flower: Before leaves reach full expansion, showy racemes of ¾ inch long white to creamy white, pea-like flowers appear. Fragrant flowers attract early season pollinators.

Bloom time is June.

Fruit and Seed: Flat pods about 2-4 inches long by ½ inch wide turning brown at maturity. Pods contain 4-8 seeds.

Life History: A nitrogen fixing legume that produces a shallow root system. Most reproduction is vegetative, the species sprouts vigorously from roots and stumps. Many stands of trees are clonal stands. It is reported that while black locust produces seed they seldom germinate.

Habitat: Performs well in full sun on well drained soils where there is little competition. Does well in disturbed areas such as roadsides, abandoned fields and woodland sites that are degraded. Has been used in the past for mine soil (spoils) reclamation due to its tough nature and nitrogen fixing capability.

Management:

Mechanical methods such as **cutting** or **mowing** are seldom worth the time or effort since the plants are strong sprouters from root and stump. All of these mechanical methods can have limited effects, but eradication or even good control is unlikely. The same is true of **prescribed fire**.

Basal bark or cut stump herbicide applications with either aminopyralid or clopyralid formulations including bark oil are effective. Other formulations for **cut stump** might include dicamba, glyphosate, imazapyr, triclopyr or combinations of picloram + 2,4-D, triclopyr + 2,4-D, or aminopyralid + triclopyr. Growing season **foliar** applications can be made with the same active ingredients; aminopyralid and clopyralid. Additionally, metsulfuron, picloram + 2,4-D, glyphosate and imazapyr are labeled for use.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn						Monitor and follow-up.			
Herbicide	Foliar			When fully leafed out and actively growing.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Restricted

Crown Vetch : *Securigera varia* (L.) Lassen

Synonym: *Coronilla varia* L., also known as purple crown vetch.

Identification: *Compare to nonnatives alfalfa, hairy vetch. See page 43.*
Compare to native American vetch. See page 50.
Compare to native Canadian milkvetch. See page 50.

Plant: Erect, perennial plant at 1-2 feet tall that forms dense tangled masses of reclining 2-6 feet long stems.
Leaves: Alternate, compound leaves, odd-pinnate with 11-25 oval, smooth-edged leaflets often with a minutely pointed tip. Leaves are stalkless.

Flower: Up to 6 inch long, erect flower stalks support dense umbels or crown-like clusters of 10-25, 5-parted, ⅛-½ inch long pinkish flowers.

Bloom time is May to September.

Roadside infestation being held in check by mowing and herbicide applications.

Fruit and Seed: Erect, narrow, multi-segmented, pointy-tipped, angular pods containing up to 12 seeds are clustered at ends of upright stalks. See seed pod images lower left.

Life History: Colonies develop rapidly as plants produce lots of seed and also spread aggressively via vegetative rhizomes. Seed is reported to remain viable for as long as fifteen years. Unattractive, large brown patches in winter and early spring help identify crown vetch infestations.
Habitat: Old fields, pastures and roadsides. Crown vetch has been planted extensively for forage products and along roadsides and steep embankments for erosion control.

Management:
Cutting or **mowing** will reduce vigor but not eliminate an infestation. Plan to mow several times a season and monitor to time operations with a goal to prevent seed set.

Prescribed fire can be used with other management tactics to encourage stands of native grasses that will compete for resources. However, monitoring is necessary as crown vetch will resprout after burns.

There is a long list of active ingredients applied as a **foliar herbicide** applications. Active ingredients include, but may not be limited to, 2,4-D, aminopyralid, clopyralid, dicamba, glyphosate, metsulfuron-methyl, sulfometuron, picloram and triclopyr. Recommendation is to apply aminopyralid before flower while others are recommended for application during active growing periods.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn		Late Spring							
Herbicide	Foliar		During active growth periods.							
	Mow		Mowing must be repeated							
	Don't mow					Prevent flower and seed.				
Flowering Period										

Restricted

Common buckthorn : *Rhamnus cathartica* L.

Identification: *Compare to the native cherries and wild plum (Prunus spp.). See page 51.*

Plant: Tall shrub at 20-26 feet with potential to become a small tree reaching 36 feet. Often one to a few stems with diameters up to 5-6 inches and occasionally larger. Light-colored lenticels on shiny gray to brown bark leads to confusion with young native cherries and plums (*Prunus* spp.). Many twigs are terminated by a small ***thorn-like spine between dark colored, scale covered buds.***.

Leaves: **Sub-opposite**, at times appearing opposite and on fast growing sprouts alternate. Shiny green, 1-2½ inches, oval with tiny teeth on leaf edges. Veins curving to the tip of the leaf (arcuate venation) provide a strong identification characteristic and green leaves persisting into autumn.

Flower: **Dioecious**, male and female flowers on separate plants, small, 4-parted and green.

Bloom time is May to June.

Fruit and Seed: Fruit on female plants only. At maturity a purplish-black, small (¼ inch), berry-like fruit held close to the stem in clusters. Strong identification characteristic are these blackish fruits held close to twigs late into winter. Typically, 3-4 seeds per fruit.

Life History: Reproduction is by seed and dispersal is often aided by birds. Heavy seed production combined with stems and stumps that sprout vigorously when damaged make control difficult.

Habitat: A strong competitor on upland sites in a variety of soil types and moisture regimes. Common buckthorn thrives in the understory, on the forest edge or in full sun often to complete exclusion of other species.

Management:

Keep in mind, if funds and/or time are limited female plants are the fruit producers and should be targeted first. Caution should be exercised to avoid creating large bare patches and/or extensive soil disturbance. Both scenarios lead to soil erosion and create good seed beds for common buckthorn regeneration.

Hand pulling or the mechanical advantage provided by a **weed-wrench** can help control small infestations. **Cutting** of stems must be accompanied by herbicide treatments or resprouting will occur. **Mowing** is typically not an option in sensitive wetland areas, but on upland sites may be a useful tool in seedling and small diameter stem control.

Prescribed fire is used to control seedlings and small diameter stems and if used consistently can drain larger plants of reserves and provide control. However, sprouting will occur and a follow-up herbicide application should be considered.

Herbicide formulations of triclopyr, imazapyr, metsulfuron-methyl, 2,4-D, glyphosate or picloram are used as foliar applications. Herbicides include triclopyr or glyphosate for late autumn into winter applications to basal bark, cut stumps or frill cuts.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out. During active growth.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Restricted

Glossy buckthorn : *Frangula alnus* Mill.

Identification: *Compare to the native cherries and wild plum (Prunus spp.). See page 51.*

Plant: Shrub or small tree at 20 feet in height, often multi-stemmed with prominent light-colored lenticels on dull grayish to dark brown bark. Heartwood may be orange to pinkish and sapwood may be yellowish, both can facilitate identification. ***No thorns or spines!*** There are no bud scales protecting overwintering buds - referred to as naked buds.

Leaves: **Alternate**, glossy, 2-3 inch length with prominent parallel veins terminating near a smooth edge. Undersides are slightly hairy and dull. Leaves will likely persist longer in autumn than native deciduous shrubs, but they will turn yellow and drop.

Flower: **Monoecious,** male and female parts present in flowers. Therefore, all shrubs can fruit. Not showy, small, 5-petaled, yellowish and borne in clusters in the leaf axils.

Bloom time is May to July.

Fruit and Seed: Clustered in leaf axils along the stem, initially reddish maturing to purplish-black in late summer into autumn. Each fruit contains 2-3 seeds, dispersed by birds.

Life History: Reproduction is by seed and while birds disperse the seed, dense thickets suggest many seeds drop close. Shades out native shrubs and forbs creating monocultures in sites that typically support very diverse flora.

Habitat: An invader of wetlands, including sedge meadows, sensitive acidic bogs and calcareous fens. Tolerant of shade, yet will perform well in full sun on upland sites.

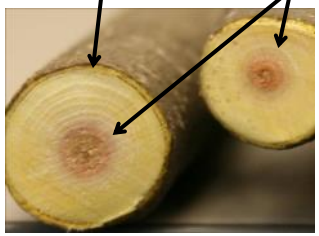
Management:

Caution should be exercised to avoid creating large bare patches and/or extensive soil disturbance. Both scenarios lead to soil erosion and create good habitat for glossy buckthorn regeneration.

Hand pulling or the mechanical advantage provided by a weed-wrench can help control small infestations. **Cutting** of stems must be accompanied by herbicide treatments or resprouting will occur. **Mowing** is typically not an option in sensitive wetland areas, but on upland sites may be a useful tool in seedling and small diameter stem control.

On upland sites **prescribed fire** can be used to control seedlings and small diameter stems and if used consistently can drain larger plants of reserves and provide control. However, sprouting will occur and a follow-up herbicide application should be considered.

Herbicide formulations of triclopyr, imazapyr, metsulfuron-methyl, 2,4-D, glyphosate or picloram are used as foliar applications. Herbicides include triclopyr or glyphosate for late autumn into winter applications to basal bark, cut stumps or frill cuts.



		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out. During active growth.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Restricted

Garlic mustard : *Alliaria petiolata* (M. Bieb.) Cavara & Grande

Identification:

Plant: Herbaceous, biennial with first year plants being basal rosettes. Second year flowering plants can attain heights of 4 feet and can produce more than one flowering stem.

Leaves: Basal rosettes with coarsely toothed, kidney-shaped foliage remains green through winter. Foliage on flowering stems is alternate, triangular, coarsely toothed and stalked. Foliage has the odor of garlic when crushed.

Flower: Clustered, 4-parted, white flowers are approximately ⅓ inch across.

Bloom time is April to June.

Fruit and Seed: The 1-2½ inch long slender seed pods are very recognizable and contain numerous black, shiny seeds.

Life History: Reproduction is by seed that matures June into July and can be dispersed about 6 inches when pods burst at maturity. Seed remains viable in soil for up to 5 years.

Habitat: An invader of shady, moist forests or woodland settings but also invades oak savannas and disturbed areas in full sun. It is reported that garlic mustard will inhibit the growth of beneficial fungi associated with native plants thus causing a decline in herbaceous cover.

Management: **Biological controls** are under investigation, but none are approved for release at this time. One insect being studied is *Ceutorhynchus scrobicollis*, a crown and stem-mining weevil.

Manual methods include pulling plants in early spring prior to flowering (seed set is almost coincidental with flowering) and cutting plants back to the ground as they bolt for flowering, prior to flower opening. Monitor the site as cutting may need to be repeated. If mature flowers (or seed pods) are present, plants should be disposed of onsite or contained (e.g., bagged) and removed to an approved facility.

Prescribed fire in spring to top-kill basal rosettes and seedlings. Follow-up treatment with **herbicide** is imperative after seedling germination to further slow growth of infestations.

Herbicide applications to foliage with formulations of triclopyr, metsulfuron-methyl, or imazapic. Use glyphosate or 2,4-D after native plants have entered dormancy and garlic mustard is still active.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Restricted

Japanese barberry : *Berberis thunbergii* DC.

Above: *B. thunbergii* in flower late May.
Below left: *B. thunbergii* 'Erecta'
Below right: *B. thunbergii* 'Rose Glow' (top) and
B. thunbergii 'Sparkle' (bottom)

Identification: *Compare to common barberry (B. vulgaris) on page 18.*
More images and regulated cultivars next page.

Plant: Perennial woody shrubs, multi-stemmed, typically 3-6 feet tall (potentially to 8 feet tall). Stems are grooved or angular and ranging in color from gray to reddish-brown. Single (possibly 3 branched) ½ inch long spines occur at nodes where leaves attach. Lateral spine branches if present may be very small.

Leaves: Alternate, typically clustered so not appearing alternate. Leaves are simple, narrow near the twig and described as obovate (wider towards the end). The leaf edge or margin is smooth (*B. koreana* and *B. vulgaris* have teeth) and occasionally there is a minute spine tip or point at the ends of leaves.

Flower: Small (¼ to ⅓ inch) yellowish flowers suspended under the foliage. Therefore not considered showy. Japanese barberry flowers are typically individual but flowers may be in clusters of 2-4 while Korean barberry (*B. koreana*) may have up to 20 flowers per raceme (cluster). See fruit of Korean barberry in upper right-hand image on next page.
Bloom time is May to early June.

Fruit and Seed: Bright red, dry flesh, a true berry that persists into and through winter (image next page, bottom right: fruit at leaf out in April). The ⅓ inch long ellipsoidal berries, like the flowers, will be solitary or in clusters of 2-4.

Life History: Seed production is strong and this special regulation targets species and cultivars producing on average more than 600 seeds. Seed bank viability (longevity) is not well understood; although, a report on *B. thunbergii* 'Beth' states that the seed remain viable up to 10 years. Reproduction can also be vegetative via root sprouts and shrub branches may root if in contact with the ground.

Habitat: Prefers well drained soils in full sun to partial or deep shade. Forest edges, open forests and other woodlands yet also found in old fields, areas of disturbance and can survive in wetland soils.

Management: **Prescribed fire** (or direct flame from a propane torch) can be useful to kill seedlings, and drain energy from mature plants. **Mowing (cutting)** can prevent or delay seed production but typically is not considered an eradication method. Monitor the infestation and utilize follow-up treatments of mowing and/or herbicide.

For small numbers of plants **manual methods** including **cutting, digging, and hand pulling** if done repeatedly **and in conjunction** with other treatments can control infestations. Monitor and consider supplemental herbicide treatments. When pulling and digging suspend roots above ground to ensure they dry out. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.

Foliar herbicide treatments with metsulfuron products at full leaf out during the active growing season. Additionally, dicamba + 2,4-D, triclopyr or glyphosate at full leaf out while the plants are fruiting during the growing season.

Cut stem applications at any time with glyphosate or triclopyr formulations can also be useful.

Basal bark treatments at any time with imazapyr or triclopyr products have proven effective.

Wild type, single and paired flowers.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out. During active growth.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Restricted

Japanese barberry : *Berberis thunbergii* DC.

Above: 'Tara' (Emerald Carousel®; *B. koreana* × *B. thunbergii* hybrid)
Above left: Grooved, reddish-brown stem, single spines at nodes. Above center: Foliage and racemes of fruits. Above right: Form

Left: *B. thunbergii*
'Bailone'
Ruby Carousel®

Right: *B. thunbergii*
'Bailtwo'
Burgundy Carousel®

Japanese barberry cultivars to be phased out and then prohibited from sale.

