

Invasive Species Best Management Practices



For Transportation and Utility Rights-of-Way

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Preface-

In 2002, the Wisconsin Council on Forestry – comprised of representatives of private and public forestry, timber and forest product industries, conservation organizations, forestry schools, and other interested groups – was created by state statute to advise the Governor, Legislature, Department of Natural Resources, and other State agencies on issues affecting forests in the state. In 2004, the Council sponsored the Governor’s Conference on Forestry. The 64 participants, who attended these discussions, again representing a wide range of interested groups, concluded that “invasive species may present the greatest threat to the long-term health and sustainability of Wisconsin’s forests” and reached “a clear consensus on the need for voluntary invasive species best management practices and a partnership-based process for creating them.” In response, the Council created the Forest Invasives Leadership Team (FILT) to help guide these efforts and identified four areas of concern: Forestry, Transportation and Utility Rights-of-Ways, Urban Forestry, and Recreation for the development of Best Management Practices (BMP).

An Advisory Committee was created in May 2008 to guide the development of the Transportation and Utility Rights-of-Way BMPs. A Right of Way is a strip of land (corridor) upon which linear facilities such as pipelines, roads, power lines or railroads are built. The Advisory Committee included representatives from public and private organizations that create and manage linear corridors in Wisconsin, including highway departments, local utilities and pipelines. With assistance from technical teams and DNR staff, the Advisory Committee collaboratively developed the voluntary BMPs found in this document.

Purpose and Scope Statements

Purpose Statement

This manual describes practices that managers can use to minimize the introduction and spread of invasive species in utility and transportation corridors. The goal is to provide practices that reduce the impact of non-aquatic invasive species.

Scope Statement

The Best Management Practice (BMP) guidelines in this manual are intended to apply to utility and transportation corridor construction and maintenance activities. The use of this manual is voluntary and non-regulatory and is intended to help utility and transportation corridor managers make the most efficient use of limited resources to combat invasive species. Using these BMPs will assist in complying with the “reasonable precaution” requirements under Chapter NR40- Identification, Classification and Control of Invasive Species.

When and how will BMPs be implemented?

Effective implementation of BMPs will be a process of continuous learning. These BMPs were developed with the understanding that each situation or entity has different needs and resources. It is important to read this manual with the understanding that flexibility in regard to implementation is part of the structure of the manual. For instance, a BMP may be a general statement, with more specific language in the considerations to help understand the intent of the BMP. Adapting to the BMPs throughout the learning process is also a critical component of properly implementing them. These BMPs recognize extenuating circumstances may arise which would make following the guidelines difficult.

The Best Management Practices (BMPs) identified in this manual are our best attempt to identify effective and realistic practices that we can integrate into routine right-of-way activities to limit the impact of invasive species. By taking reasonable precautions today, we can help protect the natural integrity of Wisconsin's landscape.

Wisconsin's Transportation and Utility Corridor Best Management Practices for Invasive Species recognizes a wide range of possible response options to any invasive species situation. Response options will need to recognize the degree of threat posed by an invasive species, the objectives of the landowner, the resources available for additional management activities, and the costs that will be borne by corridor managers of adopting Best Management Practices.

The Advisory Committee stresses the fact that the primary costs of adopting Wisconsin's Transportation and Utility Corridor Best Management Practices for Invasive Species will be borne by the corridor managers. We encourage others who may look to adopt or reference these voluntary practices to recognize the need for setting reasonable expectations and realistic goals for managers. It is our hope that everyone involved in corridors will help share the responsibility to protect our landscape from invasive species and ensure the jobs and benefits of our corridors remain as strong tomorrow as they are today.

Resource management as it is referred to in these BMPs for Invasive Species relates to the level of effort and type of method necessary to effectively control or eliminate the spread of invasive species during project activities. The level or method of management can be based on the following factors:

1. Day to Day Project Activities vs. Planned Projects
2. Size of Project
3. Known Invasive Species in the Area
4. Employee Training
5. Revegetation Options
6. Level or Detail of Planning

The delegation of responsibility of implementing the BMPs is to be determined by each entity given each situation. See Appendix H for a checklist of responsibilities.

Cooperative Weed Management Areas

A Cooperative Weed Management Area (CWMA) is a partnership of government organizations, agencies, tribes, individuals, and various interest groups that manage invasive plants within a defined area. Many counties in WI are currently included in active CWMA's. These groups may be available to conduct training sessions, help survey for invasives, identify priority populations to contain and assist with management. Most are eager to work with ROW managers. Check the CWMA listings for contacts in your area. www.ipaw.org/other_groups.htm – includes a list of CWMA's in Wisconsin and contact information.

If there isn't a CWMA in your area, contact the WDNR Invasive Plant Coordinator at 608-267-5066 or email kelly.kearns@wi.gov to get in touch with local people that may be able to help.

A local CWMA may be able to provide assistance in any of the following areas:

- Provide educational opportunities on invasive species identification, and management.
- Keep current on the changing information on invasive species that are a threat to your region
- Identify prairie remnants, rare species and other sensitive areas that should be priorities for keeping weed-free.
- Recommend priority sites and methods for management.
- Identify locations of common invasive species.
- Identify and help control new infestations of invasive plants that are new to the area, including prohibited plants regulated by NR40.
- Assist with management where appropriate.
- Conduct training sessions and workshops for state, county, municipal and utility staff.
- Act as a point of local contact for any questions or concerns about vegetation management.
- Assist in seeking funding.

How to use this manual

This manual provides Best Management Practices to aid in preventing the spread of and the management and control of invasive plants, insects, and diseases in Wisconsin. In addition to the specific BMPs, the document contains information to help the user work through a process of assessing the threats posed by invasive species, in order to plan and implement a management strategy.

The Manual is structured as in the following example:

Best Management Practice:

BMP Statement: Invasive species BMPs are in bold font and are set off from the body of the document. These statements are intended to describe voluntary practices that may reduce the impact of invasive species.

Considerations:

- a. BMP Considerations are listed below the BMP Statement.
- b. BMP Considerations were written to give more information about why the BMP is important.
- c. BMP Considerations introduce items that could be used to address the BMP; they do not apply to every species or situation, and the user does not necessarily have to follow them to address the BMP (i.e., they are optional).
- d. BMP Considerations may include details, suggestions, examples, and issues to consider about invasive species and applying the BMP.

Beyond the Scope Statement

There are additional needs in invasive species management that are beyond the scope of this manual. These needs are being addressed by complementary efforts that address forestry practices, recreation, and urban forestry. This manual does not address aquatic invasive species, but similar information can be referenced in Appendix J.

Throughout the manual, you will see that the chapters are separated into planning and activity BMPs. The planning BMPs address program and site specific project planning recommendations for land stewardship activities. Strategic planning may include the development of system wide planning needed to investigate, determine level of effort and program resources needed for effective land management within planned corridors. Education is an integral component of both planning and activity based BMPs and is addressed in each chapter. Project and maintenance “Best Management Practices” are intended as specific guidelines for site specific projects and maintenance activities.

CHAPTER 1: INTRODUCTION

What is a Corridor?

The landscape is crossed by numerous linear corridors, most of which are used for transportation or utility-type infrastructure. Two terms, corridors and rights-of-way, are both commonly used when referring to these linear features. This document uses both terms.

Transportation corridors are primarily roads and railroads. The rights-of-way (ROW) for roads are either owned by local or state governments or on easements across private property. Railroad ROWs are usually owned by the railroad company. A roadway consists of the road's pavement and adjacent shoulders. The area extending beyond the shoulders is called the roadside in this document. The roadside can include the outer edges of the underlying foundation for the road, or roadbed, which may require areas to be built-up or cut-out of the native topography. The roadside area (within the highway ROW) also includes drainage ditches, safety zones, and space for signs. Likewise, railroad corridors consist of the rail tracks themselves, the underlying supporting rail bed, space for any embankments or excavations needed to create a level rail surface, and space buffers with adjoining properties.

The utility-type corridors are used for a variety of lines and pipelines. Lines can be underground or above ground and used for transmitting electricity or telecommunications signals. Pipelines include natural gas, crude oil and refined petroleum products, water, and sewer pipelines. For simplicity's sake, the general term "utility line"¹ is used in this document to refer to this whole group of lines and pipelines. Utility lines cross private lands on easements or are within publicly-owned road ROW. The line owner must obtain easements from the private landowners allowing the line to be built, operated and maintained on those properties, while governmental permits are needed for utility lines located in road ROW. A utility line ROW across private lands includes space for the line itself along with additional space buffering the line from nearby buildings and tall vegetation.

An easement gives a utility certain rights to build and maintain lines and pipelines. In some cases, these limited rights may inhibit its options for preventing the introduction and spread of invasive species.

The construction, operation and maintenance of transportation and utility corridors can lead to the introduction and spread of invasive species, which is discussed in the remainder of this document. Lands for access, staging areas, and laydown areas used for construction and maintenance of the corridors are also included in the scope of this document.

¹ In this document the term "utility" is broader than the meaning of "public utility" in Chapter 196 and other sections of the Wisconsin Statutes.

Another group of linear corridors, recreational trails used by off road vehicles, bikes and pedestrians are discussed in a separate document on Recreation Best Management Practices.

What are Invasive Species?

Non-native plants, animals and microorganisms found outside of their natural range can become invasive. The majority of non-native species are harmless because they do not reproduce or spread abundantly in their new surroundings. However a small percentage of non-native species can harm the economy, ecology or human health in their new environment. These species thrive because they become established quickly, tolerate a wide range of conditions, are easily dispersed, and are no longer controlled by the diseases, predators and parasites that kept their populations in check in their native range.

“Invasive species”, as defined in Wisconsin law (s. 23.22 (1)(c), Stats.) means nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health. In addition, “invasive species” means nonnative species including hybrids, cultivars, subspecific taxa, and genetically modified variants whose introduction causes or is likely to cause economic or environmental harm or harm to human health, and includes individual specimens, eggs, larvae, seeds, propagules and any other viable life-stages of such species.

Invasive species cause a wide range of damages. Wisconsin's 3 top industries - Forestry, Agriculture, and Tourism are all heavily impacted by invasive species. Invasive plants take over forest floors and understories, eliminating native tree regeneration. They degrade pastures and crops and threaten the few remaining remnants of prairies and savannas left in Wisconsin. Invasive insects and pathogens kill forest and landscape trees and decrease yield in forests and in our agricultural crops. Several of the invasive plants that spread from roadsides into adjacent pastures and farm fields are toxic to cattle. Hunting and hiking lands can become impassable as invasive shrubs spread. Aquatic invasives can make most water sports very difficult, and can severely impact fish habitat. Introduced organisms are the second greatest cause, after habitat destruction, of native species endangerment and extinction worldwide.

Whether intended or unintended, human actions remain the primary means of invasive species introductions. Introduced organisms are the second greatest cause, after habitat destruction, of species endangerment and extinction worldwide. An increased level of awareness will be necessary to prevent their spread, including ongoing education on invasive species identification and management.

The creation and upkeep of transportation and utility corridors results in soil and vegetation disturbance, along with the movement of people and vehicles along the corridors. These actions can contribute to the spread of invasive species. Whether intended or unintended, human actions remain the primary means of invasive species introductions.

Transportation and utility corridors act as conduits in which invasives spread. Additional concerns with spreading invasive species along corridors include increased cost of corridor maintenance, compromised visibility and safety, and increased threat of wildfires.

This manual has been divided into four main chapters that entail most activities along utility and transportation corridors.

1. Soil Disturbance
2. Vegetation Management and Inspection / Monitoring
3. Transport of Materials
4. Revegetation and Landscaping

In addition there are several appendices that provide additional information for right-of-way managers.

CHAPTER 2: SOIL DISTURBANCE

Soil disturbance is meant to describe any situation where soil is disturbed, including disturbance from excavation, vehicular traffic, soil displacement, etc. It includes any activity where soil is moved, removed, or brought in. Disturbed soil is often just what an invasive species needs to get started. Stabilizing the disturbance as soon as possible to prevent the germination and growth of invasive species is critical.

Soil Disturbance BMPs

Planning

BMP SD 1: Prior to implementing activities scout for, locate and document invasive species infestations.

BMP SD 2: Consider the need for actions based on: 1) the degree of invasiveness; 2) severity of the current infestation; 3) amount of additional habitat or hosts at risk for invasion; and, 4) feasibility of control with available methods and resources.

BMP SD 3: Plan activities to limit the potential for introduction and spread of invasive species, prior to construction.

BMP SD 4: Provide appropriate resources in identification of known invasive species for corridor workers.

Activities

BMP SD 5: Minimize soil disturbance which may include using existing roads, access points, staging areas and/or alternative construction methods.

BMP SD 6: Avoid invasive species populations when feasible and minimize the spread of invasive species during soil disturbance activities.

BMP SD 7: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

BMP SD 8: Stabilize disturbed soils using erosion control/stormwater management technical standards as soon as possible.

BMP SD 9: Use non-invasive or native seed for cover crops or revegetation.

Planning

BMP SD 1: Prior to implementing activities scout for, locate and document invasive species infestations.

Considerations:

Knowing which invasive species are present, and where they are located is necessary in evaluating threats. The following are some steps to consider when scouting for invasive species.

- a. Where feasible, integrate scouting of invasive species into normal inventory and monitoring.

- b. The extent and intensity of scouting should be appropriate to the threat posed by invasive species in or likely in the area, and by the potential effect of activities on the further spread, release, or management of those species.
- c. The extent and intensity of scouting should be appropriate to the size of the property/project, type of activity and its degree of disturbance.
- d. Scouting can occur both within and around the activity area.
- e. Scouting for invasive plants should occur at likely introduction sites such as access points, lay-down areas, and staging areas.
- f. Scouting may also include consulting with resource managers to identify threats from invasive plants, insects, or disease within the corridors.
- g. Provide training and identification. (See also BMPs SD-4 and VM-4)
- h. Encourage corridor workers to report invasive species findings.
- i. Coordinate among multi-use entities for the same project area.
- j. Refer to Appendix A, B and J to find resources to help find out what invasives species are in your area.

BMP SD 2: Consider the need for actions based on: 1) the degree of invasiveness; 2) severity of the current infestation; 3) amount of additional habitat or hosts at risk for invasion; and, 4) feasibility of control with available methods and resources.

Considerations:

Whenever possible and consistent with project and scale objectives a threat assessment is the next step in identifying and mapping the invasive species present on the corridors, and operations and management modified to address further spread.

- a. Degree of invasiveness-
Some invasive species are able to invade habitats and hosts rapidly. Species that reproduce frequently and in high numbers, mature quickly, and have multiple ways of dispersing tend to be more invasive. These species often pose a greater immediate threat than those with less invasive tendencies.
- b. Severity of current infestation-
Areas with severe infestations will have a lower threat level than adjacent areas with little or non infestation. Project plans should minimize movement from infested to no infested project areas. (See also Chapter 4: Transport of Materials)
- c. Assess additional habitat or hosts at risk from invasive species-
On properties where an invasive species is present in only part of the area, or its arrival is imminent, the threat level will be higher if there is additional suitable habitat (for plants), or host species (for insects and diseases) that can be invaded. Consider the corridor and adjacent lands.
- d. Feasibility of control-
Controlling invasive species may be difficult and expensive. Consider control options and costs, as well as consequences and costs of not taking action. For species that do little damage, control may not be warranted. For large existing infestations, the level of effort required may be prohibitive. It is often more feasible to control small or intermediate infestations. For relatively small infestations of extremely damaging species, control is cost-effective in the long-term.

