

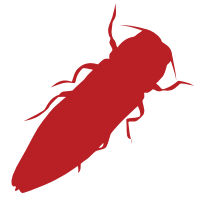


— MINNESOTA'S —
URBAN & COMMUNITY FOREST

BEST MANAGEMENT PRACTICES
FOR PREVENTING THE INTRODUCTION,
ESTABLISHMENT, AND SPREAD
OF INVASIVE SPECIES

MN INVASIVE SPECIES ADVISORY COUNCIL

2015



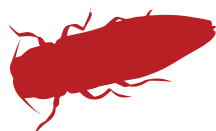
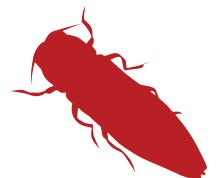
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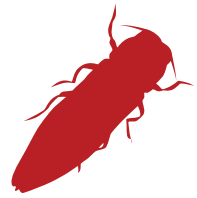
We gratefully acknowledge the efforts of the Wisconsin advisory committee members, technical team, and Wisconsin Department of Natural Resources (DNR) staff. They provided the base document upon which this Minnesota Best Management Practices (BMPs) document was developed. We thank the individuals and organizations in Minnesota that took the time to review and develop this document.

Cover Photo by Deb Rose

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The Minnesota BMPS were adapted by the Minnesota Technical Team listed below. The Minnesota BMPs were then reviewed and revised by members of the Minnesota Invasive Species Advisory Council (MISAC). The Minnesota BMPs are hosted on MISAC website:
<http://www.mda.state.mn.us/misac>

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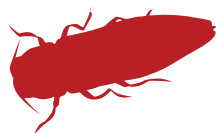
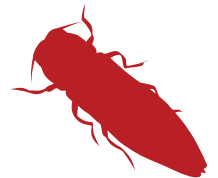
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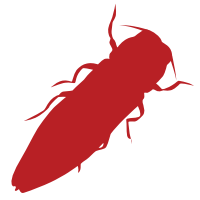
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PREFACE

In 2002, the Wisconsin Council on Forestry—comprising representatives of private and public forestry professionals, timber and forest product industries, conservation organizations, forestry schools and other interested groups—was created by state statute to advise the Governor, the Legislature, the Wisconsin 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 range of interested groups, concluded that “invasive exotic [non-native] 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 forestry/invasive best management practices and a commitment to a partnership-based process for creating them.” In response, the Council created the Forestry Invasives Leadership Team to help guide efforts to develop *Wisconsin’s Urban Forestry Best Management Practices for Invasive Species*.

Wisconsin’s Urban Forestry Best Management Practices for Invasive Species was published in 2009 and provided as a model guide that other states could adapt. In 2013, under the leadership of the Minnesota Invasive Species Advisory Council, work began to adapt the Wisconsin manual for Minnesota. An interagency technical team led the effort and solicited input and support from a wide range of Minnesota organizations and stakeholders in Minnesota.





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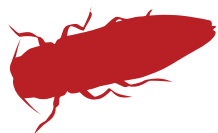
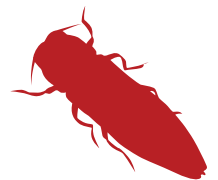
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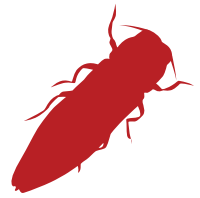
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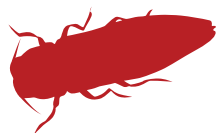
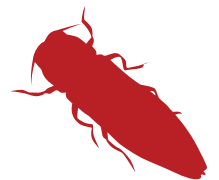
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PURPOSE AND SCOPE STATEMENTS

PURPOSE

Forest invasive species can pose a threat to Minnesota's urban and community forests which provide important environmental, social and economic services such as reduced storm water run-off, improved air quality, energy conservation, improved public health, and increased property values. Urban and community forestry professionals and homeowners alike can play a role in preventing and reducing impacts from invasive species by following the practices outlined in this manual. The goal is to provide guidance by incorporating invasive species considerations into routine urban and community forestry activities so as to prevent the introduction and slow the spread of invasive species.

additional pathways and broader scales which are not fully covered in this manual. These include non-regulatory efforts like additional BMP guidelines including those that address traditional forestry, recreation, and utility and transportation corridor rights-of-way. Other efforts focus on regulatory programs at regional or national scales including quarantine and port of entry regulations that address movement of invasive species and infested material into and within the US and federal agency actions to strengthen inspection and management. The BMPs are not intended to provide species specific control and management recommendations.