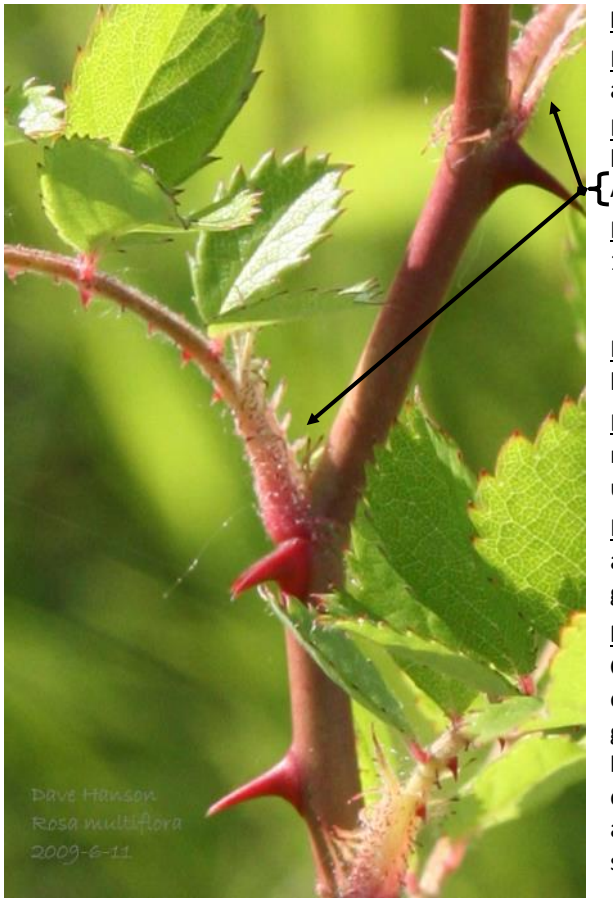
These plants average greater than 600 seeds per plant.and
began a three-year phase-out period in Minnesota beginning January 1, 2015.

'Angel Wings' 'Antares' 'Anderson' (Lustre Green™) var. atropurpurea
'Crimson Velvet' 'Erecta' 'Gold Ring' 'Inermis' 'Kelleris' 'Kobold'
'Marshall Upright' 'Painter's Palette' 'Pow Wow' 'Red Rocket' 'Rose Glow'
'Silver Mile' 'Sparkle'
'JN Redleaf' (Ruby Jewel™) 'JN Variegated' (Stardust™) 'Monomb' (Cherry Bomb™)
'Bailgreen' (Jade Carousel®) 'Bailone' (Ruby Carousel®) 'Bailtwo' (Burgundy Carousel®)
'Bailsel' (Golden Carousel®; *B. koreana* × *B. thunbergii* hybrid)
'Tara' (Emerald Carousel®; *B. koreana* × *B. thunbergii* hybrid) Wild Type (parent species - green barberry)

Above: *B. koreana* **images for comparison**.
Toothy foliage (serrulate margin) and more than 10 *rounded* fruits per raceme
Inset: Close-up of Korean barberry leaf edge.
Below: Unknown *Berberis* species / cultivar holding fruit at leaf out in April.

Restricted

Multiflora rose : *Rosa multiflora* Thunb.



Identification:

Plant: Shrub with 6-13 feet long, wide arching canes reaching 6-15 feet tall. Canes armed with stiff, downward curved prickles (thorns) form an impenetrable thicket.

Leaves: Alternate, pinnately compound, 5-11 sharply-toothed leaflets. The oval leaflets are nearly smooth on the topside and are covered with short hairs below. A unique feature are fringed stipules where leaves attach to stems.

Flower: Numerous, showy flowers. Five-parted, fragrant, white to slightly pink, ½-1½ inches across.

Bloom time is May to July.

Fruit and Seed: Numerous rose hips, ¼ inch diameter, bright red to orange-red, hairless or smooth. Hips are on a wide branched structure and persist into winter.

Life History: Plants reproduce by seed and by cane tips with ground contact taking root. The plants are prolific seed producers and seeds are viable in seed banks for up to 20 years.

Habitat: Readily invades disturbed areas such as woodlands, prairies, roadsides, along streams and has become a problem in pastures where the thorns discourage grazing.

Management:

Cutting or **mowing** frequently during the growing season (3-6 times) for 2-4 years can achieve good control of infestations. **Prescribed fire** in the spring will provide good control of small stems and seedlings.

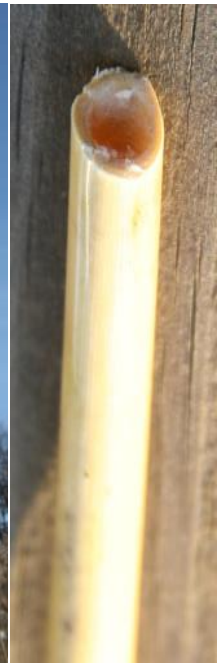
Herbicide applications to cut stems and to resprout stems with systemic herbicides such as glyphosate have proven successful. As with most species, late season applications of herbicides are effective as plants are moving photosynthates to storage in root systems.

Images clockwise order: Iowa (IA) and Illinois (IL)
UR: White, five-parted flower (IA, 2009-6-11).
LR: Wide branched, maturing ¼ in. hips (IL, 2015-10-16).
LL: Compound leaves (IA). Thorns, stipules and hips (IL).
UL: Fringed stipules and downward curved thorns (IA).

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Restricted

Nonnative phragmites or common reed (nonnative subspecies)



Phragmites australis* (Cav.) Trin. Ex Steud. subsp. *australis

Compare to native phragmites (P. australis subsp. *americanus), Page 60.*

Identification:

Plant: A perennial grass reaching heights of 15 feet. Dense stands develop from rhizomatous root systems with live stems and dead stems intermingled. Hollow stems are green in summer and yellow in winter.

Leaves: Dark green, grass-like elongated foliage that is at most 1½ inches wide. Leaf sheaths are typically retained on culms (stems) into winter even if leaves drop from dead culms. *Compare to native phragmites that sheds leaves and leaf sheaths.*

Flower: Bushy panicles of purplish or golden flowers appear in July. Bloom time is July to September.

Fruit and Seed: Large, dense seed heads become gray-brown. Hairy seeds give heads a fuzzy, fluffed appearance.

Life History: Rhizomes, rhizome fragments, root runners and copious amounts of seed provides common reed a strong competitive edge. It forms such dense stands and thick root systems that all native plants can be forced out. Rhizome segments can break free and coupled with seed production plants readily move into and take over new areas.

Habitat: Shorelines of lakes and rivers as well as pond edges and freshwater marshes. Disturbed areas and roadsides can support common reed very well.

Management: Once established, chemical treatments are recommended as a first step in restoration efforts.
Cutting or **mowing** will not kill plants or eradicate infestations, but can be effective at slowing the spread.
Prescribed fire after the plant has flowered. Used prior to herbicide treatments, fire (or mowing) removes biomass improving herbicide application to regrowth. Do not burn prior to flowering, as this timing may only encourage growth.
Herbicide applications, aquatic formulations of imazapyr or glyphosate are effective, even on established stands. Rapid recognition of infestations and treatments soon after increase effectiveness. Late summer/early autumn herbicide applications to foliage or to cut stems are best and repeat treatments in subsequent seasons are likely necessary.

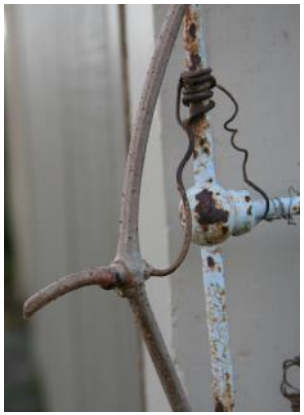
Glumes or seed covers vary in length. Upper and lower glumes are longer on the native subspecies. Best analyzed under a microscope.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn					After flower				
Herbicide	Foliar					After Flower				
	Cut stem					After Flower				
	Mow		Mowing must be repeated							
	Don't mow									
Flowering Period										

Restricted

Porcelain Berry : *Ampelopsis brevipedunculata* (Maxim) Trautv.


Image by: Paul Kortebein



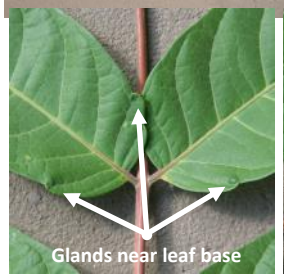
Family: Vitaceae, same genus as *Vitis* (grapes).
Synonyms: *A. brevipedunculata* (Maxim.) Trautv. var. *maximowiczii* (Regel) Rehder
A. glandulosa (Wall.) Momiy. var. *brevipedunculata* (Maxim.) Momiy.
A. heterophylla (Thunb.) Siebold & Zucc.
A. heterophylla (Thunb.) Siebold & Zucc. var. *brevipedunculata* (Regel) C.L. Li

Identification: *Compare to native riverbank grape (Vitis riparia). See page 58.*
Plant: Perennial, woody vines that climb trees or structures with assistance of tendrils. Like riverbank grape, tendrils occur opposite leaves. Bark of porcelain berry is gray and retains smoothness with age and the pith is white.
Key differences - *Riverbank grape has dark brown bark that peels in narrow, vertical strips.*
Leaves: Alternate, simple leaves with a cordate (heart-shaped) base and 3-5 palmate coarsely toothed lobes separated by deep sinuses. Some leaves may resemble wild grape leaves.
Key differences - *Riverbank grape has shallow sinuses between 3 distinct palmate, coarsely toothed lobes.*
Flower: Inconspicuous, panicles of greenish flowers occur opposite leaves .
Bloom time is June to August.
Fruit and Seed: Shiny, brightly colored berries in hues of blue to purple mature in September and October. Each berry contains 2-4 seeds and seed viability is reported to be 'several' years.
Life History: Water may play a small part in seed movement but predominant means of dispersal is by birds and small mammals that have fed on the colorful berries. Vegetative reproduction is also possible. Vines have strong root systems and will resprout after cutting.
Habitat: When found, typically in riparian (floodplain) areas that are not permanently wet. Full sun to partial shade on forest edges, stream banks, thickets and other such places.
Management:
Acceptable control can be attained with **mechanical** methods such as **hand pulling** or **cutting** (possibly **mowing**). However, after cutting, plants will resprout so there should be a plan to monitor and follow up cutting treatments with additional cutting or herbicide treatments. Follow-up to monitor for new seedlings will also be required.
For large infestations **herbicide** applications are likely the most cost effective approach. Systemic herbicides for woody brush control such as glyphosate and triclopyr have been used effectively as **foliar** or **basal bark / cut stem** treatments.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Foliar		During active growth or cut and treat resprouts.							
	Cut stem					Basal bark (with oil) or cut stem				
	Mow		Mowing, when possible, must be repeated							
	Don't mow						When seed is present			
Flowering Period										

Restricted

Tree-of-Heaven : *Ailanthus altissima* (Mill.) Swingle



Synonyms: *A. glandulosa* Desf. and *Toxicodendron altissimum* Mill.

Identification: *Compare to native sumacs* (*Rhus typhina* and *R. glabra*). *See page 61.*

Plant: Tree, woody perennial plant that can attain heights of 70 feet. Very thick twigs with dime-sized leaf scars aid winter identification. Cutting twigs reveals a soft white pith.

Leaves: Alternate, 1-4 feet long, odd-pinnate compound with 11-25 (up to 40) leaflets. Leaflets are 3-5 inches long by up to 2 inches wide, smooth edged with 1-5 distinct glands (bumps) near leaflet bases. **Key difference:** *leaflets are smooth edged, unlike toothy sumac leaflets.*

Flower: Clusters of small yellowish-green flowers are showy due to the sheer number of flowers per cluster. Species is predominantly dioecious (male and female flowers on separate trees).

Bloom time is June.

Fruit and Seed: Clusters of 1-1½ inch long twisted samaras develop mid-summer. A pinkish hue develops, then maturing to light tan. Samaras are documented to wind disperse up to 300 feet.

Life History: Trees sprout vigorously from stumps when cut or broken and there is also strong root sprouting potential. Trees in the 12 to 20 year age class produce lots of seed. Seed bank capability is reported to be low, but initial seed viability is high. Allelopathic (chemical) effects prevent germination of other plants near tree-of-heaven.

Habitat: Tolerant of urban stresses including pollution, soil disturbance, nutrient poor soils, drought conditions (once established), compaction, salty roadside soils and prefers full sun.

Management: Prevention is key - early detection and removal is recommended.

Cultural methods like **Cutting** or **mowing** are beneficial but should be followed up with good monitoring. Goal with these methods is to prevent flower and seed.

Prescribed fire, where applicable, can top kill seedlings and or saplings. The goal would be to strengthen the native plant community.

Herbicide applications of glyphosate during July through September are effective when applied to **cut stumps**. Other active ingredients would include triclopyr, dicamba, and imazapyr. Stumps should be cut as low as possible to minimize surface area from which potential resprouts occur.

Hack-and-squirt applications with dicamba, glyphosate, imazapyr, picloram or triclopyr formulations are effective. In addition, **basal bark** treatments with triclopyr or imazapyr active ingredients in oil are also recommended.

At full leaf-out during active growth, **foliar** applications with 2,4-D, glyphosate, imazapyr, picloram or triclopyr are also effective when targeting smaller trees and resprouts.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out and active growth.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Restricted

Queen Anne's Lace (wild carrot) : *Daucus carota* L.

Identification: *Compare to nonnative poison hemlock and carrot look-alikes.*
Compare to native water hemlock. See pages 13, 45 and 64.

Plant: Herbaceous, biennial, first year as a basal rosette. Basal leaves are clustered, up to 5 inches long and arch away from a central location. Second year flowering plants attain heights of 3-4 feet on hollow stems that are hairy to sparsely hairy and striped with light colored lines.

Leaves: Alternate, fern-like, finely divided leaves are widely spaced on upper stems and up to 4 inches across by 2 inches wide. Stem and basal leaves are fern-like, finely divided, narrowly lobed described as bipinnate-pinnatifid. Underside of leaves may be slightly hairy along veins. Leaves are attached to stems with sheaths, also a trait of family members.

Flower: Similar to other family members - many small (1/8 inch), 5-petaled, white flowers (florets) make up a flat-topped compound umbel 2-5 inches across. Compound umbels are dense with 20-90 umbellets of which each has 15-60 flowers. Often, outer flower petals are large in comparison to others and a central flower (or flowers) of the compound umbel is purplish (not always present).

Another distinguishing characteristic in this family are bracts beneath flower umbels. Some family members have few if any bracts, wild carrot has very prominent often branched bracts under main umbels and smaller sometimes linear (unbranched) bracts under umbellets making up the larger floral display.

Bloom time is June to September. For about two months various bloom stages within infestations.

Fruit and Seed: Each floret produces 2 seeds (a schizocarp splits into carpels). Seeds are flat and bristly to catch passing fur or clothing. Entire seed clusters may break off plants in winter to roll across the snow distributing seed.

Life History: Infestations spread mainly by seed. Seeds are reported to be viable for as long as seven years. Deep tap roots are difficult to remove and provide strong energy reserve for resprouting.

Habitat: Preferred habitat is dry to moist, disturbed soils in full sunlight. Tolerant of a variety of soils and partial shade

Management:

If performed frequently **cutting** or **mowing** are effective control methods. Same is true for hand pulling, roots and root fragments remaining in the soil may resprout. Monitor infestations and plan on additional treatments.

Prescribed fire as a tool should be used to improve the health of surrounding native vegetation. Wild carrot will likely not outcompete healthy vegetation and will decline on its own.