- e. The potential for the intended activity to further spread the invasive species.
- f. Allocate time and resources for post-treatment follow-up control measures, due to persistent seed bank and resprouting for several years.

BMP SD 3: Plan activities to limit the potential for introduction and spread of invasive species, prior to construction.

Considerations:

Activity planning may include developing budgets, schedules, and management prescriptions. The planning phase allows for consideration and precautions to be taken if invasive species are present.

- a. Consider the likely response of invasive species or target species when prescribing activities that result in soil disturbance or increased sunlight.
- b. Timing for species control
 - Consider the need for invasive species control efforts; determine whether planned control efforts should occur prior to, after or concurrent with the activity.
 - Consider pre-treatment of invasive species, and postpone activity until an infestation can be treated. Effective pre-treatment may need to occur prior to soil disturbance.
 - Consider seasonal timing that will minimize introduction and movement of invasive species.
 - Opt out of activities where the spread of invasive species will likely jeopardize sensitive habitat.
- c. Cleaning
 - Plan for appropriate cleaning of equipment to limit the introduction and spread of invasive species. Make prior arrangements for cleaning that may be needed in conjunction with corridor activities. Consider the risks different types of equipment pose for the introduction and spread of invasive species.
- d. Boundaries
 - Position activity boundaries that exclude areas infested with invasive species.
- e. Scheduling
 - Consider the sequence of operations within an activity area. When feasible, plan to enter areas infested with invasive species last.
- f. Ground Disturbance
 - Where feasible, avoid creating soil and site conditions that promote invasive plant germination and establishment. Minimize soil disturbance to no more than needed to meet corridor project objectives.
 - Consider the impacts of different types of equipment where feasible. Plan to use equipment that minimizes soil and vegetation disturbance.
 - Retain soil and native vegetation in and around the activity area to the greatest extent possible.

BMP SD 4: Provide appropriate resources in identification of known invasive species for corridor workers.

Considerations:

- a. Learn to identify locally important invasive plants.
- b. Contact Wisconsin DNR to find out which plants are invasive in your area.
- c. See Appendix A, B and J for additional resources

Activities

BMP SD 5: Minimize soil disturbance which may include using existing roads, access points, staging areas and/or alternative construction methods.

Considerations:

Invasive plants could rapidly colonize areas of disturbed soil.

- a. Determine the amount of necessary disturbance based on scale and intensity.
- b. After a soil disturbance, encourage prompt regeneration of desirable vegetation or cover exposed soil with a layer of mulch to reduce germination or introduction of invasive plants.
- c. Ground disturbance may uproot existing vegetation and expose soil, creating a seedbed for invasive plants that can overwhelm desirable vegetation.
- d. After a soil disturbance, monitor the area and treat new invasive plant infestations.
(See also Chapter 3: VM -11)

BMP SD 6: Avoid invasive species populations when feasible and minimize the spread of invasive species during soil disturbance activities.

Considerations:

- a. Avoid potential adverse impacts related to invasive species.
- b. Excavated material from areas containing invasive plants may be reused within the exact limits of the infestation.
- c. Excavated material that contains invasive plant material and is not reused within the limits of the infestation may be stockpiled until the remaining invasive plant material is destroyed.
- d. Berm top soils: rather than importing topsoil's with potential seed banks, berm existing topsoil's along the perimeter of the project for later use.

BMP SD 7: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

Considerations:

- a. Methods of cleaning include any one of the following, but are not limited to: (use most effective method that is practical)
 - Brush, broom, or other hand tools (used without water)
 - Car washes

- High pressure air (some equipment may have air tank, leaf blower)
 - Steam cleaning
 - Portable wash station that contains runoff from washing equipment
- Note: Containment must be in compliance with wastewater discharge regulations, See Appendix K: Accompanying Regulations for more details.*
- b. Clean equipment at the shop during routine equipment maintenance activities.
 - c. Preferred locations for cleaning are those where:
 - Invasive species are already established or as near as practical to the infested area
 - Areas that are easily monitored and controlled, if necessary, for new infestations due to the cleaning activity, i.e. along an already infested road, at access points.
 - d. Do not clean equipment, vehicles or trailers in or near waterways as it may promote the spread of invasives downstream.
 - e. Make prior arrangements to clean equipment in conjunction with the specific activity. Risk consideration varies with equipment types, with possible introduction and spread of invasive species.

BMP SD 8: Stabilize disturbed soils using erosion control/stormwater management technical standards as soon as possible.

Considerations:

- a. Use weed-free mulch when practicable.
- b. Use weed-free sand and gravel when practicable.
- c. See Appendix J for additional resources.
- d. Weed free materials may not be necessary for buried layers.

BMP SD 9: Use non-invasive or native seed for cover crops or revegetation.

Considerations:

- a. Use a non-persistent cover crop, such as annual rye or oats that can be used to temporarily stabilize the soil, and discourage the establishment of invasive species.
- b. Use weed-free locally appropriate seed mixes where available.
- c. Use weed-free mulch when practicable.
- d. Do not plant invasive species.
- e. See also Vegetation Management and Inspection/Monitoring, Transport of Materials, and Revegetation and Landscaping Chapters.
- f. See Appendix D: Mowing Timing Guidance

CHAPTER 3: VEGETATION MANAGEMENT AND INSPECTION/MONITORING BMPS

Introduction

Vegetation Management activities include, but are not limited to: mowing; manual clearing and trimming; mechanized clearing and trimming; herbicide application; burning (brush and prescribed); inspections; and monitoring. Some key concepts to prevent the introduction and spread of invasive species are discussed below.

Early Detection and Rapid Response

Since the chances of controlling an invasive species are greatest immediately after introduction, early detection and rapid response are an important part of managing invasive species. **Early Detection** uses a comprehensive surveillance system to locate new populations of invasive species early when control is still feasible and less costly. Detection targets a) areas where introductions are likely, such as access points and travel corridors, b) areas with high ecological value, and c) vulnerable habitats or recently disturbed areas. **Rapid response** is a systematic effort to contain and control invasive species while the infestation is localized. Having a prioritized management plan will provide the most effective, organized, and efficient response to a new introduction or infestation.

Control

Early detection and rapid response are critical to catching and containing new populations of invasive plants. These may be new invaders to the area or new populations that are just starting. These are often just a few plants and can be easily removed prior to setting seed. This immediate control when the plants are first spotted can prevent costly outbreaks in the future. When populations are widespread or large and resources are limited, a more realistic management goal is to control the invasive species by reducing their populations to levels that will allow native species to thrive. For most plants this level of control is aimed at preventing seed production and spread. Control programs are usually ongoing and can include manual, mechanical, chemical, biological, and cultural components. Property owners and land managers should evaluate their site and life cycle characteristics of the invasive species to determine which control methods will be the most effective and economical while minimizing negative environmental impacts. There are many good resources to provide guidance on species control methods. (See Appendix C.)

Mowing

Preventing seed dispersal is crucial for **preventing the spread** of many invasive species. Mowing should be carefully considered to ensure that invasive species will not actually be spread by the practice. Timing of mowing is the most important factor in spreading seeds. If weeds are mowed after they have started to develop seeds, it is likely they will be spread extensively with mowing. Mowing prior to flowering or at the very early flowering stages will minimize the spread of maturing seed. Some species, such as garlic mustard, will continue developing seeds after the tops of the plants have been cut.

Use of a mower that shreds the clippings will be more effective on plants such as this. Appendix D provides recommendations on when it is best to mow, and when mowing should be avoided. Note that these dates are established for the southern half of the state. Dates should be adjusted for northern counties where flowering times are often several weeks later than in Southern WI.

Some invasive plants have the ability to sprout from stem and root fragments. Mowing these plants should be avoided whenever possible. Consider staking populations of these plants as “do not mow”.

In areas where invasive plants occur, an attempt should be made to mow the right-of-way prior to seed maturation (approximately August 1st). This could be accomplished by identifying specific roads that are either heavily infested with invasive plants or roads that are in sensitive habitat areas, and making those roads a priority in the mowing schedule.

**If conducting mowing activities, reference Vegetation Management BMPs 2 through 10 And Appendices D: Mowing Timing Guidance.*

Monitoring

Monitoring sites after activities may detect new or re-invasions early and help to evaluate the success of invasive species control efforts. Monitoring inspections can be integrated with other activities like ROW inspections and should be kept as simple as possible to meet invasive species management objectives. While monitoring sites for known invasive species, be alert for emerging invasive threats like the Prohibited species (listed in Appendix A) that may move into the area.

Vegetation Management and Inspection/Monitoring BMPs

Planning

BMP VM 1: Prior to implementing activities scout for, locate and document invasive species infestations.

BMP VM 2: Plan activities to limit the potential introduction and spread of invasive species, prior to construction.

BMP VM 3: Assess available resources and seek new resources to prevent invasive species spread.

BMP VM 4: Provide training in identification, control and prevention of known invasive species to employees and contractors performing vegetation management activities.

Activities

BMP VM 5: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

BMP VM 6: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, and invertebrates before and after activities.

BMP VM 7: Properly dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.

BMP VM 8: Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.

BMP VM 9: Consider the likely response of invasive species when conducting activities that result in disturbed soil, increased sunlight, fire, etc.

BMP VM 10: Ensure that invasive species control treatments are applied within the appropriate time window.

BMP VM 11: Monitor right-of-ways during day-to-day activities and post-management activities; determine necessary treatments based on the presence of invasive species.

Planning

BMP VM 1:

Prior to implementing activities scout for, locate and document invasive species infestations.

Considerations:

- a. Where feasible, integrate scouting of invasive species into normal inventory and monitoring.
- b. The extent and intensity of scouting should be appropriate to the threat posed by invasive species in or likely in the area, and by the potential effect of activities on the further spread, release, or management of those species.
- c. The extent and intensity of scouting should be appropriate to the size of the property/project, type of activity and its degree of disturbance. Scouting can occur both within and around the activity area.
- d. Scouting can occur both within and around the activity area.
- e. Scouting for invasive plants should occur at likely introduction sites such as access points, lay-down areas, and staging areas.
- f. Scouting may also include consulting with resource managers to identify threats from invasive plants, insects, or disease within the corridors.
- g. Provide training and identification. (see also BMP VM-4)
- h. Encourage corridor workers to report invasive species findings.
- i. Coordinate among multi-use entities for the same project area.
- j. Contact your local native plant society or state DNR to find out which plants are invasive in your area. (See Appendix J: Resources)

BMP VM 2: Plan activities to limit the potential introduction and spread of invasive species, prior to construction.

Considerations:

- a. Consider the need for invasive species control efforts and determine whether planned control efforts should occur before, during, or after the primary activity.

- b. If pre-treatment of invasive species is necessary, postpone activity until the infestation can be treated. Effective pre-treatments sometimes need to occur one to two years prior to the activity.
- c. Develop seasonal timing schedules for vegetation management to minimize the spread of invasive species at the local level.
See Appendix D: Mowing Guidance, and Appendix E: Invasive Species Time Window as well as Timing for Species Control in Chapter 2: Soil Disturbance.
- d. Carry out work under conditions that minimize the risk of spread, e.g., frozen ground, snow cover, absence of seeds/propagules, etc. (See Appendix E for a sample “Example Identifying Time Windows for Invasive Species Management”

BMP VM 3: Assess available resources and seek new resources to prevent invasive species spread.

Considerations:

- a. Available resources include facilities, equipment, finances, and human resources.
- b. Identify local and regional partners, such as Cooperative Weed Management Areas, with whom you may collaborate and share resources.
- c. Assess information on grants, funding, and organizations.

BMP VM 4: Provide training in identification, control and prevention of known invasive species to employees and contractors performing vegetation management activities.

Considerations:

- a. Visit website resources and read guides, brochures, and pamphlets that refer to identification and control of invasive species.
- b. Pay attention to signage at infested areas and trailheads, (e.g. “this is a picture of garlic mustard; you will see it along the west side of the trail”)
- c. Provide information about where to report sightings of invasive species and locations of new infestations.
- d. Post informational items at places such as access points, shops, and work trailers.
- e. See Appendix J: Resources.
- f. See Appendix D: Mowing Timing Guidance

Activities

For each specific management activity undertaken, first scout and document any invasive species present. Then conduct a risk assessment; consider threats to the property and identify options for managing invasive species. Limiting the potential spread and introduction of invasive species may include control efforts.

BMP VM 5: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

Considerations:

- a. Equipment includes but is not limited to vehicles, trailers, machinery and materials.
- b. Methods of cleaning include any one of the following, but are not limited to: (use most effective method that is practical)
 - Brush, broom, or other hand tools (used without water)
 - Car washes
 - High pressure air (some equipment may have air tank, leaf blower)
 - Steam cleaning
 - Portable wash station that contains runoff from washing equipment

Note: Containment must be in compliance with wastewater discharge regulations, See Appendix K: Accompanying Regulations for more details.
- c. Clean in an area that is easily accessible for monitoring and control if necessary.
- d. Clean equipment at the shop during routine equipment maintenance activities.
- e. Preferred locations for cleaning are those where:
 - Invasive species are already established or as near as practical to the infested area
 - Areas that are easily monitored and controlled, if necessary, for new infestations due to the cleaning activity, i.e. along an already infested road, at access points.
- f. Do not clean equipment, vehicles or trailers in or near waterways as it may promote the spread of invasives downstream.

BMP VM 6: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, and invertebrates before and after activities.

Considerations:

- a. Especially when moving from infested to uninfested sites.
- b. Plan for appropriate cleaning of clothing, footwear, and gear and inform workers about possible seeds carried on their clothing, footwear and gear.
- c. Carry appropriate equipment (i.e. wire brush, small screwdriver, boot brush) to help remove soils, seeds, plant parts, seeds and invertebrates.
- d. Preferred locations for cleaning are those where:
 - Invasive species are already established.
 - Areas that are easily monitored for new infestations due to the cleaning activity, i.e. along a road, at access points.
- e. Do not clean clothing, footwear, gear in or near waterways – it may promote the spread of invasive species downstream.
- f. Make prior arrangements to clean equipment in conjunction with the specific activity. Risk consideration varies with equipment types, with possible introduction and spread of invasive species.

BMP VM 7: Properly dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.

Considerations:

- a. Onsite disposal within an infested area is an option.
- b. Place materials in a bag and send to landfill, where possible.
- c. Materials may be composted but only if compost pile temperature reaches very high temperatures and the finished compost can be monitored for weed emergence.
- d. Materials may be disposed of in piles. Locate the pile in an area that facilitates easy monitoring and control if infestations spread from the pile.
- e. Materials may be burned. Locate the burn pile in an area that facilitates easy monitoring and control if infestations spread from the pile.

BMP VM 8: Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.

Considerations:

- a. Set up activity boundaries to exclude areas with an invasive species infestation that could easily be disturbed by equipment, workers, or users.
- b. Consider options for the sequence of operations within an activity area, and where feasible, plan to enter areas infested with invasive species last.

BMP VM 9: Consider the likely response of invasive species when conducting activities that result in disturbed soil, increased sunlight, fire, etc.