TARGET AUDIENCE

The target audiences for this manual are urban and community forestry professionals. This includes arborists, urban and community foresters, nursery growers and retailers, landscape architects and designers, grounds managers, landscape contractors and other urban and community forestry professionals.

SCOPE

The Best Management Practice (BMP) statements in this manual are intended to apply to a wide variety of urban and community forestry activities (including land use planning, landscape design, species selection, planting, maintenance, sanitation and debris disposal, and transportation) on urban and community forests comprised of all ownerships.

The BMPs cover terrestrial plants, insects and diseases of the urban forest. The use of this manual is voluntary and non-regulatory.

BEYOND THE SCOPE

Successful invasive species management will require some additional strategies and tools that are beyond the scope of this manual. These needs are being addressed by complementary efforts that focus on

HOW TO USE THIS MANUAL

Minnesota's Urban and Community Forestry Best Management Practices for Invasive Species provides voluntary Best Management Practices (BMPs) to aid in the prevention and management of invasive plants, insects, and diseases in and around Minnesota's cities, towns, villages and other built environments. The BMPs identified in this manual are our best attempt to identify effective and realistic practices that can be integrated into routine urban forestry activities to limit the distribution and impact of invasive species.

This BMP manual was written for arborists, urban and community foresters, nursery growers and retailers, landscape architects and designers, grounds managers, landscape contractors and other urban forestry professionals. However, professionals and homeowners alike can play a role in helping to reduce the impacts of invasive species by following the practices outlined in this manual. Ultimately, everyone involved in the care and management of trees, shrubs and other vegetation shares in the responsibility of preventing and controlling invasives. By taking reasonable and practical precautions today, we can help protect Minnesota's urban and community forests and other lands into the future.

The manual recognizes a wide range of possible response options to any invasive species situation. Determining appropriate action in response to the large number of current and potential invasive species involves complex decisions that are context dependent. For that reason, practitioners applying BMPs need the flexibility to select the strategies and responses that are appropriate for their circumstances. This manual does not give priority to any particular BMP. Practitioners will need to decide how best to prioritize and implement the BMPs for their particular situation. Response options will need to recognize the degree of threat posed by an invasive species, the objectives of the homeowner or client, the resources available (if any) for additional management activities, and the costs that will be borne by those implementing the BMPs. The manual can be read as a full document or individual chapters of interest can be read.

Chapters are structured as stand-alone documents for those who focus on particular chapters. This does result in some repetition among chapters.

The Manual is structured as in the following example:
BMP Statement: Invasive species BMPs are in bold font and are set off from the body of the document with an arrow. 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 are 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.
- E. See *Appendices as directed for more information.*





CHAPTER 1

INTRODUCTION

WHAT ARE INVASIVE SPECIES?

Invasive species are species “that are not native to the ecosystem under consideration whose introduction causes or is likely to cause economic or environmental harm or harm to human health” (National Invasive Species Council 2001, 2008). Essentially, invasive species are plants, animals and pathogens that are “out of place.” A species is regarded as invasive if it has been introduced to a location, area, or region where it did not previously occur naturally (i.e. is not native), establishes a breeding population in the new location without further intervention by humans, and spreads, and causes economic or environmental harm or harm to human health.

Invasive species often exhibit aggressive reproductive characteristics, such as rapid growth, abundant reproduction, widespread seed dispersal, and, in some cases, rapid spread. They are highly adaptable and are able to tolerate a wide range of environmental conditions. Invasive species often leave their predators, parasites, competitors and diseases behind in their native ecosystems without which they are able to reproduce rapidly and out-compete native species. In essence, many plant species that have

the potential to become invasive often have many of the same characteristics that horticulturists are looking for when selecting plants for landscape use (e.g., adaptability and few pests). As a result, care is advised and the potential invasiveness of any new species should be assessed before their introduction into the nursery trade. Although species native to Minnesota should never be designated as invasive, they can sometimes exhibit invasive characteristics in particular environments.