Foliar herbicide applications to plants at rosette stage with 2,4-D or 2,4-D formulations including dicamba or triclopyr have produced good results. Nonselective herbicides such as glyphosate formulations can also produce results.

Use herbicides wisely, 2,4-D **resistant** wild carrot populations have been identified in Michigan.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn		Stimulate surrounding vegetation							
Herbicide	Foliar		Target seedlings or rosettes							
	Mow		Mowing must be repeated to prevent flowering							
	Don't mow				When seed is present					
Flowering Period										

Specially Regulated

Amur Maple : *Acer ginnala* Maxim.

Identification:
Plant: Woody perennial, large shrub or small tree up to 20 feet in height. Mature bark is faint gray developing thin vertical stripes.
Leaves: Opposite, 1-3 inch long simple leaves are three lobed with center lobe extending past shorter side lobes and edges (margins) are doubly toothed. Bright green early in the season and producing brilliant fall colors in hues of red, yellow and gold-orange.
Flower: Fragrant, but not showy, loose clusters of pale yellow to creamy white flowers appear in early spring.

Bloom time is mid May to early June.

Fruit and Seed: Approximately ¾ to 1 inch long, paired, winged seed structures called samaras. The samara pair hang at close to a right angle almost parallel to one another. Initially, seed is very red in color, maturing to a light brown.
Life History: Species is a prolific seed producer. Small animals or birds may spread seeds but wind is likely the force behind most seed dispersal. Species stump sprouts but reproduction by vegetative means is not a strong characteristic.
Habitat: Preferences are to full sun or partial shade in well drained moist soils. However, the species is considered tough and specimens will tolerate dry conditions, salt and pH range of 6.1 to 7.5. A frequent invader of savannas, prairies and open forests where native shrubs, trees and forbs can be displaced.

Management: **Prescribed fire** will set back plants and may top kill seedlings but plants will likely resprout. **Manual methods** including **hand pulling or cutting** can eliminate small infestations of seedlings and saplings while **digging or cutting** larger material can be effective. Monitor and follow up with additional treatments as necessary.

Small plants or resprouting stumps can be treated with **foliar applications** of triclopyr formulations or glyphosate. **Cut stem** treatments with glyphosate or triclopyr are effective as well as **basal bark** treatments with triclopyr.

Specially Regulated is a unique category. See page 74.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar			When fully leafed out and actively growing.						
	Basal Bark	Any time.								
	Cut stem	Any time except during heavy sap flow.								
	Mow		Mow frequently to control seedlings.							
	Don't mow									
Flowering Period										

Specially Regulated

Knotweed complex : Japanese and giant

Three knotweeds, often referred to as bamboo, are described here. They are large perennial plants with non-woody stems. Stems are smooth, green with reddish-brown blotches and hollow between swollen nodes where leaves attach. All three have branched flower structures at these leaf attachments holding many small, creamy white to greenish flowers.

Japanese knotweed Identification: *Polygonum cuspidatum* Siebold & Zucc.

Synonyms: *Fallopia japonica* (Houtt.) Ronse Decr. , *Reynoutria japonica* Houtt.

Plant: Height *5-8 feet* (*10 feet*), potentially multiple branches. Typically, only female flowers.

Leaves: Alternate, simple, can be *2 to 7 inches long* with a *truncate base* (mostly straight across). *Tips of leaves are acuminate* (narrowed to an abrupt point) and *undersides of leaves along veins* may have *brown, fuzzy ridges*.

Flowers: Typically female flowers only. Japanese knotweed has branched *flower structures that are longer than nearby leaves*, those of giant knotweed are shorter than nearby leaves.

Bohemian knotweed Identification :

Polygonum ×bohemicum (J. Chrtek & Chrtková) Zika & Jacobson [*cuspidatum* × *sachalinense*]

Synonym: *Fallopia* × *bohemica* (Chrtek & Chrtková) J.P. Bailey

Synonym: *Reynoutria* × *bohemica* Chrtek & Chrtková

Bohemian: an intermediate hybrid with characteristics of both parents, Japanese and Giant.

Plant: Heights from *6 to 16 feet*. Typically few, but potentially several branches.

Leaves: Alternate, simple, can be 2 to 12 inches long and width about ⅔ of length. Leaf bases may be straight across (see Japanese) or rounded (heart-shaped like Giant). Leaf tip may be blunt, gradually tapered or pointed. *Few to no hairs on the leaf edges* (margin) and *veins under leaves may have stiff, broad-based, small hairs.*

Flowers: Often perfect flowers (male + female). Male flowers consist of anthers attached to long stamens extending beyond a flower's petals. Structure is branched with variable length.

Giant knotweed Identification : *Polygonum sachalinense* F. Schmidt ex Maxim.

Synonym: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Ronse Decr.

Synonym: *Reynoutria sachalinensis* (F. Schmidt ex Maxim.) Nakai

Plant: Larger plant attaining heights of *9 to 20 feet*. Typically few or no branches.

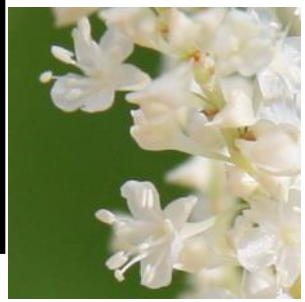
Leaves: Alternate, simple, can be up to *12 inches across* and *6-14 inches long* (width about ⅔ of length) with *rounded lobes at the base* (heart-shaped). *Tips of leaves are blunt* and *undersides of leaves may have scattered* (segmented) *hairs* early in the season.

Flowers: Perfect flowers (male + female) and fertile. Branched, flower structures of giant knotweed are compact, *shorter than nearby leaves*.

Bloom time is August to September .

Seeds: Small, black, 3-sided. Reported as not commonly produced on Japanese knotweed.

Above: Bohemian knotweed.

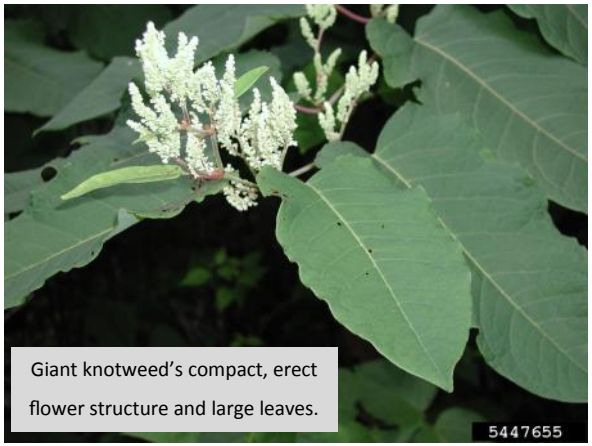


Above: Extended male stamens + anthers of Bohemian.

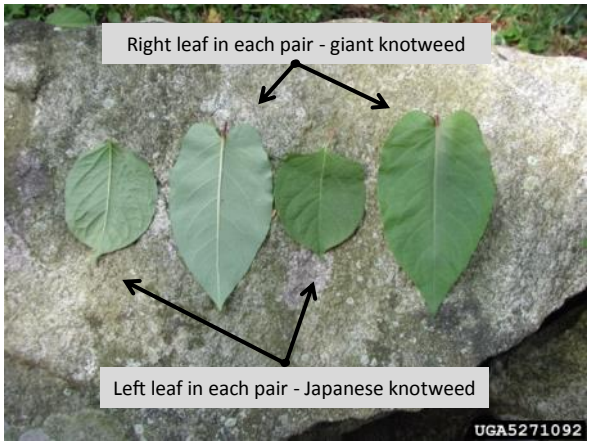
Below: Female flowers of Japanese knotweed.

Specially Regulated

Knotweed complex : Japanese and giant



Giant knotweed's compact, erect flower structure and large leaves.



Common Name	Plant form	Leaves	Leaves, underside	Flowers
Japanese knotweed	5-10 feet multiple branches	1-4 inches long, ⅔ as wide leaf base - straight across	along veins, scabers brownish, ridges, fuzzy	branched, loose typically female
Bohemian knotweed (*hybrid*)	6-16 feet, few to several branches	2-12 inches long, ⅔ as wide leaf base - variable	along veins, short, triangular hairs	branched, variable form female or perfect
Giant knotweed	9-20 feet few or no branches	7-16 inches long, ⅔ as wide leaf base - heart shaped	along veins, hairs scattered, segmented	branched , compact perfect and fertile

Life History: It is believed that seed production is limited (especially, *Japanese*) and most reproduction is vegetative. Even small root parts will re-sprout after plants are manually removed or moved. Stem fragments resulting from mowers or other machinery can sprout if nodes are present and in contact with moist soil. Plants uprooted by flooding, digging or other mechanical means will likely re-root if left in contact with moist soil.
Seeds, if produced, are said to be viable four to five years if near the soil surface and up to 15 years if buried.
Habitat: Prefers moist soils in full sun to partial shade. Plants readily inhabit moist roadside ditches, wetlands, and areas along rivers and streams. However, plants will thrive on dry soils.
Management: Most research has been carried out on *Japanese knotweed*.
Develop a four to five year plan. **Prescribed fire** in spring can set plants back and drain some energy while **mowing** can prevent or delay seed production. However, both can stimulate vegetative reproduction, thus potentially increasing stem counts. After treatments, monitor approximately 60 feet beyond original infestations and utilize follow-up treatments of periodic mowing and/or herbicide. Reasoning, root system spread can be up to 60 feet.
Manual methods should not be considered eradication tools. These include **cutting, digging, hand pulling, grazing** or **tarping** if done repeatedly **and in conjunction** with other treatments may control infestations. Monitor and consider supplemental herbicide treatments. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these options, please read MDA's guide on removal and disposal.
Prior to **foliar herbicide** treatments with aminopyralid, glyphosate, imazapyr, triclopyr, or 2,4-D it is recommended that the plants be cut twice when 3 feet tall. Follow those cuttings with a fall **foliar application** when regrowth is 3 feet tall and still actively growing. **Cut stem applications** with glyphosate, triclopyr or triclopyr + 2,4-D can be made at anytime during active growth when the plants are over 3 feet tall. **Stem injection** treatments with glyphosate can be made anytime during active growth periods. See glyphosate's supplemental label for hollow stem injection.

Any management efforts may result in bare ground; therefore, all treatment planning should include revegetation.

Specially Regulated is a unique category. Unadvisable to plant these species within 100 feet of a water body or its designated floodplain. See page 74.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
Herbicide	Inject			During active growth, treat when 3' tall.						
	Foliar	Mow / cut twice - fall treatment.								
	Cut stem			During active growth, treat when 3' tall.						
	Mow	Mowing is not recommended. If used, collect cuttings, monitor and repeat. Follow-up with herbicide treatments at 3 feet of regrowth in fall.								
	Don't mow									
Flowering Period										

Specially Regulated

Poison ivy : *Toxicodendron radicans* (L.) Kuntze

Left: Shrub form

Above: Vine form

Identification: **Common poison ivy** [*T. radicans* (L.) Kuntze subsp. *negundo* (Greene) Gillis] is potentially a larger shrub (up to 10 feet) and possibly a vine in southeastern Minnesota's riparian areas.

While both species are subject to regulation, information provided below focuses on **western poison ivy** [*T. rydbergii* (Small) Green] which is a frequently occurring shrubby plant with an extensive natural range across Minnesota.

Plant: A 1-2 foot **native** shrub with gray to tan bark and little if any branching.

Leaves: Alternate, compound leaves, 3 shiny or dull surfaced leaflets. Leaflet edges are variable from smooth to very coarsely toothed. Lower leaf surfaces are pale and often hairy.

Flower: Small, greenish flowers on erect spikes (panicles). Flower spikes are borne in leaf axils on new or current years growth with male and female flowers on separate plants (dioecious).

Bloom time is June to July.

Fruit and Seed: Creamy white to tannish berry-like drupes, approximately ¼ inch diameter. Drupes mature in August through September and persist through the winter providing a good identification characteristic on female plants.

Life History: Forms dense colonies by seed and through vegetative reproduction from surface or subsurface rhizomes.

Habitat: Invades disturbed areas such as roadsides, trail sides, fencerows, parks and can also be found in prairie (full sun) and forested settings (partial shade).

Specially Regulated is a unique category. Poison ivy, although irritating to humans, is a native plant that benefits wildlife by providing a food source to birds, small mammals and large browsers. See page 74.

Management: Caution! Use protective clothing, rubber gloves and long sleeves, contact with the sap (urushiol) from broken plant parts can cause blistering (dermatitis), even during the winter months. Caution! Smoke from burning poison ivy can deliver urushiol to airways and lungs. Do not compost as resprouting can occur and urushiol may persist in compost. Urushiol can stay on pets, tools, toys and other objects for long periods to be effectively transferred and cause irritation at a later date.

Grazing, cutting or **mowing** can inhibit flowering but must be continued in order to deplete energy reserves in the plants and to deplete the seed bank.

Prescribed fire generates potentially harmful smoke, see cautionary note above. So, while prescribed fire can provide control and often does control infestations of poison ivy, this tool should not be the first choice.

Herbicide formulations of triclopyr, 2,4-D, glyphosate, imazapyr or aminocyclopyrachlor applied to foliage or to cut stems are effective. Repeat applications will be required to exhaust seed banks.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow	Mow frequently to prevent flower and seed production.								
	Don't mow									
Flowering Period										

Nonnative

Alfalfa : *Medicago sativa* L.

Identification: *Provided for comparison to crown vetch and purple flowered weeds such as thistles or knapweeds. Return to crown vetch (page 28).*
Return to knapweed complex (pgs. 15 and 16) or spotted knapweed (pg. 17).
Return to Canada or plumeless thistles (pgs. 19, 20).
Plant: **Fabaceae** family, 4-sided stem supports a 1-3 foot tall plant.
Leaves: Alternate, 3-parted, compound leaves with individual leaflets measuring ⅜ to 1⅜ inches long, stipulate (leaf-like appendages where leaves attach to stems).
Key difference - *Thistles and knapweeds have simple leaves not compound.*
Flower: 5-parted, purplish to blue (occasionally cream colored) and approximately ¼ to ½ inch long. Alfalfa has a clustered, somewhat conical flower head.
Key difference - *Thistles and knapweeds are disk flowers with ray flowers on the edges.*
Bloom time is June to September.
Fruit and Seed: Coiled pods, mature to a brown color.

Habitat: Introduced to North America for livestock forage and is an agriculture crop. Common in roadside ditches, and similar disturbed areas.

Nonnative

Hairy Vetch : *Vicia villosa* Roth.