Considerations:

- a. Ground disturbance may uproot existing vegetation and expose soil, creating a seedbed for invasive plants that can overwhelm native vegetation.
- b. Mechanical means of soil disturbance, when combined with aggressive follow-up control measures, may be used to control invasive species within infested areas by depleting the seed bank.
- c. After a soil disturbance, encourage prompt regeneration of desirable vegetation to limit introduction of invasive plants.
- d. After a soil disturbance, monitor the area and treat new invasive plant infestations.
- e. Consider options for the sequence of operations within an activity area. If feasible, enter the activity area which is infested with invasive species last.
- f. Locate debris burn piles in an area that minimizes the invasive plant establishment.
- g. Incorporate invasive species considerations into the planning of prescribed burns.

BMP VM 10: Ensure that invasive species control treatments are applied within the appropriate time window.

Considerations:

- a. Consider the need for invasive species control efforts, and determine whether planned control efforts should occur prior to, after, or parallel with the primary activity.
- b. When planning vegetation management activities, consider the need for invasive species control efforts and minimizing their spread. Time the vegetation management efforts to maximize control of the target invasives in the area. Appendix D provides guidance for timing of mowing for widespread invasives. Adjust this schedule to your local area as flowering is generally 2-3 weeks later in the far northern part of the state than in the far southern part. Recognize that there are annual differences in phenology as well.
- c. If pre-treatment of invasive species is warranted prior to a planned construction or maintenance project, postpone activity until the infestation can be treated. Effective pre-treatments sometimes need to occur one to two years prior to the activity.
- d. Consider seasonal timing options to minimize the spread of invasive species, while still achieving management objectives, such as just prior to flowering or late in the season when seeds have already dropped.
- e. Options include choosing not to carry out activities where spread of invasive species will likely jeopardize property goals and uses.
- f. Consider life history of target invasive species in relation to timing of control methods (See Appendix E for a sample “Example Identifying Time Windows for Invasive Species Management”) chart; also see mowing considerations below.
- g. Allow time and resources for post-treatment follow-up control measures, due to persistent seed bank and resprouting for several years. In some areas a second mowing may be necessary if the invasives are beginning to flower a second time.

BMP VM 11: Monitor right-of-ways during day-to-day activities and post-management activities; determine necessary treatments based on the presence of invasive species.

Considerations:

- a. Monitoring the site following a management activity, and checking for new infestations of invasive species, or the spread of existing populations.
- b. Revegetation and/or restoration if necessary, depending on site conditions.
- c. Conduct periodic inspections of each site following a management activity. Anticipate response of invasive species to activities and check for new infestations or the spread of existing populations.
- d. Determine appropriate control measures to respond to new infestations or spreading populations; continue monitoring.
- e. Monitor areas where there were burn piles in order to preclude invasives from establishment.
- f. Incorporate invasive species considerations into the planning of prescribed burns.
- g. Plan ahead to obtain resources for monitoring and for management if necessary.

CHAPTER 4: TRANSPORT OF MATERIAL

Movement of materials such as: soil; mulch (woody and straw); aggregate; wood products (e.g., firewood, brush, etc), landscape material (e.g., plants, seed, etc.), erosion control materials (e.g. silt fence, hay bales, geotextile, etc), and packing/shipping materials have the potential to spread invasive species

Transport of Materials BMPs

BMP TM 1: Take steps to avoid the movement of invasives to non-infested areas during transport activities.

BMP TM 2: Prior to transporting materials, manage the load to limit the spread of invasive species.

BMP TM 3: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

BMP TM 4: Dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.

BMP TM 5: Establish staging areas and temporary facilities in locations that are free of invasive species.

BMP TM6: Use soil and aggregate material from sources that are free of invasive species.

BMP TM 7: Manage stock piles to limit the spread of invasive species.

BMP TM 8: Do not transport woody material that may contain invasive species.

BMP TM 9: If you must transport woody material that may contain invasive species, bring them to a designated area for appropriate disposal.

BMP TM 10: Keep and reuse onsite materials rather than importing new materials.

BMP TM 1: Take steps to avoid the movement of invasives to non-infested areas during transport activities.

Considerations:

- a. To minimize movement of live plant parts or viable seed, consider excluding infested areas from equipment travel corridors and staging areas.
- b. Carry out work under conditions that minimize the risk of spread, *e.g.*, frozen ground, snow cover, seed/propagules absence, etc.
- c. Take reasonable steps to avoid small, isolated, populations of invasives during transport activities.
- d. If existing access roads are infested with invasives, treat before using them.
- e. Avoid constructing new access roads in areas infested with invasive species where possible.
- f. Limit the number, width, and length of roads to help minimize soil disturbance, and to limit the risk of unintentionally transporting invasives on equipment into uninfested areas.

BMP TM 2: Prior to transporting materials, manage the load to limit the spread of invasive species.

Considerations:

- a. Secure the load using methods such as tarps, rope or plastic sheets.
- b. Reduce exposure of materials to weather elements that have the likelihood of spreading invasive insects, diseases and propagules. (i.e. dumping infested soil in high winds)
- c. Remove loose materials from side boards and tailgate prior to transport.

BMP TM 3: Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

Considerations:

- a. Methods of cleaning include any one of the following, but are not limited to: (use most effective method that is practical)
 - Brush, broom, or other hand tools (used without water)
 - Car washes
 - High pressure air (some equipment may have air tank, leaf blower)
 - Steam cleaning
 - Portable wash station that contains runoff from washing equipment

Note: Containment must be in compliance with wastewater discharge regulations, See Appendix K: Accompanying Regulations for more details.
- b. Clean in an area that is easily accessible for monitoring and control if necessary.
- c. Clean equipment at the shop during routine equipment maintenance activities.
- d. Preferred locations for cleaning are those where:
 - Invasive species are already established or as near as practical to the infested area
 - Areas that are easily monitored and controlled, if necessary, for new infestations due to the cleaning activity, i.e. along an already infested road, at access points.
- e. Do not clean equipment, vehicles or trailers in or near waterways as it may promote the spread of invasives downstream.
- f. Make prior arrangements to clean equipment in conjunction with the specific activity. Risk consideration varies with equipment types, with possible introduction and spread of invasive species.

BMP TM 4: Dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.

Considerations:

- a. Preferred locations for equipment cleaning areas are those where: equipment is unloaded and loaded and where invasive species are already established.

- b. Do not clean equipment, vehicles or trailers in or near waterways – it may promote the spread of invasives downstream.
- c. Materials may be composted but only if compost pile temperature reaches very high temperatures and the finished compost can be monitored for weed emergence.
- d. Do not dispose of soils, seeds, debris or invertebrates down a storm drain; place in plastic bags in the trash, or incinerate.
- e. Burying the propagules may be an option if deep enough to prevent regeneration.
- f. Clean transporting equipment prior to new load; consider using a liner if applicable.
- g. Consider tracking pads as a means to remove soil from equipment. If tracking pads are used they need to be thoroughly cleaned.

BMP TM 5: Establish staging areas and temporary facilities in locations that are free of invasive species.

Considerations:

- a. If infested areas can't be avoided, consider pre-treatment as an option. Follow specifications in Vegetation Management and Inspection/Monitoring Chapter.
- b. Use of farmer's fields is a good option for staging areas.

BMP TM 6: Use soil and aggregate material from sources that are free of invasive species.

Considerations:

- a. Inspect the sources or specify in a contract or work order that the source is free of invasives.
- b. Option to use infested materials below uninfested material for the top if applicable.

BMP TM 7: Manage stock piles to limit the spread of invasive species.

Considerations:

- a. The first step is to plant cover crops to prevent the establishment of invasive species. Plant fast-growing grasses to shield and bind the soil.
- b. Mechanically disturb stockpiled soil to prevent growth of invasives.
- c. Cover exposed piles of soil or construction materials with plastic sheeting.
- d. See Chapter 2: Soil Disturbance for additional guidance

BMP TM 8: Do not transport woody material that may contain invasive species.

Considerations:

- a. Consider chipping, burying or burning where allowed.
- b. Be aware of quarantine areas and other restrictions on the movement of materials.

- c. A quarantine is a system of rules administered by the USDA Animal and Plant Health Inspection Service and the WI Department of Agriculture, Trade and Consumer Protection.

For an example of an invasive insect that may be transported by woody material, see: **Wisconsin's Emerald Ash Borer Resource**. <http://emeraldashborer.wi.gov/> This site includes information on surveys, detection, and management, and includes an email address and phone number to report suspected infestations.

BMP TM 9: If you must transport woody material that may contain invasive species, bring them to a designated area for appropriate disposal.

Considerations:

- a. Designate an area for dumping woody material if it is infested with invasive species.
- b. Prior to movement, identify whether material contain invasive species.
- c. Pre-treat woody material prior to movement (more insect and disease related).
- d. Consider end source of woody material before disposal (i.e. brush to chip, chip to mulch, bio-fuels)
- e. Remove soil from stumps and trees.

BMP TM 10: Keep and reuse onsite materials rather than importing new materials.

Considerations:

- a. Consider keeping materials on-site to limit transport.
- b. Remove soil and plant material from waste (concrete, packing materials, etc) before transport.
- c. Check shipping/packing materials for invasive plant materials
- d. See Appendix J: Resources
- e. Follow current state regulations on Invasive Species and monitoring.

Aquatic Invasive Species: To prevent the spread of aquatic invasives, avoid moving water from one water body to another. This may include cleaning equipment that comes in contact with water infested with invasive species. For example, any equipment that draws water from one water body should not be drained into another water body. Part of general maintenance, equipment, portable pumps and hoses, should be flushed and run with clean water between uses. Also, water bodies with particularly virulent diseases (e.g. Viral Hemorrhagic Septicemia) should be recognized and operations adjusted to avoid transporting the disease. For more information See Appendix K.

CHAPTER 5: REVEGETATION AND LANDSCAPING

Very few disturbed areas will regenerate satisfactorily in a reasonable time without assistance. A properly managed revegetation program can ensure the effective return of the land to a self sustaining condition. Revegetation should establish a sound basis for the ecosystem to develop over time. Site specific revegetation should address site preparation, species selection, and overall maintenance of the area. The activities to reduce invasives are intended to compliment other practices addressing such things as erosion control, proper drainage, and protecting the initial investment in the infrastructure

It is recognized in this manual that there is certainly overlap within cities, towns and villages in regard to revegetation within rights-of-way. The Wisconsin Urban Forestry Best Management Practices for Invasive Species will also address the rights-of-way in cities.

The following BMPs for Revegetation were developed to accomplish these goals and are provided in greater detail below:

Revegetation and Landscaping BMPs

Planning

BMP RV 1: Plan activities to limit the potential introduction and spread of invasive species, prior to revegetation.

BMP RV 2: Select noninvasive or native species for revegetation and landscaping activities.

Activities

BMP RV 3: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, or invertebrates before and after activities.

BMP RV 4: Prior to moving equipment out of an infested area and into an uninfested area clean soil and debris from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

BMP RV 5: Revegetate disturbed soils as soon as feasible to minimize invasive species establishment.

BMP RV 6: Allow natural revegetation of the ground layer to occur only where site conditions permit.

BMP RV 7: Ensure the species specified in the plan are the ones being used.

BMP RV 8: Monitor the revegetation site for invasive species.

Planning

BMP RV 1: Plan activities to limit the potential introduction and spread of invasive species, prior to revegetation.

Considerations:

- a. Provide training in identification of locally known invasive plants and pests to workers on-site.
- b. Evaluate the level of infestation and land use on adjacent properties when planning revegetation.
- c. Site preparation: when to do things, think about the timing of activities to ensure the revegetation works.
- d. Surface preparation should serve to optimize plant establishment and minimize soil erosion.
- e. Have a detailed revegetation and landscaping plan and specify the timeline of monitoring.

BMP RV 2: Select noninvasive or native species for revegetation and landscaping activities.

Considerations:

- a. Identify sources of native and appropriate nonnative materials.
- b. When seeding and/or planting, use non-invasive cover crops, non-native species that are not invasive or native seed or plants.
- c. Use local native ecotypes when feasible.
- d. Prior to planting make sure seed chosen will not negatively impact the vegetation on adjacent land, i.e. although not recommended, if you are going to plant crown vetch, do not plant it next to native grasslands.
- e. For species recommended for revegetation See Appendix G.

Table 1: Do not use these species for corridor plantings. Many previously recommended species are now presenting invasive problems.

Common Name	Latin Name
smooth brome grass	<i>Bromus inermis</i>
crown vetch	<i>Coronilla varia</i>
quack grass	<i>Elytrigia repens</i>
flat pea	<i>Lathyrus sylvestris</i>
lespedeza	<i>Sericea lespedeza</i>
bird's foot trefoil	<i>Lotus corniculatus</i>
big leaf lupine	<i>Lupinus polyphyllus</i>
white sweet clover	<i>Melilotus albus</i>
yellow sweet clover	<i>Melilotus officinalis</i>
reed canary grass	<i>Phalaris arundinacea</i>

Activities

BMP RV 3: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, or invertebrates before and after activities.

Considerations:

- a. Plan for appropriate cleaning of clothing, footwear, and gear and inform workers about possible seeds carried on their clothing, footwear and gear.
- b. Carry appropriate equipment (i.e. wire brush, small screwdriver, boot brush) to help remove soil, plant parts, seeds and insects.
- c. Preferred locations for cleaning are those where: 1) Invasive species are already established. 2) Areas that are easily monitored for new infestations due to the cleaning activity, i.e. at access points.

BMP RV 4: Prior to moving equipment out of an infested area and into an uninfested area clean soil and debris from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.

Considerations:

- a. Methods of cleaning include any one of the following, but are not limited to: (use most effective method that is practical)
 - Brush, broom, or other hand tools (used without water)
 - Car washes
 - High pressure air (some equipment may have air tank, leaf blower)
 - Steam cleaning
 - Portable wash station that contains runoff from washing equipment

Note: Containment must be in compliance with wastewater discharge regulations, See Appendix K: Accompanying Regulations for more details.
- b. Preferred locations for cleaning are those where:
 - Invasive species are already established or as near as practical to the infested area
 - Areas that are easily monitored and controlled, if necessary, for new infestations due to the cleaning activity, i.e. along an already infested road, at access points.
- c. Clean equipment at the shop during routine equipment maintenance activities.
- d. Do not clean equipment, vehicles or trailers in or near waterways as it may promote the spread of invasives downstream.
- e. Make prior arrangements to clean equipment in conjunction with the specific activity. Risk consideration varies with equipment types, with possible introduction and spread of invasive species.

BMP RV 5: Revegetate disturbed soils as soon as feasible to minimize invasive species establishment.

Considerations:

- a. Prior to revegetating disturbed soils, scout for and manage invasive species germinating or resprouting within disturbed area.
- b. Treatment options include herbicide use, till under, etc.

- c. Mulching may aid in revegetation. Mulch should be chosen carefully as it may contain invasive species seed. Choose weed free mulch whenever possible. (See Appendix J: Resources)
- d. Utilize cover crops as temporary cover when delay between disturbance and planting. (See Appendix J: Resources)

BMP RV 6: Allow natural revegetation of the ground layer to occur only where site conditions permit.