Invasive species have been introduced to our state in a variety of ways. Some species initially introduced for beneficial reasons, later turned out to be invasive. Examples include Asian bush honeysuckle [*Lonicera* spp. including *L. maackii* (*Amur honeysuckle*), *L. tatarica* (*Tartarian honeysuckle*, and others) and purple loosestrife (*Lythrum salicaria*) introduced for use as landscape plants; non-native selections of reed canary grass (*Phalaris arundinacea*) introduced for forage and erosion control; and garlic mustard (*Alliaria petiolata*) introduced for use as a culinary herb. Increases in domestic and international trade are also resulting in an increasing rate of



The Urban Forest, Oshkosh, WI. Photo by Bill Sturm



unintentional introductions. Examples include emerald ash borer (EAB; *Agrilus planipennis*) and Asian longhorned beetle (ALB; *Anoplophora glabripennis*) which likely arrived in the United States on solid wood packing material carried in cargo ships or airplanes from their native Asia. EAB was likely introduced to Minnesota and other states in infested firewood or nursery stock.

Because most initial introductions occur in urban areas, the impacts of invasive species generally first occur in our urban forests. In turn, urban forests often become the source of invasive problems for our natural areas and rural landscapes.

The term “invasive disease” is used throughout this document.

Although diseases themselves are not technically invasive, the pathogens that cause plant diseases (including but not limited to fungi, bacteria, viruses and phytoplasmas) can be invasive when they infect a susceptible host and conditions are favorable for disease to develop.

WHAT ARE URBAN AND COMMUNITY FORESTS AND URBAN AND COMMUNITY FORESTRY?

The urban and community forests are comprised of all the trees, shrubs, groundcovers and associated vegetation, native and non-native, in and around a city, village or town in association with the buildings, infrastructure, soil, water, air, topography, animals and people. The urban and community forest includes landscaped private properties, trees along our streets, vegetation in our parks, trails, natural areas and more. Some of this vegetation was willfully planted and is carefully managed by the property owners, while other vegetation is an accident of land-use decisions, economics, topography or neglect (Miller 1997). This

mosaic or patchwork of highly altered landscapes spans properties, ownerships and jurisdictions.

Community forestry is represented when local people are involved in a forestry activity that benefits that community. An example is cultivating trees that will eventually provide fuel or other forestry products that either generate cash or save the community money by lessening costs for purchasing said products. Urban and community forestry is the management of trees and other natural resources that affect or are affected by trees in a community to sustain the quality of life for its residents without degrading the resources. The “community” in urban and community forestry is the nurturing of community engagement and accomplishment through the involvement of its members in the management and enjoyment of its natural resources.

Urban and community forestry integrates art, science and technology of managing the urban forest landscape for the environmental, ecological, physiological, sociological, economic and aesthetic benefits that trees, shrubs, groundcovers and associated vegetation provide. This management can include arboricultural practices as well as horticulture, gardening, landscaping and lawn care. Urban and community forest landscapes are best managed on various levels of scale because they come in all shapes and sizes and can span properties, ownerships and jurisdictions.

WHAT IMPACTS HAVE INVASIVE SPECIES HAD IN THE URBAN AND COMMUNITY FOREST?

Invasive plants, insects and pathogens can alter ecological relationships in our urban and community forests, as well as, negatively affect the economic, social and environmental benefits our urban and community forests provide.

Invasive species can displace, weaken or kill desirable plants resulting in loss of diversity; pose human health risks; degrade wildlife habitat; interfere with recreational activities; disrupt urban and community ecosystems, and divert millions of dollars for their control. In the United States, expenses associated with ecological damage and control of invasive species is estimated at \$137 billion per year and

increasing (Pimentel et al. 2001). Invasives have left our communities with exorbitant control costs, decreased economic, environmental and social benefits, and decreased biodiversity.

The American elm (*Ulmus americana*) was once a major component of Minnesota's residential and street tree populations until the Asian fungi (*Ophiostoma ulmi* and *O. novo-ulmi*) were introduced on European logs. The disease, coined Dutch elm disease, was spread by two beetle species, one European and one native, and by 1980 had killed the majority of elm trees. At one time, elms accounted for 50 to 75 percent of the total urban forest in many Midwest communities, and as much as 95 to 99 percent in some Wisconsin communities (Hafstad et al. 1965). Local governments, their residents and property owners bore the brunt of removal costs.



Tree marked for removal due to Dutch elm disease.
Photo by WDNR.