Identification: *Provided for comparison to crown vetch and purple flowered weeds.*
Also compare to American vetch, a Minnesota native. See page 50.
Return to crown vetch (pg. 28), knapweeds (pgs. 15, 16, 17) or thistles (pgs. 19, 20).
Plant: **Fabaceae** family, hairy vetch is a nonnative, short-lived perennial (biennial) with a spreading, viny form and has tendrils that assist climbing nearby plants up to 3 feet.
Leaves: Alternate, compound leaves, pinnately divided. Hairy vetch has 5-10 pairs of leaflets and tendrils are often found terminal on the compound leaves.
Key difference - *Crown vetch has no stipules, no leaf stalk and no tendrils.*
Flower: Hairy vetch has 10-40, 5-parted, pink to purple flowers about ¾ inch in length in a one-sided cluster.
Key difference - *Crown vetch has a dense cluster (crown-like) - not one-sided or spike-like.*

Bloom time is May to September.

Fruit and Seed: Pea-like pods, ½-¾ inch long, that hang.
Key difference - *crown vetch's pods stand erect, they are angled, and multi-segmented.*

Habitat: Old fields, pastures and roadsides.

Nonnative

Balkan catchfly : *Silene csereii* Baumgarten

Identification: *Provided for comparison to Dalmatian toadflax on page 7.*

Strongly resembles Dalmatian toadflax's gray-green foliage color and form as well as habitat preference.

Plant: Similar to and often confused with bladder-campion (*Silene vulgaris*). Classed as a biennial/perennial that stands as tall as 40 inches. Stems are smooth, pale grayish-green.
Leaves: Opposite, simple leaves have entire margins (no teeth on leaf edges), smooth, waxy and grayish-green.

Key difference - *Leaves of Dalmatian toadflax are alternate on the stem, not opposite.*

Flower: Flowers are five-parted, white with petals that are often rolled. The flower typically has purple tinged stamens extending forward and behind the petals is a smooth bladder-like calyx or cup that will hold the seeds. The calyx is light green, tapers at the ends and has parallel veins.

Key difference - *Flowers are significantly different. Dalmatian toadflax has yellow snapdragon like flowers, while Balkan catchfly has creamy-white, 5-parted flowers.*

Bloom time is May to October.

Fruit and Seed: Held in the calyx or bladder behind the petals. At maturity the bladder turns light tannish-brown and the five tips curl backward.

Habitat: Full sun, dry, disturbed sites such as roadsides, abandoned lots, fields and gravel pits.

Above: Calyx tapered both ends, parallel veins.

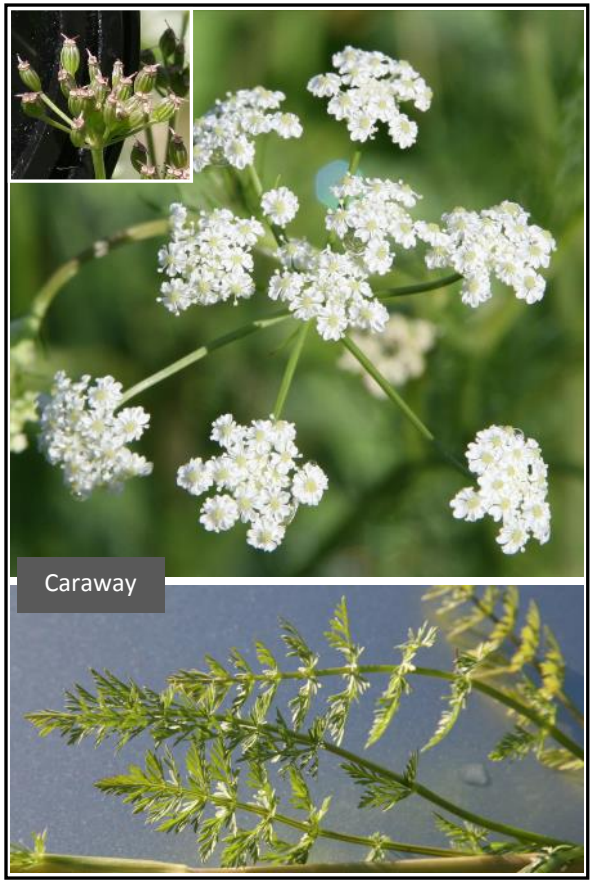
Below: Curled petals, purplish stamens.

Opposite, simple leaves, clasping and blue-gray.

Form, opposite foliage, and plants are blue-gray.

Nonnative

Carrot look-alikes : *Apiaceae* family examples



Caraway	(*Carum carvi* L.)	[biennial, 1-4 feet tall forb]	pictures upper left,
Burnett saxifrage	(*Pimpinella saxifraga* L.)	[perennial, 2-3 feet tall forb]	pictures lower left,
Japanese hedge parsley	(*Torillis japonica* [Houtt.] DC.)	[annual, 2-6 feet tall forb]	pictures lower right,

Identification: *Provided for comparison to wild carrot also known as Queen Anne's lace on page 38.*

Plant: Herbaceous, life cycles and heights provided above. All examples on this page and including wild carrot are smaller statured members of the family. Compare floral structures, foliage, seeds and in particular bracts (presence or lack of) under the flower umbels and umbellets as defining characteristics.

Leaves: All have alternate foliage. Caraway has compound leaves that are deeply divided into very linear narrow segments. Burnet saxifrage has pinnately compound leaves - basal leaves in particular have oval, toothed leaflets. As leaves ascend the stem they become smaller and deeply lobed (pinnatifid). Of these three plants, Japanese hedge parsley foliage is closest in resemblance to wild carrot and basal leaves are divided in 3-5 parts.

These members of the carrot family have leaves that are smaller near the top of the plant.

Flower: Five-petaled, all are white and all are held as flat or slightly dome-shaped clusters (compound umbels). All have loose, open umbels unlike wild carrots tighter, denser umbel. Caraway has 5-15 umbellets.

Key differences - *Wild carrot has obvious, showy, branched bracts beneath umbels. The three plants listed on this page have few if any narrow, linear bracts. Caraway may have up to 4, Burnet saxifrage may have 1 bract while Japanese hedge parsley may have 2 or more narrow bracts at bases of compound umbels and up to 8 tiny bracts under umbellets.*

Bloom time is variable - June to September.

Fruit and Seed: All are described as schizocarps splitting at maturity to two carpels (individual seeds). Caraway has elongated ridged seeds at about ¼ inch long, Burnett saxifrage seeds are about ⅛ inch in length, flattened, rounded with slight ridges while seeds of Japanese hedge parsley are about ⅛ inch long and bristly with hooked hairs.

Key difference - *Wild carrot seeds are also about ⅛ inch with ridges covered by stiff bristles (not hooked). At maturity wild carrot folds its seed structure into what is often described as a bird's nest.*

Habitat: All prefer at least partial shade to full sun with caraway preferring full sun. All take advantage of disturbance to become established and all do well on roadsides. Japanese hedge parsley thrives along woodland edges.

Nonnative

Wild chervil : *Anthriscus sylvestris* (L.) Hoffm.

Above: Disturbed woodland edge and ribbed, hairy stems with a clasping leaf attachment.
Below: Bract-like appendages at umbel base and Bracts at umbellet bases. Inset: appendages may not persist.

Identification: Also a member of the Carrot, Parsley family (Apiaceae).
Provided for comparison to poison hemlock and wild carrot, pages 13 and 38 respectively.
Compare to Carrot look-alikes and water hemlock, pgs. 45, and 64.

Plant: Herbaceous biennial that stands as tall as 5 feet (2-5 feet). Stems are hollow, ribbed, and mostly green with fine hairs, especially along the ribs.
Key difference - *Poison hemlock stems are smooth and spotted purple, not hairy or ridged.*
Leaves: Alternate, doubly pinnately compound leaves are smooth and shiny on the upper surface
with short hairs below. Vein patterns are more pronounced than on poison hemlock.
Key difference - *poison hemlock leaves have no hairs and venation is not as pronounced.*
Flower: Structure of the inflorescence is a compound umbel. Each umbel is comprised of 4-15 umbellets each with 3-10 white, 5-parted, florets.

Bloom time is April to June.

Fruit and Seed: Like other carrot family members, compound umbels of 2-parted seeds. In this species the styles persist resulting in a "beaked" seed (a pointed tip). Seed matures to ⅜ inch long and develops a dark brown color.
Habitat: Part shade to full sun, moist soils, disturbed sites such as roadsides, abandoned lots, fields and gravel pits.

Above: Hollow, ribbed stem with fine hairs.

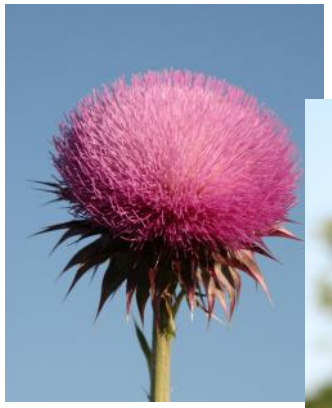
Above: Seedlings.

Grooved rachis.

Doubly, pinnately compound leaves with distinct venation.

A single umbellet of 2-parted, beaked seeds.

Nonnative | Musk or nodding thistle : *Carduus nutans* L.



Identification: *Provided for comparison to Canada and plumeless thistles on pages 19 and 20.*

Compare to native swamp thistle (Cirsium muticum). See page 62.
Compare to nonnatives alfalfa and hairy vetch. See page 43.

Plant: Herbaceous, biennial thistle, basal rosette in its first season. Second season, mature flowering stalks 1-7 feet tall.

Leaves: Rosettes can be twenty inches or more in diameter with rosette foliage deeply lobed, a light colored midrib and leaf edges that are light colored and spiny. Foliage on flowering stalks is alternate with spiny wings from leaf bases onto the stem and both surfaces are without hairs. *Compare to plumeless thistle foliage that is hairy below.*

Flower: Large at 1½-3 inches wide and deep pinks to purple. Composite flowers are solitary on branch ends, often nodding with large dark-colored spiny bracts beneath. *Compare to plumeless thistle's flowers that are ½ to 1½ inches wide with short spiny bracts and winged, spiny stems.*

Bloom time is June to August.

Fruit and Seed: Seeds are tufted with feathery plumes that are easily wind dispersed and most are deposited within 160 feet of plants. Do not mow after seed has developed as this strongly aids dispersal.

Life History: Plants have thick taproots but no rhizomes; thus, musk thistle is not clonal. Seed production is high with individual plants producing thousands of seed which can persist in seed banks up to 10 years.

Habitat: Infestations are found on dry to moist soils in woodlands, waste areas, roadsides, ditches and stream banks.

Management:

Cutting taproots 1-2 inches below ground is effective but time consuming for large numbers of plants. **Mowing** should be timed at flower bud stage to prevent seed production and should be repeated 2-3 times per season to be effective. Care should be taken to avoid spreading seed with hay or straw and with mowing and vehicle movement through infestations.

Prescribed fire can be used to encourage stands of native grasses that will outcompete thistle. However, monitoring is needed to check for thistle that germinates in bare soil soon after burns are completed.

Herbicide applications timed at the early bolting phase are foliar applications of 2,4-D ester or dicamba formulations. For foliar applications at the budding to flower stage or fall applications to basal rosettes turn to formulations of aminopyralid, clopyralid, metsulfuron-methyl or triclopyr.

		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-Mar
	Burn									
Herbicide	Foliar									
	Cut stem									
	Mow									
	Don't mow									
Flowering Period										

Nonnative

Yellow rocket : *Barbarea vulgaris* W. T. Aiton

Identification: *Provided for comparison to leafy spurge on page 21.*

Plant: Yellow rocket (a.k.a. winter cress, garden yellowrocket) was introduced from Eurasia and is common in Minnesota. A biennial plant (also described as perennial) that forms a basal rosette its first year. Subsequent growing seasons, flower stalks are erect at 8 to 36 inches tall, typically multi-branched and terminated by clusters of bright yellow flowers.

Leaves: Basal leaves and some stem leaves are pinnately lobed to deeply toothed and up to 6 inches in length. Often the terminal end of leaves is a larger rounded lobe in addition to 1-4 lesser side lobes. Leaves near the top of the plant are alternate, typically smaller, oval and often stalkless.

Key difference - *Leaves of leafy spurge are simple (not lobed) and narrowly linear at 1-4 inches in length.*

Flower: Crowded, rounded clusters of bright yellow stalked flowers. Flower clusters are terminal to branch ends.

Individual flowers range from ⅛ to ½ inch wide and have 4 bright yellow petals. As flower clusters elongate, flowers are produced above with seed pods produced below.

Key difference - *Leafy spurge has greenish-yellow flowers without petals. The greenish-yellow bracts beneath the true flowers provide the appearance of a petaled flower. Confusion occurs due to overlap in bloom periods.*

Bloom time is April to June.

Fruit and Seed: Slender pods develop along stems as flower clusters stretch upwards. The roundish pods are approximately 1 inch long, upward curved and contain small brown seeds at maturity.

Habitat: Considered a weed of lawns, gardens and agricultural fields. Often along roadsides and other disturbed sites. An infestation of yellow rocket indicates a disturbed site on which ground cover of native forbs and grasses is thin.

Minnesota Native | American bittersweet : *Celastrus scandens* L.

Oriental bittersweet, yellowish husks, fruit in leaf axils

American bittersweet, orange husks and bright red arils

Identification: *Provided for comparison to Oriental bittersweet on page 11.*

Plant: Woody vine, twining, no tendrils or aerial roots to assist in climbing.
Leaves: Alternate, elliptic to oblong or obovate, typically twice as long as wide. At bud break, leaf edges unroll in a scroll-like fashion.
Flower: Terminal panicles of numerous 5-parted flowers. Dioecious plants (male and female) producing small, rather inconspicuous whitish flowers.
Key difference - *terminal panicles. Flower location is observable on early growth.*

Bloom time is May to June.

Fruit and Seed: Like the flowers, ***terminal*** panicles. ***Orange*** colored husks covering bright red 3-parted arils (fleshy, berry-like fruits) containing 1-2 seeds each. Fruits persist into late winter.
Key differences - *terminal clusters, orange colored husks, bright red 3-parted arils.*
Habitat: Typically found in rich soil, full to partial sun often along roadsides and woodland edges.

Terminally clustered fruits, orange husks and bright red arils.

Foliage typically twice as long as wide. Oriental tends toward oval. Note the drawn out leaf tip.

Staminate (male) flowers with yellow pollen.

Pistillate (female) flowers clustered at branch ends

Minnesota Native

Canadian Milkvetch : *Astragalus canadensis* L.

Identification: *Provided for comparison to crown vetch on page 28.*

Plant: **Fabaceae** family, 1-3 feet tall perennial with ridged, pubescent stems.

Leaves: Alternate, odd-pinnate, compound leaves with 21-31 oblong leaflets, about 1½ inches long. Leaves measure 5 to 9 inches long and there are no tendrils.

Key difference - *crown vetch has 11-25 oval leaflets.*

Flower: 5-parted, cream colored and approximately ¾inch long. Milkvetch has a tall, spike-like, clustered, conical flower head with as many as 75 flowers.

Key difference - *Crown vetch has a purple to pink short, dense cluster (crown-like).*

Bloom time is June to September.

Fruit and Seed: Thickened, fuzzy, 2-parted pods with a pointed tip, mature to a brown color.