Considerations:

- a. Situations in which natural revegetation may occur include:
 - The adjacent landscape contains no invasive plants (such as a prairie remnant or high quality sedge meadow).
 - The adjacent landscape contains few invasive plants and the topsoil has been left intact.
 - The adjacent landscape contains few invasive plants and the topsoil has been segregated and replaced during construction.
 - The adjacent landscape is extensively infested by invasive plants because actively revegetating will likely fail (such as reed canary grass dominated wetland).
- b. While assessing the likelihood of natural revegetation, other than the presence of invasive plants, it is important to consider other factors including:
 - Soil type- less rich soils may revegetate slowly and may require monitoring to ensure natural revegetation.
 - Moisture levels- low soil moisture or a droughty site will limit revegetation.
 - Time of year- the heat of summer may not be conducive to revegetation or if the growing season is coming to a close.
 - It may be necessary to use a cover crop to stabilize soils as natural revegetation occurs.

BMP RV 7: Ensure the species specified in the plan are the ones being used.

Considerations:

- a. Watch out for substitutions.
- b. Watch out for naming inconsistencies.
- c. Check label for purity, composition and germination consistent with entity requirements.
- d. Make sure entity has recourse options if invasive seeds or plants are used.

BMP RV 8: Monitor the revegetation site for invasive species.

Considerations:

- a. Monitor rights-of-way during routine activities; determine necessary treatments based on presence of invasive species.

- b. Make sure the correct species have been used as specified.
- c. Follow the revegetation plan.
- d. Maintenance – effective maintenance is essential especially where seed and plants are placed in a challenging environment (i.e. low nutrient soil, dry, etc.). Maintaining new vegetation will ensure long term establishment.
- e. If control treatments are planned ensure that they are applied within the appropriate time window.
 - Consider life history of target invasive species in relation to timing of control methods.
 - Allow enough time for control prior to activity.
 - Allow time and resources for post-activity follow-up control measures, due to persistent seed bank and resprouting.

APPENDICES

Appendix A: Lists of Terrestrial Invasive Plants

There exists both formal and informal invasive plant lists for the state of Wisconsin and the surrounding region. Among these, no two lists are the same, in part because the agencies, organizations and groups who created them can have differing points of view about the invasiveness of some species. This is natural considering invasiveness varies due to location, habitat type, disturbance history, urban versus rural locations, proximity to propagules, and many other factors. In short, what may be invasive in one environment may not be invasive in another. Because no individual list will be able to meet the needs of every utility and transportation corridor worker in Wisconsin, we have put together a list of lists and have attempted to explain how they were compiled so that the user can decide for themselves which list best meets their needs. Keep in mind the lists are continually being updated as new invasive plant species appear in Wisconsin and as additional research is being reported. It is important to remember that regardless if a particular species is included in a list, implementation of the BMPs should be effective at preventing or slowing the spread of any species.

Lists:

1) Wisconsin Department of Natural Resources (WDNR)—Invasive Plant Species Regulated Under NR 40 and Plant Species Not Regulated by NR 40

<http://dnr.wi.gov/invasives/classification/>

The species lists, developed as part of the Wisconsin DNR's Invasive Species Identification, Classification and Control rule— NR 40, were created with input from the DNR, the Wisconsin Council on Invasive Species, and Species Assessment Groups (SAGs) comprised of experts in their respective fields and stake-holder groups. The SAGs reviewed literature summaries and made recommendations to the Council. The rule identifies invasive species in each specific category based on criteria and will place restrictions on those species that are classified as prohibited or restricted. This list is not all-inclusive. Additional species are or will be under review and it will be periodically updated.

2) Wisconsin Department of Natural Resources (WDNR)—Invasive Species Plants.

<http://dnr.wi.gov/invasives/plants.asp>

This is an informal list first created in 1992 by Wisconsin Department of Natural Resource staff with a great deal of input from land managers throughout the state. Species have been and continue to be added as they are brought to the attention of DNR staff. The list consists of species that appear to be anecdotally invasive, are widespread or are known to be significantly invasive outside of Wisconsin and have the potential to naturalize in our state. The list also includes native species with invasive tendencies.

3) Invasive Plants Association of Wisconsin—IPAW Working List of the Invasive Plants of Wisconsin.

<http://www.ipaw.org/list/index.htm>

The mission of IPAW, a private, nonprofit org is to advance understanding of invasive plants and encourage their control to promote stewardship of the natural resources of Wisconsin. In order to carry out their mission, members of IPAW created a working list of plants that are invasive in the natural plant communities and wild areas of Wisconsin. The list was created by a formal process that involved the collection of a wide variety of personal observations and experience of natural area and plant experts by survey. The survey was conducted in 2002 and the list was published in March 2003. It has not been updated since. The IPAW list does not include agricultural weeds; it focuses on plants that invade natural plant communities. It does not include plants that are native to Wisconsin. Those non-native species that are not known to be currently invasive in Wisconsin, but that are invasive in similar eco-regions and may have the potential to become invasive in the state, are presented separately in the "IPAW Working List of the Potentially Invasive Plants for Wisconsin". The IPAW list also does not take into consideration cultivar and varietal differences in potential invasiveness.

Appendix B: Short List of Invasive Insects and Diseases for Wisconsin

The lists below are provided for educational purposes for use in conjunction with the BMPs. The lists represent insects and diseases, native or non-native, that are the most destructive or threatening to Wisconsin's urban forests. Species are listed in alphabetical order; they are not listed in order of priority. These species may already be present in our state or they have the potential to be here in the near future. The lists may be updated as new invasive species appear in or threaten Wisconsin.

Those species assessed by Species Assessment Groups are **in bold**. Species Assessment Groups, comprised of experts in their respective fields and stake-holder groups, were asked to review literature summaries and to make recommendations to the Wisconsin Council on Invasive Species as how to categorize species for WDNR's Invasive Species Identification, Classification, and Control Rule (NR 40).

The lists are not comprehensive. Refer to **Appendix J: Resources** for links to more information about the species listed and other invasive insect and disease species.

Invasive Insects

Common name	Scientific Name	Preferred Host Species
European gypsy moth	<i>Lymantria dispar</i> (European race)	<i>hardwoods; oaks preferred</i>
Japanese beetle	<i>Popillia japonica</i>	<i>many hosts</i>
Emerald ash borer	<i>Agrilis planipennis</i>	<i>all species of ash (Fraxinus spp.)</i>
Asian longhorned beetle	<i>Anopliophora glabripennis</i>	<i>hardwoods; maples preferred</i>
Sirex woodwasp	<i>Sirex noctilio</i>	<i>pin</i>
Hemlock wooly adelgid	<i>Adelges tsugae</i>	<i>Eastern and Carolina hemlock</i>
Asian gypsy moth	<i>Lymantria dispar</i> (Asian race)	<i>hardwoods & conifers</i>

Invasive Diseases

Common name	Scientific Name	Preferred Host Species
Diplodia shoot blight	<i>Diplodia pinea</i>	<i>pin</i> ; red, scots, jack & Austrian preferred
<i>Cytospora spp.</i>	<i>Cytospora kunzei var. picea</i>	<i>Norway & Colorado blue spruce preferred</i>
Oak wilt	<i>Ceratocystis fagacearum</i>	<i>oaks; red/black family preferred</i>
White pine blister rust	<i>Cronartium ribicola</i>	<i>5-needled pin</i>
Dutch elm disease	<i>Ophiostoma ulmi</i>	<i>American elm most susceptible</i>
Fire blight	<i>Eweinaia amylovora</i>	<i>rose, apple, pear</i>
Sudden oak death	<i>Phytophthora ramorum</i>	<i>many hosts</i>
Butternut canker	<i>Sirococcus clavignenti-juglandacearum</i> (pathogen)	<i>butternut</i>

Species in bold were assessed by Species Assessment Groups comprised of experts in their respective fields and stake-holder groups. The Species Assessment Groups were asked to review literature summaries and to make recommendations to the Wisconsin Council on Invasive Species as how to categorize species for the Invasive Species Identification, Classification and Control Rule (NR 40).

<http://dnr.wi.gov/invasives/classification/>

Appendix C: Guidance to Assist Entities in Determining Priority Terrestrial Invasive Plant Species for Identification and Management

This appendix is to help identify which invasive plant species are in the area in order to schedule vegetation management activities to minimize the spread.

Introduction

Preventing seed dispersal is crucial for *preventing the spread and introducing* many invasive species. Mowing should be carefully considered to ensure that invasive species will not actually be spread by the practice.

Most invasive plants are spread by seeds. Seeds come from flowers that have been pollinated. Many invasive plants produce seeds only a few weeks after flowering begins. The flowers of some plants can continue developing seeds even after they are cut. Mowing or cutting just prior to flowering eliminates the possibility that seeds can develop and weakens the plants. Many plants can reflower several weeks after the initial mowing. A second mowing can again prevent seed set.

Recommendations

Vegetation management consists of mowing herbaceous plants, clearing woody plants (which may include mowing), and using herbicide for either. For this reason, the list of species to be considered needs to include a broad suite of invasive plants. The intent is to not assume that each species is in any given ROW, rather to provide a process to understand the threats and as awareness increases, adjust to it. With the help of partners, the species of concern can be determined given any situation (see Inventory below). Either type of plant life form has the potential to spread from management activities, but the herbaceous plants are a greater threat due to greater seed production and timing of mowing.

Some species are only found in parts of the state, certain soils, or the correct level of moisture. In any given geographical area, there will likely be a few dominant ROW invasives with others likely to invade if their seeds are introduced to the area. See below for a list of invasive plants likely to be found in transportation and utility corridors.

The list of plants includes species that have different habitat types and is indicated as such within List A. This should aid in determining which species are or may be present. There is also a clear distinction of distribution based on where in the state you are. The suite of species between the north and south is quite different. There is what is described as the tension zone which is a swath that runs approximately from Polk County to Milwaukee County. This zone is a rough break between northern and southern species. Recognize that invasive plants do not cleanly follow the zone, but it is another guide.

Furthermore, the emergence, leaf-out and flowering times of plants are generally 2-3 weeks later in the far north than the southern border. When using the mowing timing guidance, adjust for the difference by sliding the bars 2-3 weeks to the right. The concept behind the chart in Appendix D is to act as a guide; nothing in nature is as simple as a chart. Any given year there may be local climate issues, such as drought or cold, which will alter the timing schedule either direction from that listed in Appendix E. The best thing to do is actually go out and observe the particular species in your area or inquire with others to best determine the time to conduct any management.

By using a combination of identification tools during normal activities, partnering with others to help identify populations, and use of the distribution maps, you should be able to develop a list of invasive species present on your ROWs. Assessing the abundance and location of each of these species will help guide your mowing schedule.

Training and Identification

In the beginning, the hope is to develop a target list of species from List A below, which is a short list of species likely to be found in corridors. As crews and others then become more aware and can identify more species, the target list would grow.

Inventory

A major part of making the BMPs happen is having an understanding of what invasive species are in the corridors. Inventory activities can be done in two ways: during normal daily activities (cruising, inspections, surveying etc.) and by partners.

The use of partners includes CWMAs and other groups or individuals to assist in the identification and distribution of invasives in your area. It would simplify matters if each entity (local unit of government, company) has a single point of contact to manage the information and then appropriately disseminate to the crews. For example, if the local CWMA is willing to map invasive populations along county roads, they would then forward that information to the contact person at the county level. Then the information could be used to schedule vegetation management activities based on the distribution and the mowing guidance, among others.

This protocol would easily work for the species in List A. However, there are many species that are less common, locally abundant and in many ways a larger threat than the more common species. For instance, if there is a known population of a less common species, (let's say poison hemlock) in a specific county, that species should be identified and managed appropriately. This would take more coordination on some accounts. Therefore it is critical to develop the process of mapping the populations.

There are many efforts in Wisconsin to map invasives. Unfortunately there is nothing in place yet that one could use that is comprehensive. Thus, we are forced to manage it the best we can until something is developed to meet all of our needs.

Management

Vegetation management will vary depending on the type of corridor, although there is overlap. In general, highway corridors vegetation management consists of mowing herbaceous plants. Prior to scheduling mowing times it is important to know what species you are trying to contain by mowing. The timing of the mowing is critical to prevent the spread. For the majority of species, it is best to mow just before the plants bloom. This should prevent seeds from developing. Some plants can successfully produce mature fruits even if mowed during flowering. In general, never mow through an infestation that has already set seed. It will just spread the seeds further. If possible, skip mowing that year.

Although a few grassland bird nests might be impacted, most can re-nest. Research has shown that maintaining good vegetation structure is important to grassland nesting birds and that allowing their habitat to be over-taken with invasives may be more damaging to the birds.

**Managing Habitats for Grassland Birds: A Guide for Wisconsin, Wisconsin Department of Natural Resources, PUBL-SS-925-97. Sample, David W. and Micheal J. Mossman. 1997*

List of Invasive Plants likely to be found in transportation and utility corridors:

Herbaceous plants:

- Bird's foot trefoil
- Common tansy
- Common teasel
- Cut-leaved teasel
- Crown vetch
- Dame's rocket
- Garlic mustard
- Japanese knotweed
- Leafy spurge
- Canada thistle
- Musk or nodding thistle
- Plumeless thistle
- Phragmites
- Purple loosestrife
- Reed canary grass
- Spotted knapweed
- Sweet clovers (white and yellow)
- Wild parsnip

Trees and shrubs:

- Autumn olive
- Black locust
- Common buckthorn
- Eurasian bush honeysuckles (Bell's Morrow, taratarian)
- Glossy buckthorn

Early Detection species: *example* - One way to minimize the damage an invasive species may inflict on an ecosystem is to control or eliminate the species when its populations are still small, for example, an **early detection** survey could be used to determine whether purple loosestrife is present in a wetland.