The impact and economic loss caused by the Dutch elm disease epidemic has been huge; it led to an estimated loss of 60 million trees in the United States, with a financial loss in the billions (Allison 1989).

Gypsy moth (*Lymantria dispar*), originally from Europe Asia, and North Africa, was accidentally released in Massachusetts in 1867 in a failed attempt to raise a hardier silkworm. The larvae now defoliate approximately one million acres of oak and aspen

forest annually from Maine to Virginia and west to Wisconsin. While gypsy moth has not caused significant mortality, it is an additional stressor that slows growth and often contributes to mortality in trees that have been weakened by previous defoliation or other stressors such as compaction and drought. In large numbers, they can become quite a nuisance for property owners. Additionally, some people can experience allergic reactions when they come in contact with the caterpillar's hair. The Minnesota Department of Agriculture (MDA), in partnership with the Minnesota Department of Natural Resources (DNR), U.S. Forest Service, United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS), and the University of Minnesota has developed a gypsy moth program focusing on trapping, treatment, regulatory and outreach avenues to find, monitor, and manage this invasive species. Preventing new infestations through education and regulation enforcement helps keep gypsy moths out of uninfested areas, but as the moths arrive, the partnership works to



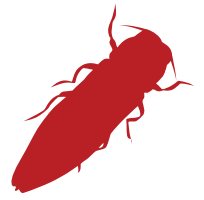
The Adult Emerald Ash Borer - Photo by Krista Hamilton, WI DATCP

facilitate treatments to eliminate or control the populations. Minnesota is engaged on a national platform to Slow the Spread of gypsy moth, delaying the impacts of this pest for its citizens and industries.

Emerald Ash Borer (EAB) is another serious invasive pest which was discovered in Minnesota in 2009. Its arrival puts our state's ash trees in peril. Minnesota's forests are home to 792 million black ash, 201 million green ash, and 2.3 million white ash trees. Another 2.7 million ash trees grow in cities and towns around the state. Ash trees make up 7.2%



EXAMPLES OF THE URBAN FOREST



Landscaped Rural Lot - Photo by Gary Johnson, UMN



Tree Lined Residential Street - Photo by Gary Johnson, UMN



Corporate Stormwater Management Landscape - Photo by Gary Johnson, UMN

EXAMPLES OF THE URBAN FOREST



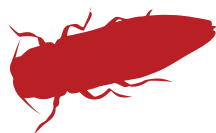
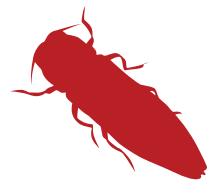
Landscaped Commercial Area - Photo by Gary Johnson, UMN



Reforested Urban Brownfield on Nicollet Island, Minneapolis - Photo by Gary Johnson, UMN



A Boulevard Kitchen Garden in St. Paul, MN - Photo by Gary Johnson, UMN





Defoliation by gypsy moth - Photo by Tim Tigner, Virginia Department of Forestry, (Bugwood.org).

of the trees in Minnesota forests and 15.1% of the trees in Minnesota communities. The larval stage of the insect feeds under the bark of ash trees, cutting off the flow of water and nutrients. Infested trees gradually die over a 3-5 year period. About 15% of Minnesota's street trees are ash, the loss of which would be devastating to many communities. Removal costs will again be borne by local governments and property owners. For an up-to-date map showing EAB distribution go to <http://www.mda.state.mn.us/plants/pestmanagement/eab.aspx>.

Invasive plants are a particular problem in the urban and community forest due to their ability to quickly colonize areas with high levels of disturbance. Our communities are full of opportunities for these plant invaders to establish themselves. Urban areas experience high use and development which leads to soil compaction, erosion and pollution. Invasive species are better able to take advantage of these conditions than our native species and can quickly populate disturbed sites.

Invasive shrubs such as common and glossy buckthorn have taken over parks, woodlands, wetlands, open spaces and backyards throughout Minnesota and the Midwest reducing the richness of desirable native species. Common buckthorn (*Rhamnus cathartica*) spreads aggressively once introduced and has been shown to alter soil ecology, making control and restoration of infested sites difficult (Heneghan et al. 2006). Glossy buckthorn (*Frangula alnus*) forms dense thickets that negatively impact the establishment of new plantings and makes

accessing infested sites difficult (Frappier et al. 2003, 2004). Common buckthorn tends to invade upland areas while glossy buckthorn is found in wetlands and upland areas. Interestingly, the common or European starling (*Sturnus vulgaris*), a primary vector of these species in their native European habitats, was also introduced along with these species.