Habitat: Used for livestock forage and as an agriculture crop. Common in roadside ditches, and similar disturbed areas.

Minnesota Native

American vetch : *Vicia americana* Muhl. Ex Willd.

Identification: *Provided for comparison to crown vetch and purple flowered weeds.*
Also compare to alfalfa and hairy vetch, nonnative family members.

Plant: **Fabaceae** family, American vetch is a native perennial with a spreading, viny form and typically has tendrils that assist in climbing nearby plants up to 3 feet.

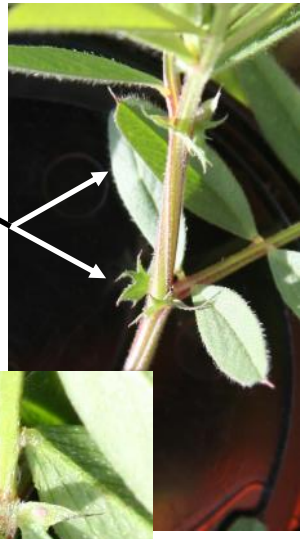
Leaves: Alternate, compound leaves, pinnately divided. American vetch has 4-8 pairs of leaflets and tendrils terminal on the compound leaves. American vetch has toothed stipules at the base of its compound leaves.

Key difference - *Crown vetch has no stipules, no leaf stalks and no tendrils.*

Flower: American vetch has 2-9 flowers in a one-sided cluster. Flowers are 5-parted, pink to purple and about ¾ inch in length.

Key difference - *Crown vetch has a dense crown-like flower cluster.*

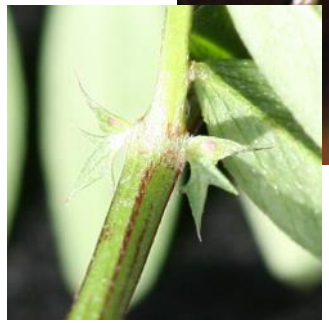
Bloom time is May to September.



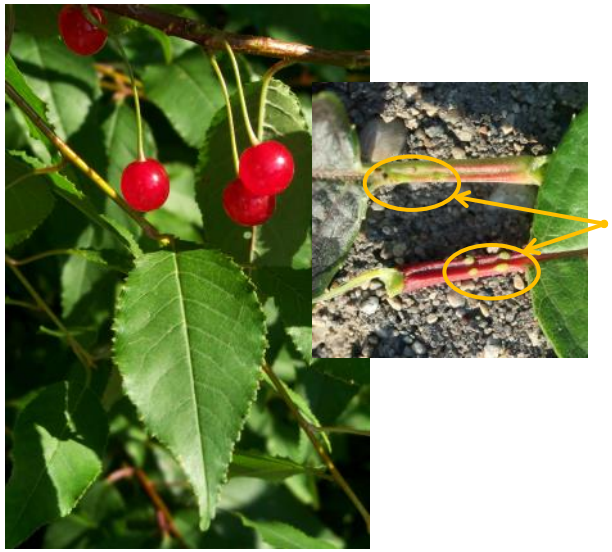
Fruit and Seed: Pea-like pods that hang. American vetch's pods are about 1 inch long. Similar to hairy vetches pea-like pod.

Key difference - *crown vetch's pods stand erect, they are angled, and multi-segmented.*

Habitat: Old fields, pastures and roadsides.



Minnesota Native | Cherries and American plum : *Prunus* spp.



Above: Mature, bright red, solitary or paired fruit and foliage of pin cherry.
Below: Flower of black cherry and maturing fruit of chokecherry.

Black cherry (*P. serotina* Ehrh.) Pin cherry (*P. pensylvanica* L. f.)
Choke cherry (*P. virginiana* L.) American plum (*P. americana* Marshall)

Identification: *Provided for comparison to common and glossy buckthorn on pages 29 and 30.*

Plant: Plums, chokecherry and fire or pin cherry are small sized trees. Black cherry may be a small tree, but reaches medium to large tree status. All have smooth, gray to brown bark that is often shiny and lenticeled. Couple that bark and American plum's thorn-like twigs and it is no surprise that these species are frequently confused with buckthorn.
Leaves: Alternate, elliptic to oblong or ovate, typically finely toothed with acuminate or drawn out leaf tips.
Key difference - *Prunus species have glands on the leaf petioles. Additionally, arcuate venation of common buckthorn.*
Flower: Numerous 5-parted, white, fragrant flowers are fairly showy or obvious. Cherries have panicles of white fragrant flowers while the plum's white flowers are clustered along the stem. In Minnesota American plum (wild plum) is one of the earliest trees to bloom, typically small groups of trees clumped along forest edges.
Key difference - *5-parted, white, fragrant flowers are fairly showy or obvious.*
Bloom time is May to June.
Fruit and Seed: Choke and black cherries panicles (loose, hanging clusters) of black fruit are readily taken by birds. Pin or fire cherry fruits mature to a bright red. Plums have a ¾-1 inch, reddish to purplish fruit that contains a large seed.
Key difference - *birds eat fruits of cherries and plums after ripening. Buckthorn fruits remain on shrubs into late winter.*
Habitat: Typically found in rich soil, full to partial sun often along roadsides and woodland edges.

Below: Thorns of wild plum on dead branches. Wild plum flowers and fruit.

Minnesota Native | Common hops : *Humulus lupulus* L.

Hooked stem hairs early spring (May).

Male flowers, 3-lobed, opposite leaves.

Identification: *Provided for comparison to Japanese hops on page 10.*

Plant: Herbaceous, perennial vine, rhizomatous (spreads by rhizomes). Leaf petioles and annual stems with stout hooked hairs. Image at left is of developing, hooked hairs in May.

Leaves: Opposite, for the most part 3 lobed (up to 5 lobes), higher on the vine leaves may be unlobed. Typically, a cordate (heart shaped) base to the leaf and leaves nearly as broad as long.

Key difference - *3 (maybe 5) lobed leaves, higher on the vine leaves may be unlobed*.

Flower: Inconspicuous, wind pollinated and dioecious (male and female) plants.

Bloom time is July to August.

Fruit and Seed: Fruiting structure is cone like, comprised of papery bladders covering individual seeds. Fragrant when crushed. Fruit persists into late winter (see image at right).

Key difference - *native common hops fruit structure is fragrant when crushed.*

Habitat: Moist soils, disturbed sites in woodlots and along fencerows.

Opposite leaves.

Winter fruit, fragrant.

Fruit, 3-lobed and un-lobed leaves.

Male flowers, 3-lobed, opposite leaves.

Female flowers, 3-lobed, and un-lobed opposite leaves.

5-lobed, 3-lobed, opposite leaves.

Minnesota Native | Cow-parsnip : *Heracleum maximum* W. Bartram

Synonym: Common cow-parsnip (*Heracleum lanatum* Michx.)

Identification: *Provided for comparison to giant hogweed on page 8.*

Plant: Perennial, single-stemmed large plants at 3-10 feet tall. Fuzzy stems are hollow and described as foul smelling. **Key difference** - *hogweed has purplish stems with coarse hairs.*

Leaves: Alternate, compound, 3-parted with toothed, palmate leaflets. The petiole or leaf stalk has an enlarged base that clasps the stem.

Key difference - *hogweed has strongly dissected leaves up to 5 feet wide.*

Flower: 8-30 small, white, 5-parted flowers with notched petals, in a 4-8 inch flat umbel, 8-30 umbellets. *Cow parsnips outer flower petals are often larger, irregular, and notched.*

Bloom time is June to July.

Fruit and Seed: Many flattened fruits that when dry split into 2 seeds. See left-hand image.

Habitat: Often found in rich, moist soils along streams or river bottoms in full to partial sun.

Caution: Although to a lesser extent, cow parsnip can cause blistering rashes similar to giant hogweed. Again, plant sap reacting with sunlight - phytophotodermatitis.

Clasping, 3-parted leaf, fuzzy stems.

Outer flowers, larger, notched and irregular.

Minnesota Native | Cucumbers : *Echinocystis lobata* Michx. and *Sicyos angulatus* L.

Above: Bur cucumber foliage and flowers.
Below: Bur cucumber foliage and prickly seed structure.

Key difference - Both cucumber species have prickly seed structures.

Wild cucumber (*Echinocystis lobata*) and bur cucumber (*Sicyos angulatus*).

Identification: *Provided for comparison to Japanese hops on page 10.*
Compare to native common hops. See page 52.

Plant: Annual vines (non woody) with tendrils, often found covering shrubs and small trees to approximately 20 feet.
Leaves: Simple, alternate, 3-5 triangular lobed wild cucumber leaves have small teeth along the leaf edge. Bur cucumber differs with its 3-5 shallowly lobed leaves having hairy undersides as well as sticky hairs on its stems.
Flower: Wild cucumber has creamy white flowers with 6 strap-like petals. These are male flowers. One rarely noticed female flower is at the end of the flower spike. Bur cucumber has 5-petaled greenish-white male flowers clustered and separate from the female flowers clustered elsewhere on the plant.

Bloom time is July to September.

Fruit and Seed: Solitary, prickly bladders distinguish wild cucumber from bur's grouped, up to 10, prickly pods.
Habitat: Can be found growing side-by-side. Plants can be found in partial shade to full sun along the edge of the woods or in thickets or open areas with moist soils.

Above: Wild cucumber hanging on a fence in winter
Key difference - cucumber vines have tendrils.

Above: Bladder-like seed pod remaining in winter, seeds dispersed.
Below: Wild cucumber foliage and flowers.

Below: Wild cucumber

Minnesota Native | Fireweed : *Chamerion angustifolium* (L.) Holub ssp. *angustifolium*

Synonym: *Epilobium angustifolium* L.

Identification: *Provided for comparison to purple loosestrife on page 23*.

Plant: Perennial, erect, rounded, single stems reaching 2-6 feet tall. **Key difference** - *rounded stem, not 4-6 sided.*

Leaves: Alternate, crowded leaves that are lance-like and stalkless. **Key difference** - *alternate (not opposite).*

Flower: Four-parted, colors range from pink to purple. The flowers are showy at ¾ to 1½ inches wide and arranged along a tall terminal spike. **Key difference** - *Fireweed has four-parted flowers (purple loosestrife has 5-parted flowers)*.

Bloom time is June to August.

Fruit and Seed: Long, slender capsules or pods that split to release small seeds with long tufted hairs.

Habitat: Often present following burns on moist soils at forest edges or in clearings.

Minnesota Native | Golden alexanders : *Zizia* spp.

Golden alexander [*Z. aurea (L.) W.D.J. Koch*] and
heart-leaved golden alexander [*Z. aptera (A. Gray) Fernald*].

Identification: *Provided for comparison to wild parsnip on page 25.*

Plant: Herbaceous, perennial reaching 1-2 feet tall.
Key difference - *golden alexanders smooth, shiny stems compared to the grooved stem of wild parsnip.*
Leaves: Alternate 2-3 inch stem leaves, mostly 3-parted with finely toothed edges. Basal leaves of heart-leaved golden alexanders are simple and oval (heart-shaped) while those of golden alexanders are compound like upper stem leaves.
Key difference - *the basal leaves of wild parsnip are pinnately compound with 5-15 leaflets.*
Flower: Terminal panicles of numerous 5-parted, yellow flowers.

Bloom time is May to July.

Fruit and Seed: Similar to wild parsnips. Ridged - when mature appears dry and splits into 2 parts.
Key difference - *wild parsnip seeds are typically larger and flatter.*
Habitat: Moderately moist to wet - sandy, loamy soils, full sun to shade.

Z. aptera heart-shaped basal leaves.

Ridged seed, few if any bracts.

Minnesota Native | Goldenrods : *Solidago* spp.

Pyramidal inflorescence of Canada goldenrod

Identification: *Provided for comparison to common tansy on page 24.*
In particular, compare common tansy to stiff goldenrod (*Solidago rigida* L.).

Plant: Perennial plants, often clumped, typically erect, single stems. Species typically ranges in height from 1-4 feet while species may reach heights of 7 feet.
Leaves: Alternate, simple, depending on species leaves are lance shaped, may or may not be toothed and may or may not be hairy.
Key difference - *tansy foliage is pinnately divided, toothed and aromatic when crushed.*
Flower: Yellow ray flowers typically arranged in branched clusters. Depending on species the inflorescence may be pyramidal, flat-topped or one-sided.
Key difference - *goldenrod flowers have **ray petals** surrounding central, disk-like florets.*
Bloom time is late July through September.

Ray petals of stiff goldenrod

Fruit and Seed: Dry, light seeds often tufted with light-colored to brownish hairs easily carried by wind.
Key difference - *Tansy seed is not tufted and persists into winter in the flower heads.*
Habitat: goldenrod species thrive in a variety of sites. They can be found in dry to wet prairies, dry to moist forests and on a variety of roadsides. Partial to full sun.

Flat-topped inflorescence of stiff goldenrod

One-sided inflorescence of gray goldenrod

Minnesota Native | Riverbank Grape : *Vitis riparia* Michx.

Identification: *Provided for comparison to porcelain berry on page 36.*
Plant: Perennial, woody, vines climbing into trees and structures or spreading over low growing vegetation. Height can be variable and up to 80 feet. Tendrils opposite some leaves assist climbing and support. Stems of grape vines can attain diameters of 7-8 inches with bark maturing to dark brown and shredding from stems in narrow strips.
Key difference - *Porcelain berry's bark does not shed in vertical strips.*
Leaves: Alternate, simple, cordate (heart-shaped) leaves are sharply toothed and palmately lobed, often three distinct lobes. Leaves may be up to 6 inches long and 4 across. Upper leaf surface is typically dark green and smooth while underside may be whitish. There may or may not be hairs along the major veins.
Key difference - *Porcelain berry's leaves are often deeply divided by sinuses.*
Flower: Often dioecious, male and female flowers on separate plants, occasionally flowers are perfect (all reproductive parts). Hanging panicles of greenish-yellow, 5-parted flowers are not showy. Most are held opposite a leaf.

Bloom time is May to late June.

Fruit and Seed: Green berries (grapes), covered by a whitish film (glaucous), that mature to a purple color. Berries contain 1 to 4 seeds.
Key difference - *Porcelain berry has shiny, berries in hues of blue/purple.*
Habitat: Grapes prefer full sun but will tolerate partial shade. Preference is moist soils and as the name implies, riverbank grapes are often found in river bottoms climbing into trees where there is good sunlight at forest edges and in openings.

Above and below: June 13 - flowers, leaves and tendrils of grape on the Anoka sandplain.

Minnesota Native | Honeysuckles : *Diervilla lonicera* and *Lonicera* spp.

Above: Landscape use of northern bush honeysuckle.
Yellow tubular flowers, and serrated, lance shaped foliage.

Below:
Left 2 images - fly honeysuckle foliage, fruit and flower.
Second from right - rounded foliage of vining hairy honeysuckle and extreme right is red flower, fused foliage of wild honeysuckle.