Herbaceous plants:

- Black swallowwort
- Sericea lespedeza
- Cypress spurge
- European marsh thistle
- Japanese hedge parsley
- Japanese hops
- Japanese stilt grass
- Giant hogweed
- Hill mustard
- Hound's tongue
- Oriental bittersweet
- Poison hemlock
- Scotch broom
- Spreading hedge parsley
- Wild chervil
- Yellow star thistle

Trees and shrubs:

- Amur honeysuckle
- Japanese barberry
- Tree-of-heaven

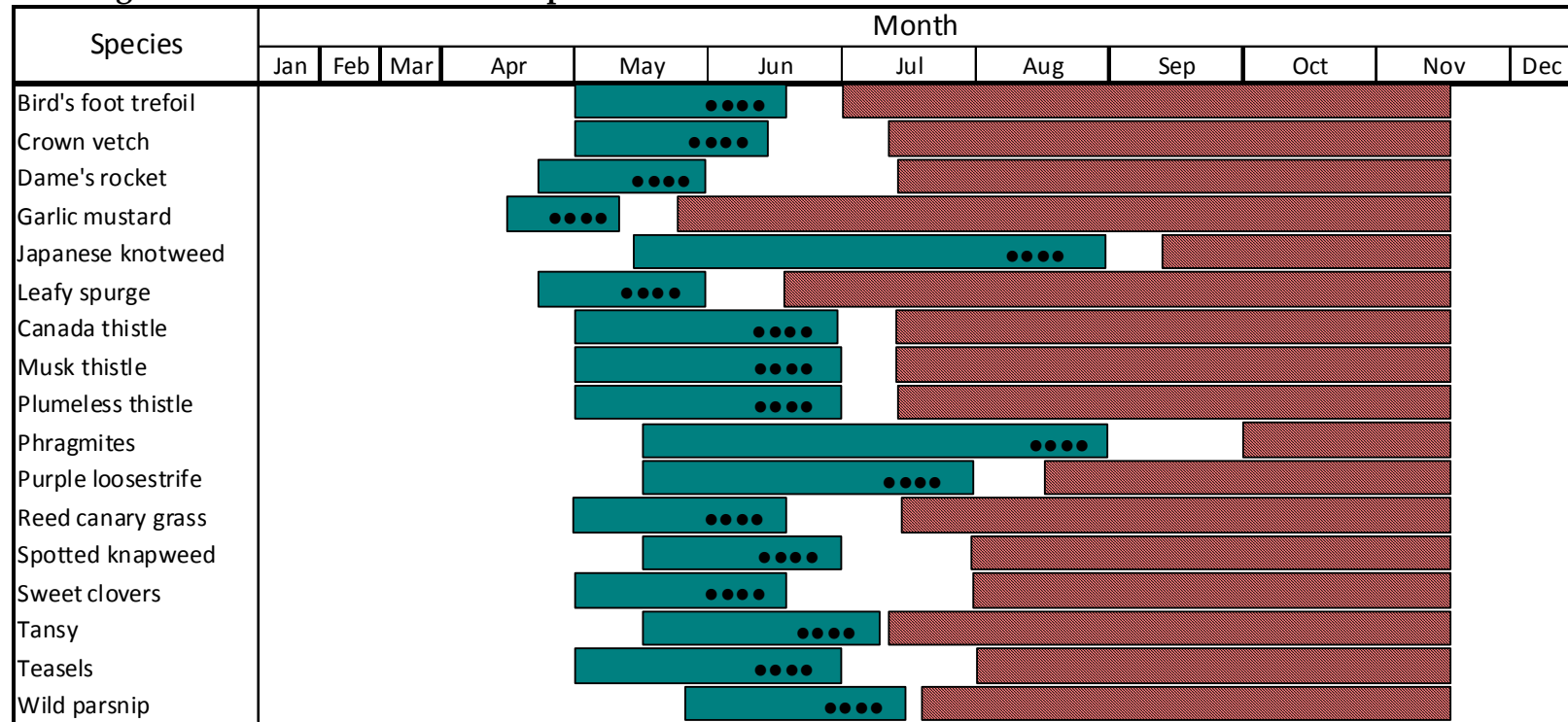
Please note: (For further information see **Appendix E: Example Identifying Time Windows for Invasive Species Management** as well as **Appendix D: Mowing Timing Guidance**)

Appendix D: Mowing Timing Guidance

Suggested mowing times for select species in southern Wisconsin

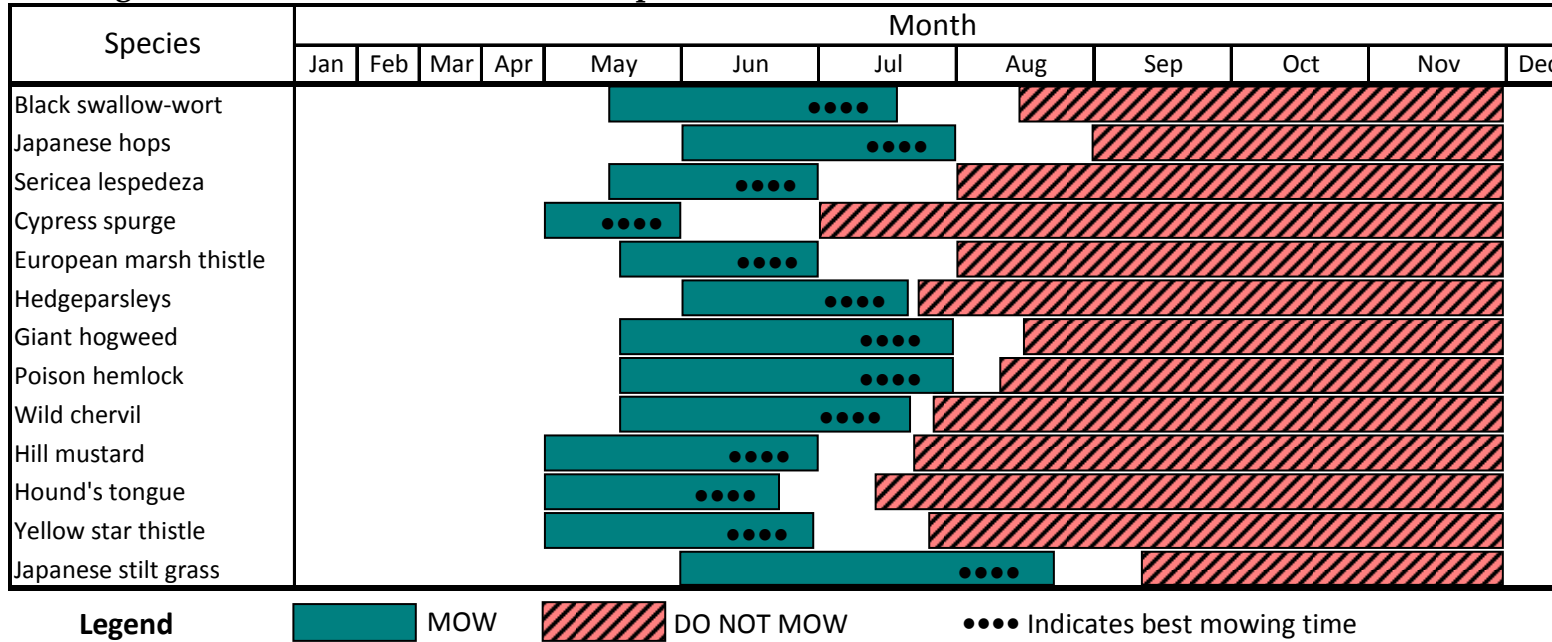
Mowing can be an effective control for some invasive species; however it can spread those species if not timed correctly. Mowing can be done multiple times per growing season (into the “Do Not Mow” time) to prevent seed production and to deplete root reserves; however the first mowing should occur when the target invasive is just about to flower or in the early flowering stage. Avoid mowing if seeds have already developed as this will spread them. Emergence, flowering and seeding times vary from year to year for most species; the charts show average times. These times become later as you move north or for areas near the Great Lakes.

Mowing times for common invasive species in southern Wisconsin



Legend ■ MOW ■ DO NOT MOW •••• Indicates best mowing time

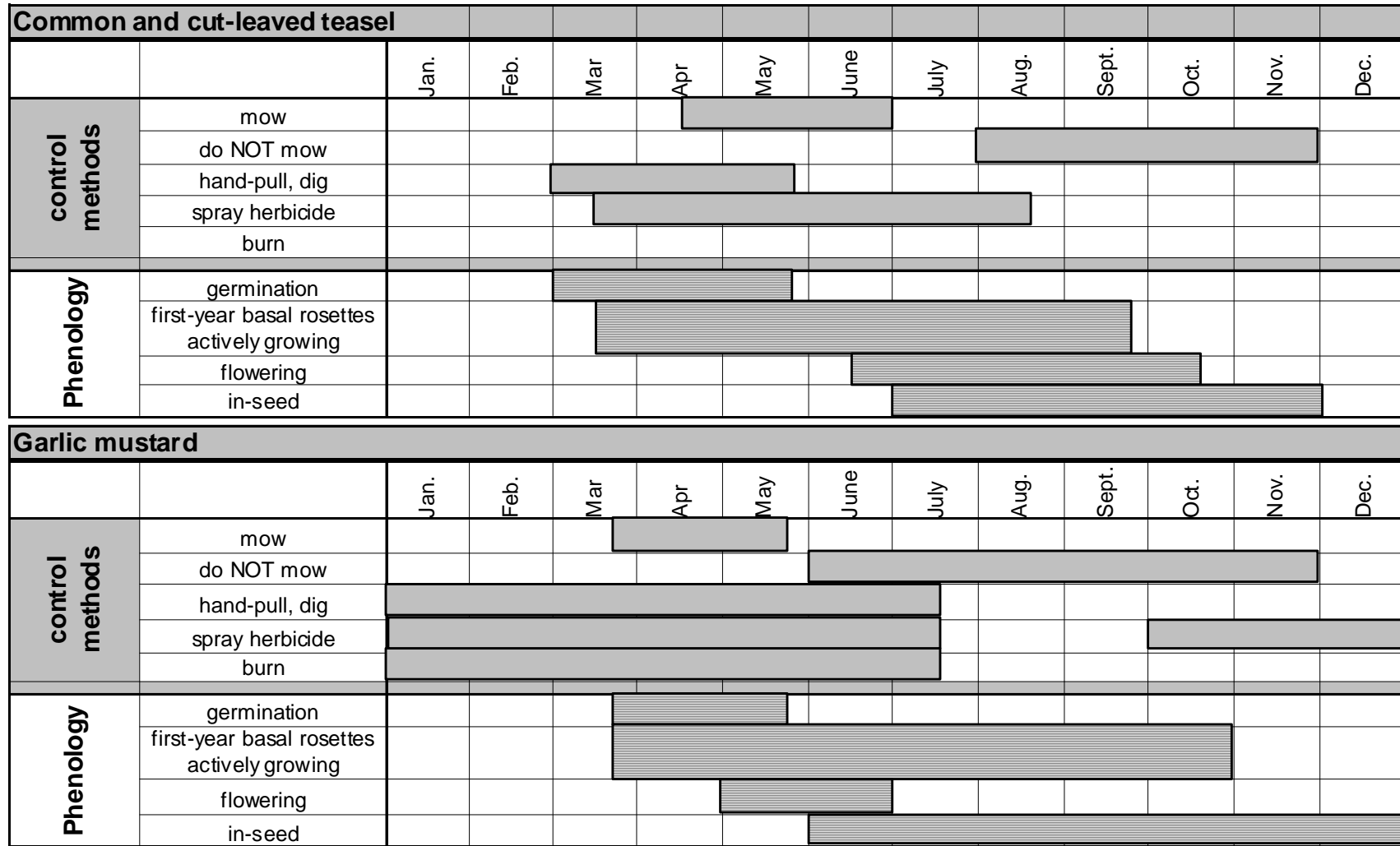
Mowing times for less common* invasive species in southern Wisconsin



* These species are not yet common in most of Wisconsin and need to be contained if found where prohibited.

Appendix E: *Examples*: Identifying Time Windows for Invasive Species Management

* These charts are intended as **examples**, while it is important to eventually determine the size of invasive species patches in an ecosystem only identification and early detection can determine if a species is present or absent.



Most invasive plants are spread by seeds. Seeds come from flowers that have been pollinated. Many invasive plants produce seeds only a few weeks after flowering begins. The flowers of some plants can continue developing seeds even after they are cut. Mowing or cutting just prior to flowering eliminates the possibility that seeds can develop and weakens the plants. Many plants can re-flower several weeks after the initial mowing. A second mowing can again prevent seed set.

Appendix F: Overview of Control Methods

Manual control techniques include activities such as hand-pulling, digging, flooding, mulching, burning, removal of alternate hosts, and manual destruction or removal of nests, egg masses or other life stages. These techniques work best on small populations or in areas where chemicals or motorized equipment cannot be used. Manual control efforts must be persistent and several treatments may be needed to reduce or eliminate the target population. If infestations are too pervasive, manual control may become labor intensive and thus not economically feasible.

Mechanical control techniques include hoeing, cutting, girdling, tilling, mowing, chopping and constructing barriers using tools or machines. These techniques are most useful in areas with large infestations where terrain does not create safety or equipment issues. Repeated mowing or cutting of invasive plants can weaken the population by depleting root reserves and preventing flowering; however, mechanical control is typically most effective when used in conjunction with herbicide treatments. If infestations are small, the cost of mechanical control is usually relatively low, and when combined with other treatments it can be very effective. However, cutting large populations of woody invasive plants can become labor and resource intensive.

Chemical control refers to the use of pesticides, and for all practical purposes, some invasive organisms cannot be controlled without the use of pesticides. There are many kinds of herbicides, insecticides, and fungicides, and not all of them will be appropriate for every situation. The choice of pesticide depends on the target population, stage of growth, the presence of desirable species that may be affected, the proximity of water resources and environmental conditions. Additionally, there may be some areas where chemical control is inappropriate, for example if rare species are present. Pesticides must always be applied in accordance with the label. Landowners should possess the proper equipment and the knowledge to safely apply chemicals or hire a licensed applicator. Proper personal protection gear should be used, and materials to contain spills should be kept close by. Major invasive plant infestations may require complete stand removal, using herbicides to remove the invasives after harvest, and establishing a plantation of native tree species.

Biological control refers to the use of animals, fungi, or diseases to control invasive populations. Control organisms usually come from the native range of the target species, and require a period of study to ensure that they will remain specific to the target population, and will not harm native species, crops, or other ornamental species. Biological control typically does not eliminate the invasive species, and usually takes several years to show results. However, biological control has been effective for some species.

Examples include the *Galerucella* beetle which has been used with some success to control the European perennial purple loosestrife (*Lythrum salicaria*), and two species of parasitic wasp (*Agathis pumila* and *Chrysocharis laricinellae*) which were introduced to control larch casebearer (*Coleophora laricella*) infestations in tamarack.

Appendix G: Species Recommended for Revegetation

Plant species listed in this appendix may be purchased at a variety of nurseries and sales outlets. Many species can be grown from seed, while others are typically sold as living plants, and some are available as both seed and plants. See the Wisconsin Department of Natural Resources website at <http://dnr.wi.gov/org/land/er/plants/nurseries.htm> for a list of native plant nurseries and ecological consultants in Wisconsin. Ask the nursery supplying the seed or plants for help selecting site-appropriate species and determining proper seeding or planting rates.

Species chosen for seeding or planting must be appropriate for site conditions. If soil or moisture conditions are variable across the site, more than one seeding or planting mix may be needed. Using species unsuited to the site will not usually provide satisfactory revegetation, as survival is likely to be poor. Other important considerations when selecting seed mixes or plant materials include: project objectives, project size, budget, timeline, seed availability, and species already present on the site. Nursery staff can usually help you develop a seeding or planting strategy that is appropriate for site conditions and project objectives.

Seeding rate is the number of seeds or weight of seed needed for planting per unit area (acre, hectare, etc.). Seeding rates can vary greatly depending on species used (aggressive vs. less aggressive species, size of plant), site conditions (e.g. steep slopes, low moisture, weed competition, etc.) and seeding method (e.g. mechanical, hand broadcasting, hydroseeding etc.). When using live plant materials, the density of planting (i.e. planting rate) will also need to be considered keeping in mind many of the above factors. Determining an appropriate seeding or planting rate is important because rates that are too high waste money and materials, and rates that are too low may not provide the desired revegetation.

It is important to use seed that does not contain weed seeds, especially invasive weed seeds. One way to do this is to purchase Pure Live Seed. Pure Live Seed (PLS) is a measure of seed quality. A bag of seed often includes inert material such as dust, chaff, and empty seed; weed seed; and Pure Live Seed (PLS) of the desired species. Percentage Pure Live Seed is calculated by multiplying the *percent germination* by the *percent purity* of the seed; then dividing by 100.

For example: $(95\% \text{ germination} \times 80\% \text{ purity})/100 = 76\% \text{ PLS}$

Seeds with a low PLS will need to be sown at a higher rate than seeds with a high PLS. Seeds with a higher PLS cost more per unit, but more of what you plant will germinate, so less is needed. Not all species are tested for Pure Live Seed.