Invasive forbs are also major problem in the urban and community forest. The invasive plant garlic mustard (*Alliaria petiolata*) is found in backyards, parks, and woodlands alike. It quickly reproduces and out-competes other forbs and seedlings in the area. Garlic mustard appears to suppress tree regeneration by disrupting beneficial associations between tree seedling roots and fungi (mycorrhizal associations), which may help explain its ability to invade undisturbed sites (Stinson et al. 2006).

Invasive species are now widespread across an increasing number of acres in the United States, posing threats to habitats and economies in areas as diverse as agriculture, forestry, urban and community forestry, livestock, fisheries, water bodies and recreation. Invasive species have spread to a wide range of ecosystems and now rank just behind habitat loss as the leading cause of native and rare species declines (Wilcove et al. 1998).



Garlic Mustard Infestation - Photo by WDNR

Boundaries of the urban forest are not solid. The urban and community forest can include a subdivision surrounded by farm fields. Likewise, a residential yard on property out in the country can be considered part of the urban forest if it is managed as such. A forested area in the center of town is also considered part of the urban and community forest.

WHAT CAN URBAN and community forestry practitioners, landscape and tree managers, governments, property owners and special interest groups do about invasive species?

Invasive species do not respect municipal or ecological boundaries. They, like urban and community forests, are best managed on various levels of scale. Individual property owners, urban and community forestry practitioners, professionals, local, state and federal governments, and special interest groups all have a hand in the management of invasive species in our urban and community forests.

Managing existing invasive species infestations is difficult, expensive, and often requires years of effort. In many cases, management is impossible given the resources and technology available. For these reasons, three of the most important invasive species concepts to consider include preventing the occurrence, limiting the spread and reducing impacts. Limiting the spread of invasive species means working to contain an infestation within a defined area. Preventive measures may include quarantines, restricting activities, and minimizing travel through infested areas, especially during certain times of year. Other practices like inspecting clothing and equipment may also limit the spread of invasives. Following the voluntary BMPs outlined in *Minnesota's Urban and Community Forestry Best Management Practices* will help to prevent the introduction and limit the spread of invasive species. Reducing impacts implies that if control and containment methods fail to manage an infestation, a final option may be to reduce the impact on desirable species and the ecosystem. Through this method, the focus shifts from managing invasive species populations to preserving desirable species.

SEVEN ELEMENTS FOR MANAGING INVASIVE SPECIES INCLUDE...

Proper Identification and Life Cycle Knowledge

The effective management of invasive species begins with the ability to properly identify and recognize

invasive species and their impacts and requires a working understanding of their life cycles.

Prevention

An awareness of invasive species, proactive measures to prevent their introduction, and an understanding of their environmental preferences and tolerances and potential mode(s) of invasion are important aspects of prevention planning. Prevention should be the top priority in any invasive species program since once invasive species are introduced the likelihood of their elimination is a difficult prospect.

Early Detection and Rapid Response

Detecting new populations early and responding rapidly increases the likelihood of successful containment and eradication while keeping costs down.

Control and Management

In many cases an invasive species may become too widespread and abundant to eradicate. In those cases, it may be cost-effective to reduce impacts by slowing the spread of the species and reducing its population density to lower levels through integrated control and management planning.

Monitoring

The periodic inspection of target areas (e.g., travel corridors, access points, post-activity areas and areas with previously treated infestations) can lead to earlier detection and more successful treatment in the long run.

Restoration

Invasive species are more likely to colonize sites that have been disturbed. The earlier a land manager can return the land to desirable vegetation or find ways to minimize site disturbance, the less vulnerable a site will be to invasion. Planting disease resistant cultivars and maintaining high levels of species diversity are good steps for restoring a site.

Communication and Education

Educate yourself, employees, volunteers, clients, customers, and users about invasives, control options, and management effectiveness. Report new infestations to invasive species specialists. History has shown that communication and education efforts are important, but are rarely



effective by themselves. Creating and budgeting for a strategic outreach and education work plan is an important function to consider.