Northern bush honeysuckle [shrub] (*Diervilla lonicera* Mill.) - pictures upper right and left,
fly honeysuckle [shrub] (*Lonicera canadensis* Marsh.) - pictures lower left,
swamp fly honeysuckle [shrub] (*L. oblongifolia* [Goldie] Hook.) - not pictured,
mountain fly honeysuckle [shrub] (*L. villosa* [Michx.] J. A. Schultes) - not pictured,
hairy honeysuckle [vine] (*L. hirsuta* Eat.) - picture second from lower right,
wild honeysuckle [vine] (*L. dioica* L.) - picture lower right.

Identification: *Provided for comparison to Asian bush honeysuckles on page 26.*
Plant: Shrubs range in heights up to 3 feet for northern bush honeysuckle on up to 6 feet for fly honeysuckles. Twining vines may be sprawling, standing weakly or climbing to heights of 9-15 feet (hairy and wild) on up to 24 feet for the uncommon grape honeysuckle.
Key difference - *Native bush honeysuckles have solid piths, typically white. Vine forms have hollow stems, white piths.*
Leaves: Opposite. It is difficult to generalize leaf types and shapes for these species. Bush honeysuckle has lance-shaped leaves with a long tip, serrated and ciliated margins with hairs possibly present on surfaces or mid-veins. Fly honeysuckles have elliptical to oblong shapes with blunt or acute tips. Vining honeysuckles tend to have rounded or ovate leaves except terminal leaf pairs tend to be fused (see image at right).
Key difference - *Northern bush honeysuckle has serrated, lance shaped foliage. Vining honeysuckles tend to have rounded foliage with the terminal pair fused.*
Flower: Tubular. Northern bush honeysuckles have a yellow flower (image left) while wild honeysuckles are red (image lower right). Others, like fly honeysuckle, vary from pale yellow to white.

Above: northern bush honeysuckles beaked, capsule fruit.

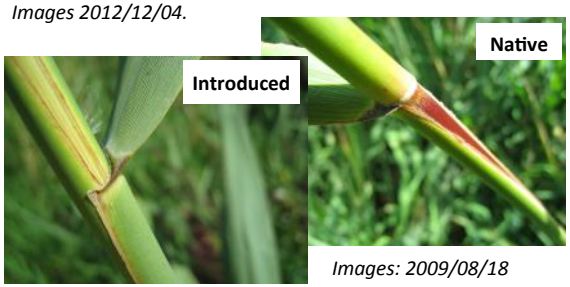
Below: Vining honeysuckles fused terminal leaves.

Bloom time is typically May to July. Northern bush honeysuckle as late as September.

Fruit and Seed: Typically berry-like, typically red except for bush honeysuckles beaked, capsule with sepals attached.
Habitat: Woodland habitats with some species tolerant of deeper shade while others require partial sun. Swamp fly and mountain fly honeysuckles are typically found in moist soils such as forested swamps or bogs.

Minnesota Native | Native phragmites : *Phragmites australis* ssp. *americanus* Saltonstall

Left: Introduced - diffuse fungal spots and leaf sheaths intact on yellow winter stems.
Right: Native - sharply defined fungal spots may be present on some stems and note the maroon to pink color.
Images 2012/12/04.



Images: 2009/08/18

Left: Introduced - green stems at the nodes.
Right: Native - maroon to pink color at the stem nodes.

Above: Introduced - larger, grayish, fuzzy seed head.
Right: Native - smaller, golden, some fuzziness to seed heads.

Complete nomenclature from USDA GRIN: *Phragmites australis* (Cav.) Trin. ex Steud. subsp. *americanus* Saltonstall

Identification: *Provided for comparison to nonnative phragmites on page 35.*
Plant: Perennial grass. Stand density can be similar to introduced common reed but, stands often have other native plants interspersed. In comparison to introduced form, native plants are typically shorter and foliage appears yellowish.
Leaves: Summer leaves are yellowish. Leaves and leaf sheaths will drop from plants in winter leaving bare reddish stems (photo at left). Ligule length determined under a dissecting microscope is diagnostic, typically > 1.0mm.
Flower: Approximately 3-4 months after spring growth begins.
Bloom time is June-September.
Fruit and Seed: Plumes are sparse and likely not persistent through winter. Glume lengths are diagnostic and as with ligules a dissecting microscope is useful for measurement and comparison.
Habitat: Native phragmites occurs near water sources such as rivers, streams, shorelines of ponds and lakes as well as within wetland systems including wet roadside ditches.

Native phragmites seed heads tend to be less dense, less fuzzy and typically not as large.

Left foreground: Introduced - dark green foliage with larger, grayish, seed heads.
Right background: Native - yellowish foliage with smaller, golden, seed heads.

Native phragmites has maroon stems at the nodes or segment joints. *Image 2009/11/02*

Minnesota Native

Sumacs : *Rhus typhina* L. and *R. glabra* L.

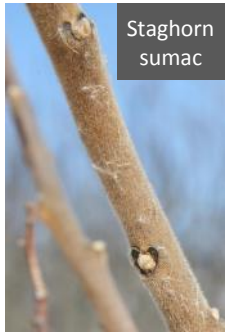
Staghorn sumac [shrub] (*R. typhina* L.) - pictures left.
Smooth sumac [shrub] (*R. glabra* L.) - pictures right,

Identification: *Provided for comparison to tree-of-heaven on page 37.*
Plant: Shrubs ranging in heights up to 18 feet for smooth sumac and staghorn sumac considered a shrub or small tree at heights up to 36 feet (or taller). Both smooth and staghorn sumac develop clonal, multi-stemmed, colonies. The names are indicative of the hairiness of the plants. Smooth sumac has smooth bark, fruits and foliage while staghorn has very fuzzy twigs, fruit and leaf parts.
Key difference - *Tree-of-heaven has smooth twigs similar to smooth sumac, but twigs and small branches of tree-of-heaven are very stout with very large leaf scars.*
Leaves: Alternate, odd pinnate compound. Smooth sumac has 9-23 hairless, sessile (no stalk) leaflets while staghorn sumac has 13-27 hairy, sessile leaflets. In particular the petioles (stalks that leaflets attach to) of staghorn sumac are fuzzy as is the midvein on the underside of the leaflet. Both species have serrated (toothed) leaflet edges. Leaflet color of the sumacs is darker green on top surface and pale green, almost whitish, on the bottom.
Key difference - *Tree-of-heaven has 11-25 or more smooth leaflets that have smooth edges and glands near leaf bases. Leaf color is a consistent green top and bottom.*
Flower: Dioecious species, male and female flowers on separate plants. Pyramidal multi-branched, stalks of greenish, 5-parted flowers. Many ¼ inch greenish flowers are somewhat showy as they are held on terminal, pyramidal structures that can be up to 15 inches tall by 9 inches wide.

Bloom time is typically late June into July.

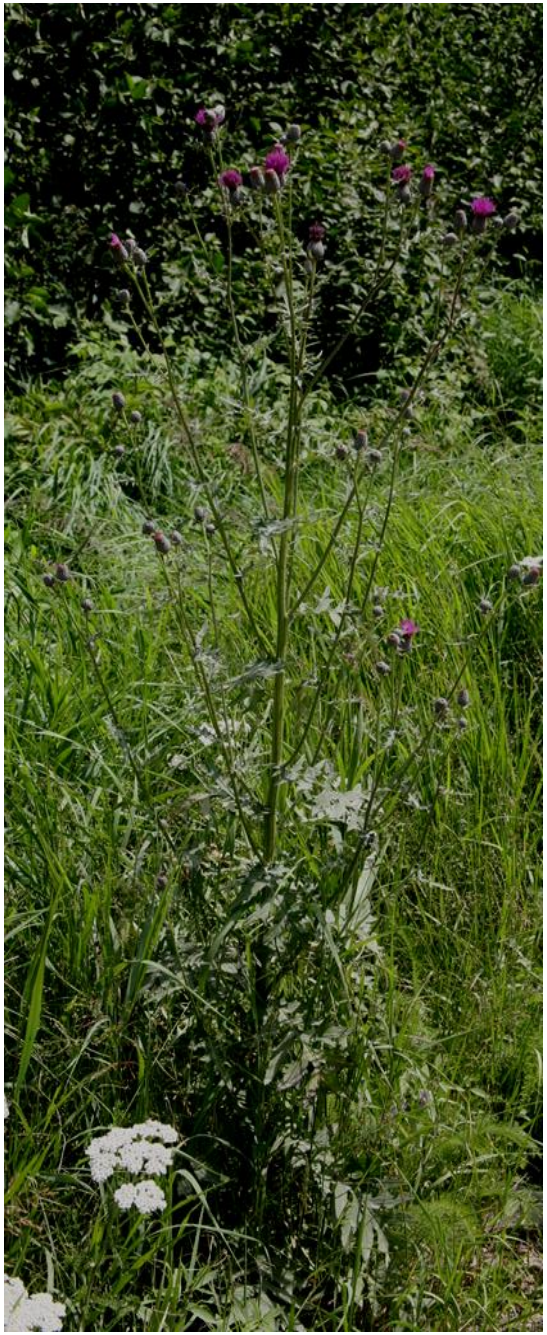
Fruit and Seed: The pyramidal structure of female flowers will be replaced by red fruits called drupes, each contains a single seed. Individual fruits of smooth sumac are covered by very short red hairs while those of staghorn are covered by very noticeable fuzzy, reddish hairs. Fruits of both species while rounded are slightly flattened and will hold on through winter and potentially into the following summer.
Key difference - *Tree-of-heaven, clusters of slightly twisted, single-seeded samaras.*

Above: Greenish male flowers of smooth sumac. July 18, BWCAW.
Below: Smooth sumac fruit October 15th near Mankato.



Habitat: Both sumac species prefer full sun. Both are found along forest edges and in forest openings. However, they may also be found near lakes or rivers or even on the drier extremes of rocky outcrops, prairie and savanna habitats. Sumacs are a common sight along dry roadsides.

Minnesota Native | Swamp thistle : *Cirsium muticum* Michx.



Identification: *Provided for comparison to nonnative thistles; Canada and plumeless thistle on pages 19, 20.*

See also: BWSR Featured Plant: Minnesota's Thistles, Publication date 2013-3-6.

Plant: Biennial, mature plants from 2-7 feet tall with multiple-branches terminated by many heads. Stems are not spiny but woolly, especially lower portions of the plant.
Leaves: Alternate, deeply divided leaves have lance-like or oblong segments that are described as softly spiny.
Flower: Purples to pinks typically not white. Composite flowers are 1½ inches wide held together by whitish, woolly, non-spiny bracts that have a visible light-colored dorsal (central) ridge.

Bloom time is July to October.

Fruit and Seed: Tufted seed matures and is wind-dispersed late summer into autumn.
Habitat: Swamps, bogs and areas like wet meadows, moist woods and thickets.

Key difference - *Woolly, non-spiny bracts with a light colored dorsal ridge.*

Key difference - *Deeply divided foliage that is softly spiny. Stems are hairy or wooly, not spiny.*

Minnesota Native | Woodbine : *Parthenocissus* spp.

Woodbine, palmately compound leaves.

Virginia creeper [*Parthenocissus quinquefolia* (L.) Planch.] and
woodbine [*P. vitacea* (Knerr) Hitchc.], synonym: *P. inserta* (Kerner) K. Fritsch.

Identification: *Provided for comparison to Japanese hops on page 10.*
Compare to native common hops on page 52.

Plant: Woody, perennial vines, with tendrils that assist climbing into trees and onto structures (Virginia creeper and woodbine) or sprawling on the forest floor (woodbine). Virginia creeper may develop aerial roots while woodbine does not. Tendrils of Virginia creeper develop adhesive disks while tendrils of woodbine usually attach by wrapping around an object, seldom developing adhesive disks.

Leaves: Alternate, palmately compound with 4-5 leaflets (typically 5). Leaflet bases are tapered and the leaf edges are toothed (possibly doubly toothed).

Key difference - *Leaves of Japanese hops are simple not palmately compound*.

Flower: Both species have greenish flowers held on compound cymes (branched, flat-topped structures with terminal flowers opening first). Virginia creeper's structure has a central axis while woodbine's does not.

Bloom time is June to July.

Fruit and Seed: Fruits are berries, bluish at maturity and held on red structures.

Key difference - *Japanese hops does not produce berries.*

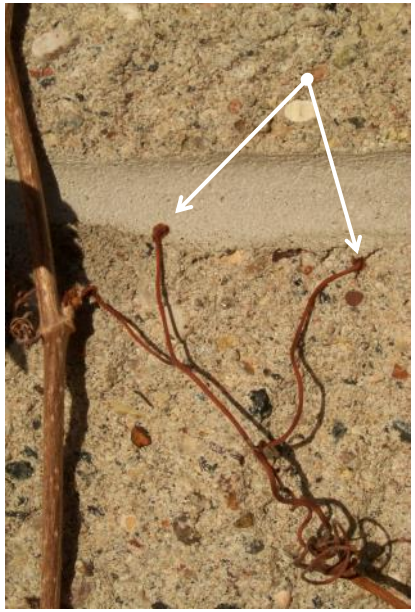
Habitat: Virginia creeper is often found in forest interiors where it climbs high into the canopy. Woodbine on the other hand will sprawl over the ground, on fences, rock piles unless it encounters a structure or tree suitable for climbing. Full sun to partial shade of the forest, moist soils, along fencerows or found growing on disturbed sites where animals and birds have dropped the seeds.

Woodbine climbing a fence post.

Virginia creeper, aerial roots holding onto elm bark.

Welby Smith describes the flower petals as "Boat-shaped."

Fall foliage and blue berries.



Adhesive disks at tendril ends.

Minnesota Native | Water Hemlock : *Cicuta maculata* L.

United States Dept. of Agriculture fact sheet states: "the most violently toxic plant that grows in North America."

Caution All plant parts (foliage, seeds, stems, roots) are ***poisonous to humans*** and livestock. Caution

Reported that toxin can be absorbed through bare skin! Wear appropriate PPE - gloves, long sleeves, and long pants.

Identification: *Provided for comparison to wild carrot on page 38. Also, compare to poison hemlock on page 13.*

Plant: Herbaceous, biennial (short-lived perennial), first year as a basal rosette and second year water hemlock is a lightly branched, 3-6 feet tall, plant. Stems are smooth (no hairs), hollow (lower portion), appear ridged due to veins and are light green or pinkish or reddish purple.

Key difference - *wild carrot stems are hollow and sparingly hairy to hairy. Stems are not spotted, see poison hemlock.*

Leaves: Alternate, generally triangular in form. Compound leaves are pinnate or doubly pinnate with 3-7 leaflets. Leaflets are not fern-like. Leaflets are 1-4 inches long by ½- 1¼ inches wide. Leaflets are toothed and veins appear to terminate in the notch between teeth - not at the tip. Petiole to stem attachments are partially covered by a sheath.