Sources:

Dorner, J. An Introduction to Using Native Plants in Restoration Projects. Plant Conservation Alliance, Bureau of Land Management and US Environmental Protection Agency. <http://www.nps.gov/plants/restore/pubs/intronatplant/planting.htm> Accessed 11/15/07.

Harper-Lore, B. Roadside Use of Native Plants: Specifying a Native Planting Plan, Specifications from Experience. Federal Highway Commission. http://www.fhwa.dot.gov/environment/rdsduse/rd_use11.htm

Plant Species		Revegetation Method		Life-cycle ²	Site Characteristics						Range in WI ³
Common Name	Scientific Name	Seedlings ¹	Seed		Dry	Dry-Mesic	Mesic	Wet	Shady	Open	
Shrubs											
Juneberry	<i>Amelanchier spp.</i>	√	√	P	•	•	•		◆	◆	N, C, S
Black Chokeberry	<i>Aronia melanocarpa</i>	√	√	P		•	•	•		◆	N, C, S
Sweet Fern	<i>Comptonia peregrina</i>	√		P	•	•				◆	N, C
Alt-leaved Dogwood	<i>Cornus alternifolia</i>	√	√	P		•	•		◆	◆	N, C, S
Silky Dogwood	<i>Cornus amomum</i>	√	√	P			•	•		◆	N, C, S
American Hazelnut	<i>Corylus americana</i>	√	√	P	•	•	•			◆	N, C, S
Beaked Hazelnut	<i>Corylus cornuta</i>	√		P	•	•	•		◆	◆	N, C
Northern Bush-Honeysuckle	<i>Diervilla lonicera</i>	√		P	•	•	•			◆	N, C, S
Winterberry	<i>Ilex verticillata</i>	√		P			•	•	◆	◆	N, C, S
Pin cherry	<i>Prunus pennsylvanica</i>		√	P	•	•	•			◆	N, C, S
Sand Cherry	<i>Prunus pumila</i>	√	√	P	•	•				◆	N, C, S
Common Juniper	<i>Juniperis communis</i>		√	P	•	•				◆	N, C, S
Early Wild Rose	<i>Rosa blanda</i>	√	√	P	•	•	•		◆	◆	N, C, S
Upland Willow	<i>Salix humilis</i>	√		P		•	•			◆	N, C, S
American Elder	<i>Sambucus canadensis</i>	√	√	P			•	•		◆	N, C, S
Maple-leaved Viburnum	<i>Viburnum acerifolium</i>	√		P		•	•		◆		N, C, S
Nannyberry	<i>Viburnum lentago</i>	√	√	P		•	•	•	◆	◆	N, C, S
Arrow-wood	<i>Viburnum rafinesquianum</i>	√	√	P		•	•		◆		N, C, S
Grasses and Sedges											
Big Bluestem	<i>Andropogon gerardii</i>	√	√	P	•	•	•			◆	N, C, S
Bluejoint Grass	<i>Calamagrostis canadensis</i>	√	√	P			•	•		◆	N, C, S
Oval Sedge	<i>Carex bicknelli</i>	√	√	P		•	•		◆		C, S
Poverty Oat Grass	<i>Danthonia spicata</i>		√	P	•	•				◆	N, C, S
Canada Wild-Rye	<i>Elymus canadensis</i>	√	√	SP		•	•	•		◆	N, C, S
Virginia Wild-Rye	<i>Elymus virginicus</i>		√	SP		•	•	•		◆	N, C, S
Common Rush	<i>Juncus effusus</i>	√	√	P				•		◆	N, C, S
Path Rush	<i>Juncus tenuis</i>		√	P		•	•	•	◆	◆	N, C, S
June Grass	<i>Koeleria macrantha</i>		√	P	•	•				◆	N, C, S
Switch Grass	<i>Panicum virgatum</i>	√	√	P	•	•	•	•	◆	◆	N, C, S
Little Bluestem	<i>Schizachyrium scoparium</i>	√	√	P	•	•				◆	N, C, S

Indian Grass	<i>Sorghastum nutans</i>	√	√	P	•	•	•	♦	♦	N, C, S
Prairie Cord Grass	<i>Spartina pectinata</i>	√	√	P			•	•	♦	N, C, S
Needle Grass	<i>Stipa spartea</i>	√	√	P	•	•			♦	C, S
Forbs										
Canada Anemone	<i>Anemone canadensis</i>	√	√	P			•	•	♦	N, C, S
Thimbleweed	<i>Anemone cylindrica</i>	√	√	P	•	•	•		♦	C, S
Columbine	<i>Aquilegia canadensis</i>	√	√	SP		•	•		♦	N, C, S
Common Milkweed	<i>Asclepias syriaca</i>	√	√	P	•	•	•		♦	N, C, S
Smooth Aster	<i>Aster laevis</i>	√	√	P	•	•	•		♦	N, C, S
New England Aster	<i>Aster novae-angliae</i>	√	√	P			•	•	♦	N, C, S
Frost Aster	<i>Aster pilosus</i>	√	√	P	•	•			♦	N, C, S
Swamp Aster	<i>Aster puniceus</i>	√	√	P			•	•	♦	N, C, S
Flat-topped Aster	<i>Aster umbellatus</i>	√	√	P			•	•	♦	N, C, S
Prairie Coreopsis	<i>Coreopsis palmata</i>	√	√	P	•	•	•		♦	N, C, S
Fireweed	<i>Epilobium angustifolium</i>	√	√	P		•	•		♦	N, C, S
Joe-pye Weed	<i>Eupatorium maculatum</i>	√	√	P			•	•	♦	N, C, S
Boneset	<i>Eupatorium perfoliatum</i>	√	√	P			•	•	♦	N, C, S
Wild Strawberry	<i>Fragaria virginiana</i>	√	√	P	•	•			♦	N, C, S
Wild Geranium	<i>Geranium maculatum</i>	√		P		•	•		♦	N, C, S
Sweet everlasting	<i>Gnaphalium obtusifolium</i>		√	A	•	•			♦	N, C, S
Sneezeweed	<i>Helenium autumnale</i>	√	√	P			•	•	♦	N, C, S
Woodland sunflower	<i>Helianthus divaricatus</i>	√	√	P	•	•	•		♦	C, S
Saw-tooth Sunflower	<i>Helianthus grosseserratus</i>		√	P	•	•	•		♦	N, C, S
Few-leaved Sunflower	<i>Helianthus occidentalis</i>	√	√	P	•	•	•		♦	N, C, S
Early Sunflower	<i>Heliopsis helianthoides</i>	√	√	P	•	•			♦	N, C, S
Canada Hawkweed	<i>Hieracium Kalmii</i>	√	√	P	•	•			♦	N, C, S
Round-headed Bush Clover	<i>Lespedeza capitata</i>	√	√	P	•	•			♦	N, C, S
Rough Blazing Star	<i>Liatris aspera</i>	√	√	P	•	•			♦	N, C, S
Northern Plains Blazing Star	<i>Liatris ligulistylis</i>	√	√	P		•	•		♦	N, C, S
Wild Bergamot	<i>Monarda fistulosa</i>	√	√	P		•	•		♦	N, C, S
Wood Betony	<i>Pedicularis canadensis</i>	√	√	P	•	•			♦	N, C, S
Blue Phlox	<i>Phlox divaricata</i>	√	√	P		•	•		♦	N, C, S
Yellow Cone Flower	<i>Ratibida pinnata</i>	√	√	P	•	•	•		♦	N, C, S
Black-eyed Susan	<i>Rudbeckia hirta</i>	√	√	B/P	•	•			♦	N, C, S

Green-headed Coneflower	<i>Rudbeckia laciniata</i>	√	√	P			•	•		♦	N, C, S
Zig-zag Goldenrod	<i>Solidago flexicaulis</i>	√	√	P	•	•				♦	N, C, S
Early Goldenrod	<i>Solidago juncea</i>	√	√	P	•	•				♦	N, C, S
Gray Goldenrod	<i>Solidago nemoralis</i>	√	√	P	•	•				♦	N, C, S
Showy Goldenrod	<i>Solidago speciosa</i>	√	√	P	•	•				♦	N, C, S
Elm-leaved sunflower	<i>Solidago ulmifolia</i>	√	√	P	•	•			♦	♦	C, S
Spiderwort	<i>Tradescantia ohiensis</i>	√	√	P	•	•	•		♦	♦	N, C, S
Blue Vervain	<i>Verbena hastata</i>	√	√	B/P			•	•		♦	N, C, S
Hairy Vervain	<i>Verbena stricta</i>	√	√	B/P	•	•	•		♦		N, C, S
Violets	<i>Viola spp.</i>		√	SP	•	•	•	•	♦	♦	N, C, S
Golden Alexander	<i>Zizia aurea</i>	√	√	P		•	•	•		♦	N, C, S
Cover crops for short term erosion control (non-natives except as noted)											
Oats	<i>Avena sativa</i>		√	A						♦	
Canada Wild-Rye (native)	<i>Elymus canadensis</i>	√	√	SP		•	•			♦	
Virginia Wild-Rye (native)	<i>Elymus virginicus</i>	√	√	SP		•	•	•		♦	
Buckwheat	<i>Fagopyrum esculentum</i>		√	A						♦	
Red Fescue	<i>Festuca rubra</i>		√	SP		•	•			♦	
Barley	<i>Hordeum vulgare</i>		√	A		•	•			♦	
Alfalfa	<i>Medicago sativa</i>		√	P						♦	
Cereal Rye	<i>Secale cereale</i>		√	A							
Alsike Clover	<i>Trifolium hybridum</i>		√	SP		•	•			♦	
Red Clover	<i>Trifolium pratense</i>		√	SP		•	•	•	♦	♦	
White Clover	<i>Trifolium repens</i>		√	SP		•	•		♦	♦	
Wheat, winter also	<i>Triticum aestiva</i>		√	A						♦	
<p>¹ Propagation from seedlings, bare root stock, plugs, containers etc.</p> <p>² Annual (A), Short-lived Perennial (SP), Perennial (P) or Biennial (B) life cycle.</p> <p>³ Plant is appropriate for Northern (N), Central (C), and/or Southern (S) Wisconsin.</p>											

Appendix H: Checklist of Responsibilities - Using the BMPs described below, you will better be able to determine if invasive species have invaded your area because invasive species often first invade travel corridors you may want to focus your search along these areas.

***Any organization can establish the appropriate levels of responsibility for their staff.**

BMP #	BMPs	Responsible party				Comments
		Management	Project Managers	Supervisors/ Superintendents	Crews	
Soil Disturbance						
SD-1	Prior to implementing activities scout for, locate and document invasive species infestations.					
SD-2	Consider the need for action based on: 1) the degree of invasiveness; 2) severity of the current infestation; 3) amount of additional habitat or hosts at risk for invasion; 4) feasibility of control with available methods and resources.					
SD-3	Plan activities to limit the potential for introduction and spread of invasive species, prior to construction.					
SD-4	Provide appropriate resources in identification of known invasive species for corridor workers.					
SD-5	Minimize soil disturbance which may include using existing roads, access points, staging areas and/or alternative construction methods..					
SD-6	Avoid invasive species populations when feasible and minimize the spread of invasive species during soil disturbance activities.					
SD-7	Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.					
SD-8	Stabilize disturbed soils using erosion control/stormwater management technical standards as soon as possible.					
SD-9	Use non-invasive or native seed for cover crops or revegetation.					
Vegetation Management - Inspection and Monitoring						
VM-1	Prior to implementing activities scout for, locate and document invasive species infestations.					
VM-2	Plan activities to limit the potential introduction and spread of invasive species, prior to construction					
VM-3	Assess current available resources and seek new resources to prevent invasive species spread.					

VM-4	Provide training in identification, control and prevention of known invasive species to employees and contractors performing vegetation management activities					
VM-5	Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.					
VM-6	Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, and invertebrates before and after activities-					
VM-7	Properly dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.					
VM-8	Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other v viable plant parts.					
VM-9	Consider the likely response of invasive species when conducting activities that result in disturbed soil, increased sunlight, fire, etc.					
VM-10	Ensure that invasive species control treatments are applied within the appropriate time window.					
VM-11	Monitor right-of-ways during day-to-day activities and post management activities; determine necessary treatments based on the presence of invasive species.					
Transport of Material						
TM-1	Take steps to avoid the movement of invasives to non-infested areas during transport activities.					
TM-2	Prior to transporting materials, manage the load to limit the spread of invasive species.					
TM-3	Prior to moving equipment out of an infested area and then into an uninfested area, clean soils, seeds, plant parts, and invertebrates from exterior surfaces to the extent practical , to minimize the risk of transporting propagules.					
TM-4	Dispose of soils, seeds, plant parts or invertebrates found during inspection and cleaning.					
TM-5	Establish staging areas and temporary facilities in locations that are free of invasive species.					
TM-6	Use soil and aggregate material from sources that are free of invasive species.					
TM-7	Manage stock piles to limit the spread of invasive species.					
TM-8	Do not transport woody material that may contain invasive species.					

TM-9	If you must transport woody material that may contain invasive species, bring to a designated area for appropriate disposal.					
TM-10	Keep and reuse onsite materials rather than importing new materials.					
Revegetation and Landscaping						
RV-1	Plan activities to limit the potential introduction and spread of invasive species, prior to revegetation.					
RV-2	Select noninvasive or native species for revegetation and landscaping activities.					
RV-3	Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, or invertebrates before and after activities.					
RV-4	Prior to moving equipment out of an infested area and into an uninfested area clean soil and debris from exterior surfaces, to the extent practical, to minimize the risk of transporting propagules.					
RV-5	Revegetate disturbed soils as soon as feasible to minimize invasive species establishment.					
RV-6	Allow natural revegetation of the ground layer to occur only where site conditions permit.					
RV-7	Ensure the species specified in the plan are the ones being used.					
RV-8	Monitor the revegetation site for invasive species.					

Appendix I: Glossary

Biological Control: The management of pests using other organisms, often natural predators.

Chemical Control: The application of a pesticide as the primary means of managing a pest.

Containment: Slowing the spread of an invasive species from a defined geographical area.

Control: To reduce the impact of a pest to a level necessary to meet site management goals.

Cultural Control: A planned series of treatments designed to change stand structure and composition to one that meets pest management goals.

Early Detection: An integrated system of active or passive surveillance to find new populations of invasive species, as early as possible while their population is low, when eradication and control are still feasible and less costly. It may be targeted at: a) areas where introductions are likely, such as access points and travel corridors, b) areas with high ecological value where impacts are likely to be significant, and c) vulnerable habitats or recently disturbed areas.

Impact: The cumulative net effect of a pest population on any or all forest resources.

Invasive Species: A species that is not native to the ecosystem under consideration whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Integrated Pest Management: To reduce the impact of destructive agents by the planned use of a variety of preventive, suppressive, or regulatory tactics and strategies that are ecologically and economically efficient and socially acceptable.

Inventory: A set of objective sampling methods designed to quantify the spatial distribution, composition, and rates of change to forest parameters within specified levels of precision for the purpose of management.

Manual Control: The deliberate management of pests using means such as hand-pulling, digging, flooding, mulching, burning, removal of alternate hosts, and manual destruction or removal of nests, egg masses or other life stages.