CHAPTER 2

ELEMENTS OF
INVASIVE SPECIES
MANAGEMENT

CHAPTER 2

ELEMENTS OF INVASIVE SPECIES MANAGEMENT

In urban and community forest ecosystems we have a situation that is very different from traditional forested environments. A great diversity of vegetation, native and non-native, can be found in our communities. This includes landscaped private properties, trees along our streets, vegetation in our parks, trails, natural areas and more. Much of this vegetation was willfully planted and is carefully managed by the property owners, while other vegetation is an accident of land-use decisions, economics, topography or neglect (Miller 1997). This mosaic or patchwork of highly altered landscapes spans properties, ownerships and jurisdictions. Invasive species do not respect boundaries. They, like urban and community forests, are best managed on various levels of scale. Individual property owners, urban and community forestry practitioners, professionals, local, state and federal governments and special interest groups all have a hand in the management of invasive species.

Invasive species management programs across the country have incorporated several common elements including: Prevention, Early Detection and Rapid Response, Control, and Restoration. These elements serve as guiding principles of the National Invasive Species Management Plan (<http://www.invasivespeciesinfo.gov/council/nmp.shtml>) and form the basis for the USDA-Forest Service Invasive Species Program (<http://www.fs.fed.us/invasivespecies/>). Elements of invasive species management include physical and chemical means, but they may also include legislative, education, biological control, and planning components. These elements can help guide the actions of those who are concerned about invasive species within our urban and community forests. For example, these elements can assist homeowners and companies managing individual properties. Municipal tree managers may use the elements to manage invasives for an area that includes hundreds of different properties within their community. A multi-agency or multi-partner approach would be needed for even broader scales.

PROPER IDENTIFICATION and life cycle knowledge

The effective management of invasive species begins with the ability to properly identify and recognize invasive species and their impacts and requires a working understanding of their life cycles.

PREVENTION

An awareness of invasive species, proactive measures to prevent their introduction, and an understanding of their environmental preferences and tolerances and potential mode(s) of invasion are important aspects of prevention planning. Prevention should be the top priority in any invasive species program since once invasive species are introduced the likelihood of their elimination is a difficult prospect.

EARLY DETECTION & RAPID RESPONSE

One of the most difficult aspects of managing invasive species is that they are usually widespread before they are recognized as harmful. Some species, like small insects or fungi, are so inconspicuous that populations can go unnoticed for many years after introduction. Others species do not spread quickly or cause damage at first, but become invasive later due to adaptation, because wildlife begin to spread them [e.g., multiflora rose (*Rosa multiflora*)] or because population sizes reach the point where exponential growth allows them to increase rapidly.

The figure 1 illustrates this problem using a hypothetical population with a growth rate of 1.5x each generation. For the first 30 generations population growth is barely detectable; this is called the lag phase. After that, the species reaches a population threshold that allows for a rapid increase in the next ten generations – the exponential growth phase. Often a species is not recognized as invasive until it reaches the exponential phase, but





by this point control is very difficult and eradication is usually impossible. Gaining an advantage in controlling such species may require taking action during the lag phase, rather than assuming that these species will not become invasive in the future. Recognizing invasive characteristics and taking action early in the invasion process will make control efforts more effective and less costly.

Even the best prevention efforts cannot stop all introductions. Early detection of incipient invasions and quick, coordinated responses are needed to eradicate or contain invasive species before they become too widespread and control becomes technically and/or financially impossible. Populations that are not addressed early may require costly ongoing control efforts.

National Invasive Species Management Plan, 2001

It is widely agreed that exclusion is the most effective approach to the problem of invasive species. However, there is a similar consensus that in the current climate of trade and travel, more introductions are inevitable. Because the chances for eradication or control are greatest immediately after introduction, early detection and rapid response will be an important part of managing invasive species (Worall 2002).

Early Detection, as applied to invasive species, is a comprehensive, integrated system of active or passive surveillance to find new populations of invasive species as early as possible, when eradication and control are still feasible, less damaging to native ecosystems, and less costly. It may be targeted at: a.) areas where introductions are likely such as ports of entry, campgrounds or natural areas that border residential properties, b.) areas with high ecological value to the urban and community forest where impacts are likely to be significant, and c.) vulnerable habitats or recently disturbed areas (Worall 2002).