Flower: Petals are notched at the tip and narrowed at the base. Flowers are five-petaled, white and held as flat or slightly dome-shaped, loose, open compound umbels. Each umbel is comprised of 10-20 domed umbellets each holding 12-15 flowers. Main branches (rays) of umbels are not subtended by bracts. Secondary branches of umbellets have lanceolate bracts with scarious (thin, dry, membranous) margins.

Key differences - *wild carrot has obvious, showy, branched bracts beneath flower umbels and umbellets.*

Bloom time is variable - June to August.

Fruit and Seed: Seeds are schizocarps splitting at maturity to two carpels (individual seeds). Seeds are ⅛ inch long and angular. There are no hairs.

Key difference - *Wild carrot seeds are also about ⅛ inch with ridges covered by stiff bristles. At maturity wild carrot folds its seed structure into what is often described as a bird's nest.*

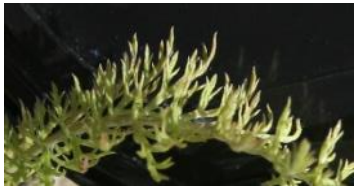
Habitat: Partial shade is tolerated but preference is full sun with wet to moist fertile soils with organic material. Often found in wet meadows and pastures and other similar sites like moist to wet roadside ditches. Prefers more moisture than poison hemlock and typically, does not compete or occur with poison hemlock.

Minnesota Native | Common yarrow : *Achillea millefolium* L.

Identification: *Provided for comparison to poison hemlock and wild carrot, pages 13 and 38 respectively. Compare to Carrot look-alikes, wild chervil and water hemlock, pgs. 45, 46, and 64.*
Plant: Perennial, herbaceous plant reaching heights of 1-2 (3) feet. Stems are pale green, hollow and typically covered with fine hairs. Plants are often unbranched except near the top.
Leaves: Alternate, narrow and finely divided - single or double pinnate - very fern like. Stem leaves are sessile (no leaf stalk) and near top of plants, typically smaller. Leaflets are longest at the middle of the rachis and shorter near the tip and base.
Flower: Terminal branched flower structures (compound corymb) of numerous 5-parted flower heads. Each flower head consists of 5 ray florets and 5 disk florets. Florets are typically whitish to pale cream. White flowers on a flat-topped structure brings about confusion with the carrot family.
Key difference - *terminal **branched** panicles or compound corymb versus carrot families compound umbels.*
Bloom time is June to September.

Fruit and Seed: Like the flowers, terminal panicles. Florets are replaced by seeds (achenes) lacking hairs. Roots are rhizomatous - thus colonies can be formed.
Habitat: Mesic to dry soils, full to partial sun often in prairies, along roadsides and woodland edges.

Typical form with flowers terminal to branches. Branches may be few.



Leaf Bases to ----------> Leaf Tips

Images of pinnately, compound foliage. Very finely divided, very fern-like.

Top leaf - sessile stem leaf.
Bottom leaf - petioled basal leaf.

End of season, dry flower structure. Historically used in architectural modeling as trees.

Citations / Resources:

Prohibited: Eradicate

Black swallow-wort: *Cynanchum louiseae* Kartesz & Gandhi Page 4
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
https://www.invasive.org/weedcd/pdfs/wgw/blackswallowwort.pdf
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Common teasel: *Dipsacus fullonum* L. Page 5
Image citations – Bugwood.org:
Flowering head close-up - David Cappaert, Michigan State University,
Flower group, basal rosettes, seed head - Steve Dewey, Utah State University.
Identification and management:
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Image citations: Dave Hanson and Tina Markeson, MnDOT.
Identification and management:
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http://www.missouriplants.com/Whiteopp/Dipsacus_laciniatus_page.html

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Image citation: all images - Dave Hanson, MnDOT
Identification and management: http://www.cwma.org/Dalmation.html
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http://www.invasiveplantatlas.org/subject.html?sub=5939
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Image citations – Bugwood.org:
Flower - Leslie J. Mehrhoff, University of Connecticut,
Flower and pen - USDA APHIS PPQ Archive, USDA APHIS PPQ,
Leaf - Donna R. Ellis, University of Connecticut,
Foliage to human - Thomas B. Denholm, New Jersey Department of Agriculture.
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Image citations: Dave Hanson and Tina Markeson, MnDOT,
Identification and management:
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Foliage images: Aaron Hager, University of Illinois at Urbana-Champaign.
Image citations from Bugwood.org:
Leaf/petiole and plant form - Ross Recker, University of Wisconsin - Madison,
Female seed spike and thick stem - Rebekah D. Wallace, University of Georgia.
Identification and management:
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Image citation: all images - Dave Hanson, MnDOT.
Identification:https://gobotany.newenglandwild.org/species/conium/maculatum/
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Image citations – Bugwood.org: Bolting stage - Cindy Roche,
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Knapweed complex: Page 15-16
Identification and management: http://wiki.bugwood.org/Archive:Knapweed
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Flower - Rob Routledge, Sault College; Flower side view - Cindy Roche.
Foliage and form - Bruce Ackley, The Ohio State University,
Identification and management:
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Image citation: all images - Tom Jacobson, MnDOT.
Identification and management:
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Diffuse knapweed: *Centaurea moncktonii* C. E. Britton Page 15-16
Image citation: Steve Dewey, Utah State University, Bugwood.org
K. George Beck and James Sebastian, Colorado State University, Bugwood.org
Identification and management:
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Russian knapweed: *Acroptilon repens* (L.) DC. Page 15-16
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Identification and management:
http://extension.colostate.edu/topic-areas/natural-resources/russian-knapweed-3-111/

Prohibited: Control

Spotted knapweed: *Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek Page 17
Image citation:
Flower top/side views, basal rosette, rosette foliage - Dave Hanson, MnDOT.
Image citations – Bugwood.org: Foliage - James H. Miller, USDA Forest Service.
Images and good identification write-up: Minnesota wildflowers
http://www.minnesotawildflowers.info/flower/spotted-knapweed
Discussion and management considerations:
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Image citations: Bugwood.org: Leslie J. Mehrhoff, University of Connecticut.
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Japanese Barberry control information:
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Canada thistle: *Cirsium arvense* (L.) Scop. Page 19
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
http://www.minnesotawildflowers.info/flower/canada-thistle
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Plumeless thistle: *Carduus acanthoides* L. Page 20
Image citation: all images - Dave Hanson, MnDOT.
Images and good identification write-up: Minnesota wildflowers
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Image citation: all images - Dave Hanson, MnDOT.
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Image citations – Bugwood.org: Leslie J. Mehrhoff, University of Connecticut.
Identification and management:
http://www.minnesotawildflowers.info/flower/narrow-leaf-bittercress
http://www.invasive.org/browse/subinfo.cfm?sub=11539

Purple loosestrife: *Lythrum salicaria* L. and *Lythrum virgatum* L. Page 23
Image citation: all images - Dave Hanson, MnDOT.
Images and good identification write-up: Minnesota wildflowers
http://www.minnesotawildflowers.info/flower/purple-loosestrife
Write-up on identification and control options:
https://www.invasive.org/weedcd/pdfs/wgw/purpleloosestrife.pdf
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http://www.dnr.state.mn.us/invasives/aquaticplants/purpleloosestrife/index.html

Common tansy: *Tanacetum vulgare* L. Page 24
Image citation: all images - Dave Hanson, MnDOT.
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Wild parsnip: *Pastinaca sativa* L. Page 25
Image citation: all images - Dave Hanson, MnDOT.
Images and good identification write-up: Minnesota wildflowers
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Identification and management:
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Asian bush honeysuckles: *Lonicera* spp. Page 26
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
Dirr, Michael. 2009. *Manual of Woody Landscape Plants* (full citation page 69)
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Black locust: *Robinia pseudoacacia* L. Page 27
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
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Crown vetch: *Securigera varia* (L.) Lassen Page 28
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
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Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
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Glossy buckthorn (and all cultivars): *Frangula alnus* Mill. Page 30
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
http://dnr.wi.gov/topic/Invasives/fact/GlossyBuckthorn.html
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Garlic mustard: *Alliaria petiolata* (M. Bieb.) Cavara & Grande Page 31
Image citation: all images - Dave Hanson, MnDOT.
Images and good identification write-up: Minnesota wildflowers
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Japanese barberry: *Berberis thunbergii* DC. Page 32- 33
Image citation: all images - Dave Hanson, MnDOT.
Identification and Management: http://www.mipn.org/control.html
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http://dnr.wi.gov/topic/Invasives/fact/JapaneseBarberry.html
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Multiflora rose: *Rosa multiflora* Thunb. Page 34
Image citation: all images - Dave Hanson, MnDOT.
Identification and Management:
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http://wiki.bugwood.org/Rosa_multiflora#MANAGEMENT.2FMONITORING

Nonnative phragmites: *Phragmites australis* (Cav.) Trin. Ex Steud. Page 35
Image citations: Ken Graeve and Dave Hanson, MnDOT.
Identification and Management:
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Porcelain berry: *Ampelopsis brevipedunculata* (Maxim.) Trautv. Page 36
Image citations: Foliage image - Paul Kortebein.
Other images - Dave Hanson, MnDOT.
Identification and management:
https://www.nps.gov/plants/alien/pubs/midatlantic/ambr.htm

Tree-of-Heaven: *Ailanthus altissima* (Mill.) Swingle Page 37
Image citation: all images - Dave Hanson, MnDOT.
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Wild carrot: *Daucus carota* L. Page 38
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
https://www.minnesotawildflowers.info/flower/queen-annes-lace
Controlling Wild Carrot in Hay fields and Pastures
Controlling wild carrot

Specially Regulated Plants:

Amur maple: *Acer ginnala* Maxim. Page 39
Image citation: all images - Dave Hanson, MnDOT.
Identification and management:
http://www.invasiveplantatlas.org/subject.html?sub=3965
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Specially Regulated Plants:

Knotweed, Japanese: *Polygonum cuspidatum* Siebold & Zucc. Page 40-41
Image citation: all images - Dave Hanson, MnDOT.
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Knotweed, giant: *Polygonum sachalinense* F. Schmidt ex Maxim. Page 40-41
Image citation: all images -
Leslie J. Mehrhoff, University of Connecticut, Bugwood.org
Identification and Management:
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Image citations: Dave Hanson, MnDOT and
see citations for Japanese and giant knotweeds, pages 40-41.
Identification and management:
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http://www.kingcounty.gov/s. . . ./weed-identification/invasive-knotweeds/bohemian-knotweed.aspx
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Biology, Ecology and management of the Knotweed complex (*Polygonum* species)

Poison ivy: western [*Toxicodendron rydbergii* (Small) Green] Page 42
common [*T. radicans* (L.) Kuntze ssp. *negundo* (Greene) Gillis]
Image citation: all images - Dave Hanson, MnDOT.
Identification and Management:
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http://www.dnr.state.mn.us/trees_shrubs/deciduous/poisonivy.html

Web links verified January, 2018.

Miscellaneous images: Dave Hanson, MnDOT
Cover photo: Oriental bittersweet in Winona, County on October 26, 2017..
Photos page 2: Dalmatian toadflax, Japanese hops and garlic mustard.
Photos page 3: field thistle, cow parsnip and stiff golden rod.

Page 69: Dave Hanson, MnDOT
Biological control images including: spotted knapweed root weevil, loose-strife beetle, leafy spurge flea beetle and spotted knapweed seedhead weevil.

Miscellaneous image: MnDOT
Page 69: herbicide application.

Miscellaneous images: Ken Graeve, MnDOT
Page 69: mowing and prescribed fire.

Nonnative Plants:

Alfalfa: *Medicago sativa* L. Page 43
Image citations – Bugwood.org:
Foliage - Gerald Holmes, Valent USA Corporation,
Flower - Keith Weller, USDA Agricultural Research Service.
Identification:
http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=4213

Hairy vetch : *Vicia villosa* Roth Page 43
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Balkan catchfly: *Silene csereii* Baumgarten Page 44
Image citation: Dave Hanson and Ken Graeve, MnDOT.
Identification:
http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=5045
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Carrot look-alikes: Various species of carrot family members Page 45
Image citation: all images - Dave Hanson, MnDOT.
Identification:
https://www.minnesotawildflowers.info/flower/caraway
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Chervil, wild: *Anthriscus sylvestris* (L.) Hoffm. Page 45
Image citation: all images - Dave Hanson, MnDOT.
Identification:
https://www.minnesotawildflowers.info/flower/wild-chervil

Musk or nodding thistle: *Carduus nutans* L. Page 46
Image citation: all images - Dave Hanson, MnDOT.
Other images and good identification write-up: Missouri Plants
http://www.missouriplants.com/Pinkalt/Carduus_nutans_page.html

Yellow rocket: *Barbarea vulgaris* W. T. Aiton. Page 47
Image citation: Dave Hanson and Tina Markeson, MnDOT.
Identification:
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American bittersweet: *Celastrus scandens* L. Page 48
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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American vetch: *Vicia americana* Muhl. Ex Willd. Page 49
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Canadian milkvetch: *Astragalus canadensis* L. Page 49
Image citation: all images - Dave Hanson, MnDOT.
Identification:
http://www.illinoiswildflowers.info/prairie/plantx/can_milkvetchx.htm
https://www.minnesotawildflowers.info/flower/canada-milkvetch

Cherries and wild plum: *Prunus* spp. Page 50
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://wisflora.herbarium.wisc.edu/imagelib/index.php
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Common hops: *Humulus lupulus* L. Page 51
Image citation: all images - Dave Hanson, MnDOT.
Identification:
http://www.hort.purdue.edu/newcrop/duke_energy/humulus_lupulus.html

Cow-parsnip: *Heracleum lanatum* Michx. Page 52
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://www.minnesotawildflowers.info/flower/common-cow-parsnip

Cucumbers, wild and bur: *Echinocystis lobata* Michx. and *Sicyos angulatus* L. Page 53
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://www.minnesotawildflowers.info/flower/wild-cucumber
http://www.minnesotawildflowers.info/flower/bur-cucumber

Fireweed: *Chamerion angustifolium* (L.) Holub ssp. *angustifolium* Page 54
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://www.minnesotawildflowers.info/flower/fireweed

Golden alexanders: *Zizia aurea* (L.) W.D.J. Koch and *Z. aptera* (A. Gray) Fernald Page 55
Image citation: all images - Dave Hanson, MnDOT.
Identification:
http://www.minnesotawildflowers.info/flower/golden-alexanders
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Goldenrods: *Solidago* spp. Page 56
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://www.minnesotawildflowers.info/
Search plant name: solidago

Grape, riverbank:. *Vitis riparia* Michx. Page 57
Image citations: all images - Dave Hanson, MnDOT.
Identification:
Smith, Welby R. 2008. *Trees and shrubs of Minnesota.* (full citation page 69).