Mechanical Control: The deliberate management of pests by means such as hoeing, cutting, girdling, tilling, mowing, chopping, and constructing barriers using tools or machines.

Monitoring: The periodic inspection of post-activity sites to detect new invasions and evaluate the success of pest management plans and control measures.

Pest: An organism that is undesirable or detrimental to achieving management objectives.

Prevention: The prescriptions or strategies used to discourage the presence or spread of pests.

Propagule: Any reproductive structure or part of an organism that can grow independently of its parent source. In plants, this may be a fruit, seed, bud, tuber, root, stem with rooting structures, or shoot. In insects, this may be an egg, larva, pupa or adult. In diseases, this may be a spore, mycelial fragment (similar to roots), or a fruiting body.

Rapid Response: A systematic effort to contain, control, or eradicate invasive species while the infestation is still localized. It may be implemented in response to new introductions or to isolated infestations of a previously established species. Preliminary assessment and subsequent monitoring may be part of the response. It is most effective when based on a plan organized in advance so that the response is rapid and efficient.

Reforestation: The reestablishment of forest cover either naturally (*e.g.*, natural seeding, coppice, root suckers) or artificially (*e.g.*, direct seeding or planting).

Restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Revegetation: The reestablishment and development of vegetation.

Appendix J: Resources for Additional Information

Invasive Plants (See also *All Invasives*):

Center for Invasive Plant Management (CIPM). <http://www.weedcenter.org>

This web site provides information on invasive plant identification, biology, and impacts of invasive species. It also includes links to a resource guide, weed control methods, and invasive plant management online textbook.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)—Exotic Plant Information Center.

<http://www.glifwc.org/invasives/> This site features a searchable database of invasive species accounts. It also provides distribution maps, educational materials, and a slide library.

Invasive Plants Association of Wisconsin (IPAW). <http://www.ipaw.org>

The mission of IPAW is to promote better stewardship of the natural resources of Wisconsin by advancing the understanding of invasive plants and encouraging the control of their spread. Their web site offers a photo gallery, invasive species list, educational resources, news and events, and more.

Midwest Invasive Plant Network (MIPN). <http://www.mipn.org/>

This organization's mission is to reduce the impact of invasive plant species in the Midwest. The web site provides information on prevention, early detection and rapid response, control and management, education, research, and more.

Plant Conservation Alliance (PCA), Weeds Gone Wild, Alien Plant Invaders of Natural Areas.

<http://www.nps.gov/plants/alien/> This web site provides a list of invasive plants in the US, background information on the threats and impacts of invasive species, fact sheets, and relevant links.

University of Wisconsin Herbarium. <http://www.botany.wisc.edu/wisflora>

The Herbarium's web site is fully searchable for Wisconsin's vascular plant species. It includes photos, habitat information, distribution maps, and herbarium specimen data.

Wisconsin Department of Natural Resources (WDNR) <http://dnr.wi.gov/>

The Department of Natural Resources is dedicated to the preservation, protection, effective management, and maintenance of Wisconsin's natural resources.

Wisconsin Department of Transportation (WisDOT) <http://www.dot.wisconsin.gov/>

WisDOT supports all forms of transportation. The department is responsible for planning, building and maintaining Wisconsin's network of state highways and Interstate highway system as well as air, rail and water transportation, well bicycle and pedestrian facilities.

Invasive Insects and Diseases (See also *All Invasives*):

Department of Agriculture Trade and Consumer Protection (DATCP).

<http://www.datcp.state.wi.us/core/insectspesticides/insectspesticides.jsp>

DATCP is responsible for the prevention, introduction and spread of plant pests. This webpage provides information on specific pests, rules, firewood restrictions, and firewood dealer certification.

Department of Agriculture Trade and Consumer Protection (DATCP)—Wisconsin Pest Bulletin.

<http://pestbulletin.wi.gov/index.jsp> The most relevant links are: *Nursery and Forest*, *Exotic Pest of the Week*, and *DATCP Contacts*.

Emerald Ash Borer: What you need to know. <http://www.emeraldashborer.info/> This web site is part of a multi-state effort to provide the latest information about EAB to the public.

National Agricultural Pest Information System (NAPIS)—Pest Tracker. <http://ceris.purdue.edu/napis/> This web site has links to state information, pest information, survey maps and publications. Information presented here is derived, in part, from the National Agricultural Pest Information System (NAPIS), an agricultural pest tracking and database

sponsored by the US Department of Agriculture Animal and Plant Health Inspection Service (APHIS) and Plant Protection and Quarantine (PPQ) Cooperative Agricultural Pest Survey, (CAPS).

Wisconsin's Emerald Ash Borer Resource. <http://emeraldashborer.wi.gov/> This site includes information on surveys, detection, and management, and includes an email address and phone number to report suspected infestations.

All Invasives:

National Invasive Species Council's Definition of Invasive Species.

<http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf>

National Invasive Species Management Plan. <http://www.invasivespeciesinfo.gov/council/nmp.shtml> *The Nature Conservancy (TNC)—Global Invasive Species Initiative.* <http://tncweeds.ucdavis.edu> This web site provides many resources designed to help conservationists deal most effectively with invasive species. It provides links to an introduction on invasive species management, planning and strategy, control methods, and photo archive and more.

USDA Forest Service Invasive Species Program. <http://www.fs.fed.us/invasivespecies> This web site serves as a portal to Forest Service invasive species information and related management and research activities across the agency and with partners. The program's goal is to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships.

Wisconsin Council on Invasive Species. <http://dnr.wi.gov/invasives/iscouncil.htm>

This site includes a link to the comprehensive state management plan.

Wisconsin Department of Natural Resources (WDNR). <http://dnr.wi.gov/invasives>

The Invasive Species webpage provides links to invasive species information including a photo gallery, complete plant and animal invasive species lists, and information on managing invasive species populations.

General Sites of Interest:

University of Wisconsin Extension. <http://www.uwex.edu/locations/> The Extension has offices in every county in Wisconsin.

Wisconsin Department of Natural Resources (WDNR). List of Native Plant Nurseries and Restoration Consultants in Wisconsin.

<http://dnr.wi.gov/org/land/er/plants/nurseries.htm> The list includes nurseries within 100 miles of Wisconsin that may be able to provide native seed and/or plants for your projects. Consultants provide services such as design, landscape installation, and maintenance services including prescribed burning.

Wisconsin Department of Natural Resources (WDNR). State Nursery Program. <http://dnr.wi.gov/forestry/nursery/> The DNR operates three forest tree nurseries: the Wilson State Nursery in Boscobel, the Griffith State Nursery in Wisconsin Rapids, and the Hayward State Nursery in Hayward. Trees are sold for reforestation, wildlife habitat, and erosion control purposes.

General Invasive Plant Management:

Center for Invasive Plant Management (CIPM)—Weed Control Methods. <http://www.weedcenter.org/management/control.htm>

The Weed Control Methods web page offers information and links on the following control techniques: biocontrol, grazing, herbicides, mechanical and prescribed burning.

Department of Conservation and Natural Resources Invasive Exotic Plant Tutorial for Natural Land Managers. Invasive Exotic Plants in Pennsylvania List.

<http://www.dcnr.state.pa.us/forestry/invasivetutorial/List.htm>

Although this site is for Pennsylvania most of the species featured are also invasive in Wisconsin. The site provides links to fact sheets and management and control recommendations.

Garlic mustard (Alliaria petiolata)—Guide for identifying and controlling.
<http://www.for-wild.org/download/garlicmustard.pdf>

Illinois Nature Preserve Management Guidelines. http://dnr.state.il.us/INPC/Management_guidelines.htm The information presented gives guidance to landowners, managers, custodians and stewards of sites in the Illinois Nature Preserve Programs on control methods for common invasives.

Invasive Plants of the Upper Midwest by Elizabeth J. Czarapata. This book is a comprehensive, fully-illustrated guide to the identification and control of invasive plant species. Available for purchase at www.ipaw.org.

Plant Conservation Alliance—Alien Plant Invaders of Natural Areas.

<http://www.nps.gov/plants/alien/factmain.htm> This web site features illustrated, easy-to-read fact sheets on select invasive plants with native ranges; plant descriptions; ecological threats; US distributions and habitats; background of introductions; plant reproduction and dispersal; management approaches; alternative native plants; and other useful information.

The Nature Conservancy (TNC)—Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas.
<http://tncweeds.usdavis.edu/handbook.html>

The handbook provides detailed information on the use of manual and mechanical techniques, grazing, prescribed fire, biocontrol, and herbicides for use in controlling invasive species in natural areas.

USDA Forest Service Invasive Species Program—Control and Management.

<http://www.fs.fed.us/invasivespecies/controlmgmt/index.shtml> This page provides links for more information on research, management planning, forest service activities, and pest-specific control and management.

US Forest Service—Dangerous Travelers: Controlling Invasive Plants along America's Roadsides (Video).

<http://www.fs.fed.us/invasivespecies/> The video outlines the best management practices that road crews should be following in their day-to-day operations. This is the first in a series on “Best Management Practices for Invasive Species Prevention.” The video can also be ordered on DVD by contacting: USDA Forest Service; San Dimas Technology and Development Center; 444 East Bonita Avenue; San Dimas, CA 91773; (909) 599-1267

Wisconsin Department of Natural Resources (WDNR). Wisconsin Manual of Control Recommendations: Ecologically Invasive Plants.

http://dnr.wi.gov/invasives/publications/manual/manual_toc.htm

Biocontrol:

Cornell University. Biological Control: A Guide to Natural Enemies in North America.

<http://www.nysaes.cornell.edu/ent/biocontrol/> This web site provides photographs and descriptions of biocontrol agents of insect, disease and weed pests in North America.

Grazing:

University of Idaho Rangeland Ecology and Management. Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement. <http://www.cnr.uidaho.edu/rx-grazing/Handbook.htm> The handbook outlines the basics of applying targeted grazing for vegetation management. This handbook includes 18 chapters and represents a compilation of the latest research on harnessing livestock to graze targeted vegetation in ways that improve the function and appearance of a wide variety of landscapes.

Prescribed Fire:

California Invasive Plant Council—The Use of Fire as a Tool for Controlling Invasive Plants. <http://www.cal-ipc.org/ip/management/UseofFire.pdf>

This document contains information on the following: planning and implementing prescribed burns, control of invasive plants with prescribed fire, using prescribed burning in integrated strategies, effects of fire on plant communities, effects of fire on chemical, physical, and biotic properties of soil.

Center for Invasive Plant Management (CIPM)—Fire As a Tool For Controlling Nonnative Invasive Plants.

http://www.weedcenter.org/management/burning_weeds.pdf

This review focuses on the intentional use of fire, alone or integrated with other methods, to control exotic plants in North America.

Wisconsin Prescribed Fire Council. <http://www.prescribedfire.org/index.html> The Wisconsin Prescribed Fire Council strives to make the use of prescribed fire in Wisconsin safer and more accepted for all practitioners. The site provides information and links on government relations, liability, training, weather, and fire implementation.

Herbicide:

Department of Agriculture Trade and Consumer Protection (DATCP)—Pesticide Database Searches.

<http://www.kellysolutions.com/wi/> Use this site to search for registered pesticide products, the companies that sell and use pesticides, and the people that apply them.

Herbicide safety information—Material Data Safety (MDS) sheets and product labels.

<http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=>.

The Nature Conservancy (TNC)—Safe Herbicide Handling in Natural Areas: A Guide for Land Stewards and Volunteer Stewards. <http://tncweeds.ucdavis.edu/products/library/herbsafe.pdf>

The Nature Conservancy (TNC)—Upkeep and Maintenance of Herbicide Equipment: A guide for natural area stewards. <http://tncweeds.ucdavis.edu/products/library/herbupkeep.pdf>

Early Detection and Rapid Response:

iMapInvasives: Geotracking invasive exotic species. <http://imapinvasives.org/index.html>

A consortium developed an on-line GIS-based invasive species mapping tool designed to aid in Early Detection and Rapid Response efforts. The site allows one to display maps and query by invasive species or contributing organization. Currently the site has only sample plant data for the state of New York. Long-term goals for the site include seeking participation of additional states and/or provinces.

National Biological Information Infrastructure (NBII). National Framework for Early Detection, Rapid Assessment, and Rapid Response to Invasive Species.

[http://159.189.176.5/portal/community/Communities/Ecological_Topics/Invasive_Species/Early_Detection,_Rapid_Response_\(EDRR\)](http://159.189.176.5/portal/community/Communities/Ecological_Topics/Invasive_Species/Early_Detection,_Rapid_Response_(EDRR)) This framework includes seven main components: 1) identification and validation, 2) reporting, 3) expert verification, 4) occurrence databases, 5) rapid assessment, 6) planning, 7) rapid response.

The Nature Conservancy (TNC)—Weed Information Management System (WIMS).

<http://tncweeds.ucdavis.edu/wims.html> WIMS is a Microsoft Access-based relational database application that is designed to assist natural resource managers in managing their weed data.

The North American Weed Management Association. <http://www.nawma.org/> The North American Weed Association has developed a data collection standard for invasive plant monitoring in the western United States and it has been adopted by several federal agencies, including US Forest Service and the National Park Service. At the home page, scroll down to “Mapping Standards” link.

USDA Forest Service. The Early Warning System for Forest Health Threats in the United States.

http://www.fs.fed.us/foresthealth/publications/EWS_final_draft.pdf

This is a monitoring framework for early detection and response to environmental threats (e.g., insects, diseases, invasive species, and fire) to forest lands. The framework is based on the following steps: 1) identify potential threats, 2) detect actual threats, 3) assess impacts, and 4) respond.

Herbarium—Invasive Plants of the Future. <http://dnr.wi.gov/invasives/futureplants/>

This monitoring and early reporting project has three main goals: 1) identify and report populations of high-risk early-stage target weed species in Wisconsin; 2) eliminate or contain those populations before they spread; and 3) coordinate long-term monitoring of occurrence sites. All land managers are encouraged to participate in this program.

Prioritizing Management:

NatureServe—An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impacts on Biodiversity.

<http://www.natureserve.org/library/invasiveSpeciesAssessmentProtocol.pdf>

The Invasive Species Assessment Protocol was developed as a tool for assessing, categorizing, and listing non-native invasive vascular plants according to their impact on biodiversity in a large area such as a nation, state or province, or ecological region. This protocol is designed to make the process of assessing and listing invasive plants objective and systematic.

Animal and Plant Health Inspection Service (APHIS)—Weed-Initiated Pest Risk Guidelines for Qualitative Assessments.

http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/wra.pdf

This document provides a template for conducting pest risk analysis: initiating the process by identifying a pest that may qualify as a quarantined pest, and/or pathways that may allow introduction or spread of a quarantine pest; and assessing pest risk (determining which pests are quarantine pests, characterized in terms of likelihood of entry, establishment, spread, and economic importance.)

Invasive Species Plant Lists:

Chequamegon-Nicolet National Forest, Invasive Plants of Immediate Concern.

http://www.fs.fed.us/r9/cnnf/natres/nnis/species_list.html

Invasive Plant Association of Wisconsin, Working List of Invasive Plants in Natural Plant Communities and Wild Areas of the State.