Rapid response is a systematic effort to eradicate or contain 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

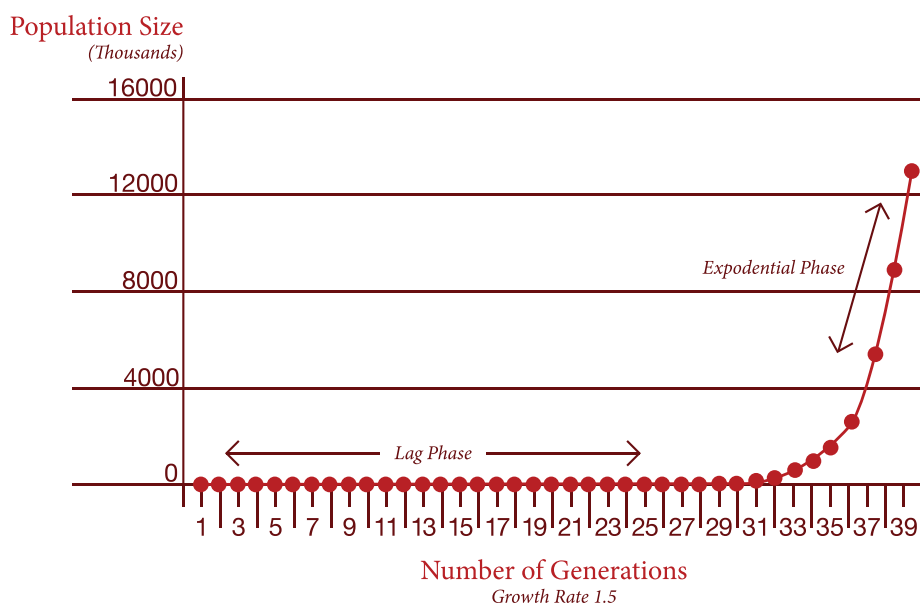


Figure 1. Population growth curve, illustrating the lag and exponential phases for a hypothetical population with a growth rate of 1.5x each generation. Population growth rates vary by species. A species with a growth rate higher than 1.5x (e.g. musk thistle, at 2.2x (Shea and Kelly 2004)) would have a shorter lag phase, and one with a lower growth rate (e.g. spotted knapweed, at 1.17x (Emery and Gross 2005)) would have a longer lag phase.

when based on a plan organized in advance so that the response is rapid and efficient (Worall 2002). Everyone involved in the response should understand the priority for this effort. Work to build consensus among stakeholders.

It is ultimately up to property owners and managers to stay vigilant and take action for invasives on their property. They must be ready and willing to alert the proper authorities in the case of regulated species, such as emerald ash borer. Of course, federal, state, and local governments have a role to play in supporting the efforts of the private citizen, as well as, urban and community forestry practitioners who have a responsibility to educate and inform their clients, report findings and, if possible, offer solutions.

CONTROL & MANAGEMENT

There are control strategies and control methods. The control strategies described below are: eradication, containment and reducing impacts. Control strategies are different approaches to addressing invasive species based on, for example, the size of an infestation, the source of infestation, the quality of the invaded site, the amount of resources available, etc.

Control methods are measures employed to carry out control strategies. They include manual (e.g., pulling and burning), mechanical (e.g., cutting and tilling), chemical, (e.g., targeted pesticide use), biological (e.g., use of the fungus *Bacillus thuringiensis* (BT) for insect pests), and cultural methods (e.g., planting non-host tree species). Usually no one method is effective at controlling invasive species. To determine the best method or combination of methods to use, one should evaluate the site and the life cycle of the invasive species of concern. See *Appendix A: Brief Overview of Control Methods for additional explanations of control methods.*

When a combination of control methods is used it is referred to as integrated pest management (IPM). In the urban and community forest context, integrated pest management can be defined as the maintenance of destructive agents (plants, insects and diseases) at tolerable levels by the planned use of a variety of preventive, control or regulatory strategies that are ecologically and economically efficient as well as socially acceptable.

Eradication is the elimination of the entire population of an invasive species in a defined geographical area. Site level eradication of some invasive populations can be an attainable goal if new introductions are detected early, resources are available and infestations are not large or pervasive. When limited resources or the degree of infestation rule out eradication, a more realistic management goal may be to slow the spread or reduce the impacts of invasive species.