Native honeysuckles: *Diervilla lonicera* Mill. and *Lonicera* spp. Page 58
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Native phragmites: *Phragmites australis* (Cav.) Trin. ex Steud. ssp. *americanus* Saltonstall
Image citations: Ken Graeve and Dave Hanson, MnDOT.
Identification: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?451454
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Sumac, Staghorn and Smooth: *Rhus typhina* L. and *R. glabra* L. Page 60
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Swamp thistle: *Cirsium muticum* Michx. Page 61
Image citation: all images - Dave Hanson, MnDOT.
Identification: http://www.minnesotawildflowers.info/flower/swamp-thistle

Virginia creeper and woodbine: *Parthenocissus* spp. Page 62
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Water hemlock: *Cicuta maculata* L. Page 63
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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Yarrow, Common: *Achillea millefolium* L. Page 61
Image citation: all images - Dave Hanson, MnDOT.
Identification:
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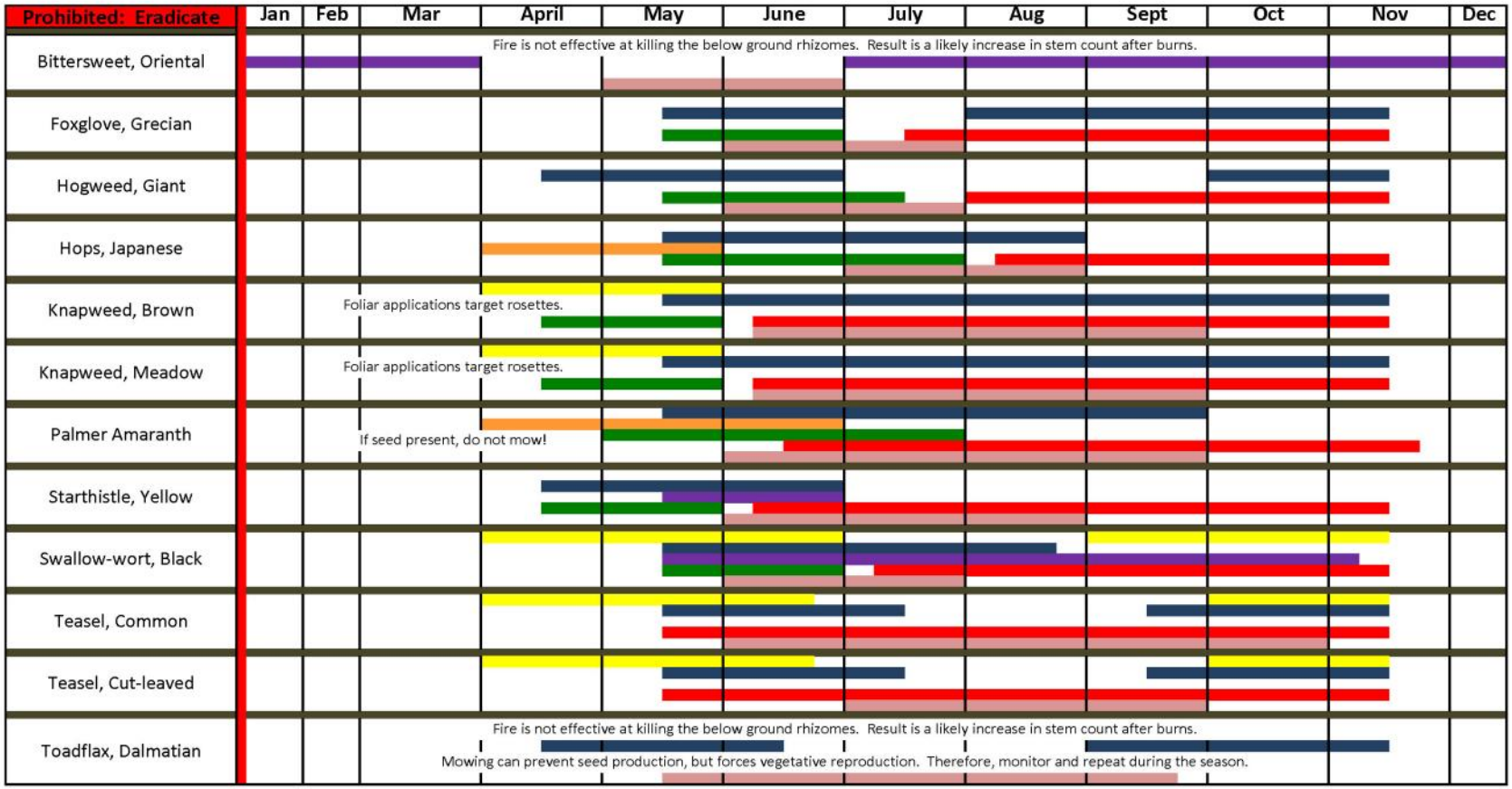
Wisconsin Department of Natural Resources factsheets:
Online. Terrestrial Invasive Species: List, Factsheets, Images

Biological Controls **Mowing or Other Mechanical Means** **Herbicide** **Prescribed Fire**

Management tactics can take many forms and should be based on predefined vegetation management goals.

Suggested timing of management tactics or control options can be found in graphical form on the following two pages.
Timings are based on recommendations described in the many resources listed on the previous pages.

Suggested Timing of Control Options for Minnesota Noxious Weed Species (2016)

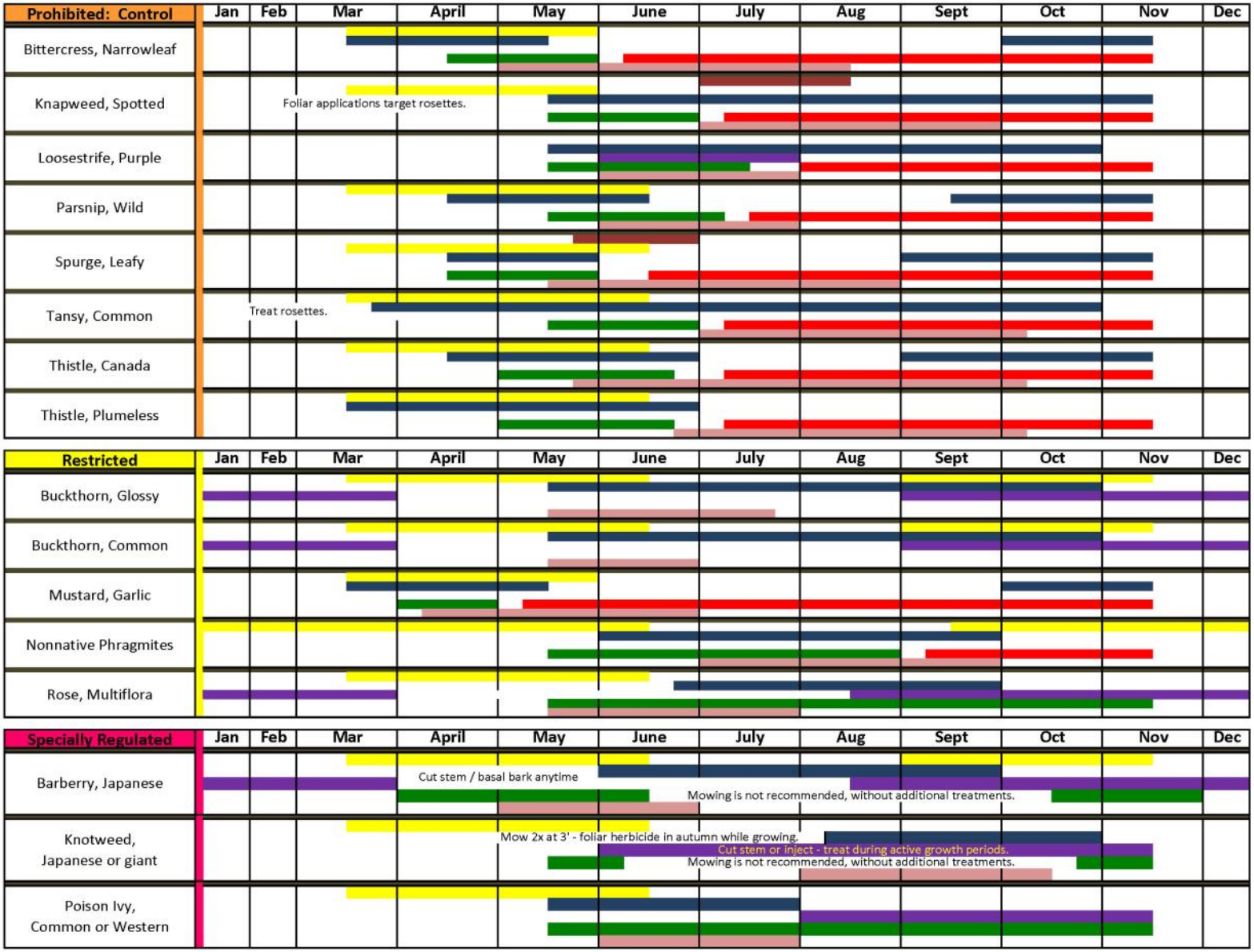


Herbicide: Foliar	Burn	Note: Suggested timings are approximate since weather and seasonal variations play a role in deciding how and when to control an infestation.
Herbicide: Stem or Stump	Mow	
Herbicide: Pre-emerge	Do Not Mow	
Biocontrol	Approximate Bloom	

N:_Programs\Roadside_Veg_Mngt\Pesticide\Herbicide-options-calendar\2016-Herbicide_tables-cheat-sheets\2016_Management-calendar.xlsx

dlh (March, 2016).

Suggested Timing of Control Options for
Minnesota Noxious Weed Species (2016)



N:_Programs\Roadside_Veg_Mngt\Pesticide\Herbicide-options-calendar\2016-Herbicide_tables-cheat-sheets\2016_Management-calendar.xlsx

dlh (March, 2016).

Definitions of the noxious weed categories from the Minnesota Department of Agriculture web page:
http://www.mda.state.mn.us/en/plants/pestmanagement/weedcontrol/noxiouslist.aspx

State Prohibited Noxious Weeds

Prohibited noxious weeds are annual, biennial, or perennial plants that the commissioner designates as having the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, livestock or other property. There are two regulatory listings for prohibited noxious weeds in Minnesota:

1. Eradicate List: Prohibited noxious weeds that are listed to be eradicated are plants that are not currently known to be present in Minnesota or are not widely established. These species must be eradicated, meaning all of the above and below ground parts of the plant must be destroyed, as required by Minnesota Statutes, Section 18.78. Additionally, no transportation, propagation, or sale of these plants is allowed. Measures must also be taken to prevent and exclude these species from being introduced into Minnesota.
2. Controlled List: Prohibited noxious weeds listed to be controlled are plants established throughout Minnesota or regions of the state. Species on this list must be controlled, meaning efforts must be made to prevent the spread, maturation and dispersal of any propagating parts, thereby reducing established populations and preventing reproduction and spread as required by Minnesota Statutes, Section 18.78. Additionally, transportation, propagation, or sale of these plants is prohibited.

Restricted Noxious Weeds

Restricted noxious weeds are plants that are widely distributed in Minnesota and are detrimental to human or animal health, the environment, public roads, crops, livestock or other property, but whose only feasible means of control is to prevent their spread by prohibiting the importation, sale, and transportation of their propagating parts in the state except as allowed by Minnesota Statutes, Section 18.82. Plants designated as Restricted Noxious Weeds may be reclassified if effective means of control are developed.

Specially Regulated Plants

Specially regulated plants are plants that may be native species or have demonstrated economic value, but also have the potential to cause harm in non-controlled environments. Plants designated as specially regulated have been determined to pose ecological, economical, or human or animal health concerns. Plant specific management plans and or rules that define the use and management requirements for these plants will be developed by the Minnesota Department of Agriculture for each plant designated as specially regulated. Measures must also be taken to minimize the potential for harm caused by these plants.

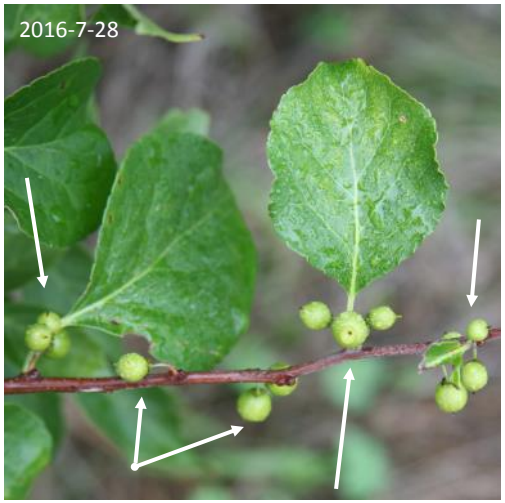
Amur maple: Sellers shall affix a label that advises buyers to only plant Amur maple and its cultivars in landscapes where the seedlings will be controlled by mowing or other means. Amur maple should be planted at least 100 yards from natural areas. Return to Amur maple.

Knotweeds, giant and Japanese: Any person, corporation, business or other retail entity distributing Japanese and/or giant knotweeds for sale within the state, must have information directly affixed to the plant or container packaging that it is being sold with, indicating that it is unadvisable to plant this species within 100 feet of a water body or its designated flood plain as defined by Minnesota Statute 103F.111, Subdivision 4. Return to knotweeds.

Poison ivy: Must be eradicated or controlled for public safety along rights-of-ways, trails, public accesses, business properties open to the public or on parts of lands where public access for business or commerce is granted. Must also be eradicated or controlled along property borders when requested by adjoining landowners. Return to poison ivy.

Minnesota Noxious Weeds

http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf



This book has two parts; part 1 (index pg. 2) contains terrestrial noxious weeds and part 2 (index pg. 3) contains look-alike plants.

For example, compare:

Left: Noxious weed, Oriental bittersweet (*Celastrus orbiculatus*) that has flowers and fruits in leaf axils along its vine (white arrows).

Right: Native plant, American bittersweet (*Celastrus scandens*) has flowers and fruits only at the terminus of branches.

Index on page 2 contains terrestrial noxious weeds listed under:

Minnesota Noxious Weed Law:
Find more information at:
Minnesota Department of Agriculture.

Index on page 3 contains a list of terrestrial nonnative and native species often mistaken for the associated noxious weeds.

These terrestrial plant descriptions are provided in an effort to prevent mistaken identities.

Scientific names (genus and species) were sourced from : USDA Plants Database

Minnesota Noxious Weeds

http://www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf

The index on page 2 contains
terrestrial noxious weeds listed under
Minnesota Noxious Weed Law

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Attachment F

Equipment Cleaning Log

Equipment Cleaning Log

Form Completed By: _____

Date: _____ Time: _____

Location of Equipment (tract & milepost): _____

Equipment Type: _____

Equipment ID (e.g., company, unique ID number): _____

Cleaning Method: (check all that apply)

- □ Scrape Down
- □ Steam Wash Blow Down (compressed air)
- □ Power/Pressure Wash (water)
- □ Other (Describe): _____

Comments: _____

_____

_____

_____

_____

Attachment G

Minnesota Aquatic Invasive Species Guide

(Large-size file available for download in PDF format here: https://www.maisrc.umn.edu/sites/maisrc.umn.edu/files/ais_id_guide_2018.pdf)