<http://www.ipaw.org/list/list1.htm?n0>

USDA Forest Service, Invasive Plants Field and Reference Guide: An Ecological Perspective of Plant Invaders of Forests and Woodlands.

http://www.na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

USDA PLANTS Database. Invasive and Noxious Weeds. <http://plants.usda.gov/java/noxiousDriver> This database provides information about the vascular plants, mosses, liverworts, hornworts, and lichens of the US, including invasive plants. It includes species distribution, characteristics, species abstracts, images, references and links to more information.

Wisconsin DNR, Program Feasibility Study: Invasive Plants in Forests Plants Currently a Problem in Wisconsin's Forests (p.6-12).

<http://dnr.wi.gov/org/land/forestry/Publications/pdf/InvasivePlantStudy.pdf>

WDNR Target Invasive Plants of the Future.

<http://dnr.wi.gov/invasives/futureplants/target.htm>

Insects and Diseases Lists:

Wisconsin DNR Forest Health Protection Unit's Annual Report: Forest Health Conditions in Wisconsin, 2005.

<http://dnr.wi.gov/org/land/forestry/fh/pdf/AnnualReport2005.pdf>

The Nature Conservancy's Invasive Species Initiative Regional List of Pests, 2004 (scroll down to Midwest region, but note that this covers from MI to ND, south to TX).

<http://tncweeds.ucdavis.edu/products/gallery/regionlist.html>

WDNR- WPDES General Wastewater Discharge Permits- this link provides regulatory information regarding suspended solid, erosion control, Ch. 30 & WPDES permitting among many others.

<http://dnr.wi.gov/runoff/>

Appendix K: Accompanying Regulations

Invasive Plant Statutes and Codes

Wisconsin Statutes <http://www.legis.state.wi.us/rsb/stats.html>

See left navigation area to search for a specific Statute in the website's *Info-base* or go to a Statute Chapter.

15.34 Department of natural resources; creation.

15.347 Same; councils.

(18) INVASIVE SPECIES COUNCIL

History: 1973 c.74; 1991 a.316; 2001 a.16.

23.22 Invasive species.

Cross Reference: See also ch. NR 198, Wis. adm. code.

History: 2001 a. 109 ss. 72t, 72xd; 2003 a. 33.

23.235 Nuisance weeds.

History: 1987 a. 41; 1999 a. 150 s. 616; Stats. 1999 s. 23.235; 2001 a. 16; 2001 109 ss. 72td to 72wj.

26.02 Council on forestry.

History: 2001 a. 109.

66.0407 Noxious weeds.

History: 1975 c. 394 s. 12; 1975 c. 421; Stats. 1975 s. 66.96; 1983 a. 112, 189; 1989 a. 56 s. 258; 1991 a. 39, 316; 1997 a. 287; 1999 a. 150 ss. 617 to 619; Stats. 1999 s. 66.0407.

94.38 Agricultural and vegetable seeds; definitions.

History: 1975 c. 39, 308; 1983 a. 189; 1985 a. 138; 1993 a. 112.

94.39 Seed labeling requirements.

History: 1975 c. 39, 308; 1985 a. 138.

94.41 Prohibitions.

History: 1973 c. 194, 195; 1985 a. 138; 1993 a. 492.

94.45 Powers and authority of the department [Department of Agriculture].

History: 1975 c. 39, 308; 1983 a. 189 s. 329 (20).

Cross Reference: See also ch. ATCP 20, Wis. adm. code.

Administrative Code <http://www.legis.state.wi.us/rsb/code.htm>

See left navigation area to search for a specific Statute in the website's *Infobase* or go to a Code Chapter (look under "NR Natural Resources".) <http://www.legis.state.wi.us/rsb/code/codtoc.html>

NR 150.025 Policy.

History: Register, February, 1981, No. 302, eff. 3-1-81; renum. (2) (g) and (h) to be (2) (h) and (i), cr. (2) (g), Register, February, 1984, No. 338, eff. 3-1-84; am. (2) (e), Register, January, 1987, No. 373, eff. 2-1-87.

NR 44.04 Master plan development, adoption and public involvement.

History: Cr. Register, August, 1996, No. 488, eff. 9-1-96.

Insects and Diseases Statutes

Wisconsin Statutes <http://www.legis.state.wi.us/rsb/stats.html>

See left navigation area to search for a specific Statute in the website's *Infobase* or go to a Statute Chapter:
<http://www.legis.state.wi.us/rsb/Statutes.html>

Wisconsin Statutes that apply to the Department of Natural Resources (WDNR):

26.30 Forest insects and diseases; department jurisdiction; procedure.

History: 1977 c. 29 s. 1650m (1); 1979 c. 32 s. 92 (9); 1979 c. 110 s. 60 (11); 1983 a. 189; 1985 a. 13; 1991 a. 316; 2003 a. 33, 57.

Cross Reference: See also s. NR 47.910, Wis. adm. code.

Wisconsin Statutes that apply to the Department of Agriculture, Trade and Consumer Protection (WDATCP):

94.01 Plant inspection and pest control authority.

History: 1975 c. 394 s. 18; Stats. 1975 s. 94.01.

Cross Reference: See also ch. ATCP 21, Wis. adm. code.

94.02 Abatement of pests.

History: 1975 c. 394ss. 5, 19; 1975 c. 421; Stats. 1975 s. 94.02; 1977 c. 418; 1981 c.20.

94.10 Nursery stock; inspection and licensing.

History: 1975 c. 394 ss. 20, 22; 1975 c. 421; Stats. 1975 s. 94.10; 1983 a. 189; 1989 a. 31; 1993 a. 16; 1995 a. 27; 1999 a.9.

94.685 Pesticides; licensing of dealers and distributors of restricted-use pesticides.

History: 1987 a. 27; 1991 a. 269; 1993 a. 16, 490; 1997 a. 27.

Cross Reference: See also chs. ATCP29, 30, and 31 and ss. ATCP 160.19 and 160.21, Wis. adm. code.

94.69 Pesticides; rules.

History: 1975 c. 94s. 91 (10); 1977 c. 106; 1983 a. 410; 1997 a. 27, 237.

Cross-reference: See s. 94.709 for prohibition of use of DDT and exceptions to the prohibition.

Cross Reference: See also chs. ATCP 29, 30, and 31 and ss. ATCP 160.19 and 160.21, Wis. adm. code.

Wisconsin Statutes that apply to both the Department of Agriculture, Trade and Consumer Protection (WDATCP) and the Department of Natural Resources (WDNR):

146.60 Notice of release of genetically engineered organisms into the environment.

History: 1989 a. 15; 1993 a. 213; 1995 a. 27 s. 9126 (19); 1997 a. 283; 2001 a. 109.

Appendix L: Financial Assistance for Controlling Invasives

***Generally, these funding sources may be applied in conjunction with CWMAs and local partners. These programs and funding opportunities typically apply to private lands.**

Invasive Plants:

Conservation Reserve Program (CRP)

CRP is a federal program administered by the Farm Service Agency (FSA) with NRCS and DNR providing technical advice. It is an annual payment program based on bids submitted by the landowner, offering a 50% cost-share for establishing ground cover and agreeing not to farm the land. Cost sharing is available for plan preparation, tree planting, wildlife planting, grass establishment, erosion control structures, and stream buffers. For more information, go to: <http://www.wi.nrcs.usda.gov/programs/crp.html>.

Conservation Technical Assistance (CTA)

The CTA Program provides the technical capability, including direct conservation planning, design, and implementation assistance, that helps people plan and apply conservation on the land. This assistance is provided to individuals, groups, and communities who make natural resource management decisions on private, tribal, and other non-federal lands. NRCS, through the CTA Program, provides conservation technical assistance that addresses natural resource conservation issues at the local level that are of state and national concern.

<http://www.nrcs.usda.gov/programs/cta/>

Cooperative Forest Health Management Program

This is a US Department of Agriculture grant and partnership program to fund weed management activities on state and private forest lands. Eligible entities include Cooperative Weed Management Areas, states, and non-profit organizations. This program requires a 50% match. For more information contact Rob Mangold at (703) 605-5340 or rmangold@fs.fed.us.

Environmental Quality Incentives Program (EQIP)

EQIP is a federal program administered by the NRCS, with DNR Forestry providing technical advice for forested lands. This program provides up to a 75% cost share, with 65% of funds allocated to priority areas and the remainder available statewide. Contracts are for five or ten years. Maximum cost shares set by the program are currently \$10,000 annually and \$50,000 per contract. Cost sharing is available for tree planting, ecosystem management including prescribed burning and brush management, erosion control, agricultural waste management, and stream buffers. For more information, go to: <http://www.wi.nrcs.usda.gov/programs/eqip.html>.

Forest Land Enhancement Program (FLEP)

FLEP was authorized by the 2002 Farm Bill, but was not re-funded in 2004, so funding under this program is not currently available. It replaced the Stewardship Incentives Program (SIP) and the Forestry Incentives Program (FIP). FLEP provided technical, educational, and cost share assistance to non-industrial private forest landowners. There is a possibility that it may be reauthorized in future Farm Bills.

LIP is funded by the U.S. Fish and Wildlife Service and administered by the DNR Bureau of Endangered Resources. The program helps private landowners by providing financial and technical assistance to manage and restore habitat for at-risk species on their land. At-risk species include rare and declining plants and animals in Wisconsin such as those that are listed as endangered or threatened, special concern or species of greatest conservation need. LIP provides up to 75% of the project cost for eligible projects. The maximum cost share is \$25,000. Potential projects include conducting prescribed burns, planting native vegetation, and controlling invasive and woody species. For more information, go to: <http://dnr.wi.gov/org/land/er/wlip/>.

National Fish & Wildlife Foundation Pulling Together Initiative (PTI)

PTI applications are accepted from private non-profit (501) (c) organizations, local, county, and state government agencies, and from field staff of federal government agencies. Individuals, for-profit businesses, and USDA staff are not directly eligible to receive PTI grants, but are encouraged to work with eligible applicants to develop and submit applications to PTI. Proposals may be submitted that describe initiatives to prevent, manage, or eradicate invasive and noxious plants through a coordinated program of public/private partnerships; and that increase public awareness of the adverse impacts of invasive and noxious plants. For more information, see: <http://www.nfwf.org>.

Partners for Fish and Wildlife (U.S. Fish & Wildlife Service)

The Partners for Fish and Wildlife (PFW) program provides technical and financial assistance to private landowners who voluntarily restore wetlands and other fish and wildlife habitats on their lands. A dollar-for-dollar cost-share, although not a program requirement, is sought on a project-by-project basis. Up to 100-percent funding for habitat restoration projects is available through the Service and its partners. Landowners agree to maintain the restored habitats for no less than 10 years, but otherwise retain full control of their lands. For more information, go to: <http://www.fws.gov/partners>.

Wildlife Habitat Incentives Program (WHIP)

WHIP is a federal program administered by the NRCS, with NRCS and DNR Fisheries and Wildlife providing technical advice. WHIP provides 75% cost share for items proposed in a five or ten year contract. The maximum cost share per year is \$10,000. Cost sharing is available for wildlife planting, grass establishment, fencing, prescribed burning, farmstead shelterbelts, and wildlife practices that include nesting habitat, vegetation management, tree and shrub planting, creation of openings, and wildlife corridors. For more information, go to: <http://www.wi.nrcs.usda.gov/programs/whip.html>.

More information

Grants are sometimes available for special purposes or community projects. See the following websites for current announcements or opportunities.

- Midwest Invasive Plants Association - <http://www.mipn.org/grants.html>
- Invasive Plants Association of Wisconsin - <http://www.ipaw.org/funding/index.htm>
- All federal grants - <http://www.grants.gov/>

Appendix M: References

- Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. *Measuring and Monitoring Plant Populations*. Technical Reference 1730-1. Bureau of Land Management, National Business Center, Denver Co.
- Emery S.M. and Gross K.L. 2005. Effects of timing of prescribed fire on the demography of an invasive plant, *Centaurea maculosa* (spotted knapweed). *Journal of Applied Ecology*, 42:60–69.
- Frappier, B., R.T. Eckert, and T.D. Lee. 2003. Potential impacts of the invasive exotic shrub *Rhamnus frangula* L. (glossy buckthorn) on forests of southern New Hampshire. *Northeastern Naturalist*. 10(3):277-296.
- Frappier, B., R.T. Eckert, and T.D. Lee. 2004. Experimental removal of the non-indigenous shrub *Rhamnus frangula* L. (glossy buckthorn): effects on native herbs and woody seedlings. *Northeastern Naturalist*. 11(3):333-342.
- Hodkinson, D.J. and K. Thompson. 1997. Plant dispersal: the role of man. *Journal of Applied Ecology*. 34:1484-1496
- Kolar, C.S. and D.M. Lodge. 2001. Progress in invasion biology: predicting invaders. *Trends in Ecology & Evolution*. 16(4):199-204.
- Leung, B., D.M. Lodge, D. Finnoff, J.F. Shogren, M.A. Lewis and G. Lamberti. 2002. An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. *Proceedings of the Royal Society – Biological Sciences*. 269:2407-2413.
- Mack, R.N., D. Simberloff, W.M. Lonsdale, H. Evans, M. Clout, and F.A. Bazzaz. 2000. Biotic invasions: causes, epidemiology, global consequences, and control. *Ecological Applications*. 10(3):689-710.
- National Invasive Species Council. 2001. *Meeting the Invasive Species Challenge: National Invasive Species Management Plan*. 80 pp.
- Shea, K. and D. Kelly. 2004. Modeling for management of invasive species: musk thistle (*Carduus nutans*) in New Zealand. *Weed Technology*. 18:1338–1341.
- Simberloff, D., I.M. Parker and P.N. Windle. 2005. Introduced species policy, management, and future research needs. *Frontiers in Ecology and the Environment*. 3(1):12-20.
- Smith, L.L. 2005. *Invasive Exotic Plant Management Tutorial for Natural Lands Managers*. Pennsylvania Department of Conservation and Natural Resources in cooperation with Mid-Atlantic Exotic Pest Plant Council.
- Radosevich, S. Plant Invasions and Their Management *In* CIPM Invasive Plant Management Online Textbook. http://www.weedcenter.org/textbook/pdf_files/chapter3.pdf (last updated 12/7/07).



WISCONSIN DEPARTMENT OF NATURAL RESOURCES NOTICE OF FINAL GUIDANCE & CERTIFICATION

Pursuant to ch. 227, Wis. Stats., the Wisconsin Department of Natural Resources has finalized and hereby certifies the following guidance document.

DOCUMENT ID

FA-20-0018

DOCUMENT TITLE

Invasive Species Best Management Practices for Transportation and Utility Rights of Way

PROGRAM/BUREAU

Forest Health, Applied Forestry Bureau

STATUTORY AUTHORITY OR LEGAL CITATION

S. 23.22, Wis. Stats. & Ch. NR40, Wis. Admin. Code

DATE SENT TO LEGISLATIVE REFERENCE BUREAU (FOR PUBLIC COMMENTS)

2/10/2020

DATE FINALIZED

4/6/2020

DNR CERTIFICATION

I have reviewed this guidance document or proposed guidance document and I certify that it complies with sections 227.10 and 227.11 of the Wisconsin Statutes. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is not explicitly required or explicitly permitted by a statute or a rule that has been lawfully promulgated. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is more restrictive than a standard, requirement, or threshold contained in the Wisconsin Statutes.

March 27, 2020

Signature

Date