Slowing the spread of invasive species, or containment, refers to the process or goal of containing an infestation within a defined geographical area (Moore 2005). Containment to a defined area can be very effective at limiting the regional spread of an invasive species. However, containing a species in a defined area requires constant attention and control of the species at the boundary of the defined area. Steps must be taken to prevent spread and new infestations must be located early so control measures can be implemented quickly. Steps in a containment program may include inventory and prioritization of populations for treatment, restricting activities in certain areas or during certain times of year, inspecting and cleaning clothing and equipment to minimize species transport, and locating and controlling new infestations promptly. Successful containment can be costly and difficult to achieve.

Another strategy is to **reduce the impact** of invasive species on local and regional urban and community forest ecosystems to a level necessary to meet site management goals. At this level, the focus shifts from managing invasive species populations to managing the local and regional urban and community forest ecosystems. Methods for reducing the impacts of well-established and widespread invasive species can include planting a diversity of tree species or planting species less susceptible to invasive insects and diseases. This strategy can be used simultaneously and in conjunction with the other strategies, especially for species known to be difficult to control.

Control strategies must strike a balance between the ecological impacts of allowing invasive species to spread and the economic realities of control methods. Not all control methods are practical, effective, economically feasible, or environmentally





sound for application in the urban and community environment. Control strategies should be integrated in ways that maximize management objectives while minimizing negative environmental impacts. Furthermore, control methods continue to develop based on ongoing research. Therefore, the most recent science should be consulted to determine an appropriate course of action.

MONITORING

Monitoring is the periodic inspection of sites to detect new invasions and evaluate the success of applied management plans and control measures. Regular monitoring may result in the early detection of new infestations in recently treated areas may make control measures more successful and may reduce costs.

Monitoring can be an informal process, or it can be highly formal. Most urban and community forestry managers will not need complex monitoring programs; monitoring should be kept as simple as possible and can be integrated with other urban and community forestry activities. Monitoring can be simplified by setting priorities, including identifying specific areas to visit, identifying specific species to monitor and using a list of prioritized target species likely to be encountered in an area (Colorado Natural Areas Program 2000). Target areas can include areas susceptible to invasion, such as transportation corridors and recently disturbed areas, and/or previous infestations that have undergone control measures. Target species can include those susceptible to specific invasive insects or diseases. Periodic visits to these areas and of these species will allow urban and community forestry managers to detect new invasions and assess the success of their control efforts. Appendix B: Monitoring has examples of data sheets that can be used for inventorying, monitoring, and managing invasive species.

RESTORATION

Restoration that establishes and maintains healthy plant communities may prevent invasive species infestations or prevent reoccurrence after invasive species removal. Urban and community forest restoration seeks to reestablish the ecological health of the urban and community forest by returning some of its structure and function lost through development, mismanagement or the neglect of time. Options for restoration sites include: yards, vacant

lots, shopping centers, schoolyards, parks, industrial parks, brown fields, and waterways (Duryea et al. 2000). Successful projects should have the support of the community and a well laid-out restoration plan. Examples include: eliminating mowing or leaf-raking in a park to reestablish a natural forest floor, planting non-invasive, site-appropriate species to decrease erosion, or integrating rain gardens into a residential yard. Additional benefits to urban and community forest restoration include improved storm-water management, increased wildlife habitat, and increased biodiversity. By returning the urban and community forest to a form which is more ecologically sustainable, it can contribute to a community instead of being a drain on its resources.

COMMUNICATION AND EDUCATION

Again, prevention must be the top priority and prevention ultimately begins with a commitment to meaningful prevention measures. The prevention and control of invasive species will also require modifying behaviors, values, and beliefs and changing the way decisions are made. A successful plan to address invasive species issues will depend on the understanding and acceptance of the magnitude and urgency of the invasive species problem and the actions and resources needed to protect valuable native plant communities and designed landscapes. A wide variety of education, outreach and training programs are needed: to raise awareness of the causes of establishment and consequences of invasive species, to educate people about their management options, to keep them abreast of the most current information and to help motivate them to take action.



CHAPTER 3
PLANNING

CHAPTER 3

PLANNING

Invasive species introduction, spread, and impact can be minimized with proper planning. Long term costs can be decreased and resources can be used more effectively and efficiently when land use and activity planning take invasive species into account. This chapter is divided into these two major types of planning activities: land use planning and activity planning.

LAND USE PLANNING

BMP 3.1: Know which invasive species affect or could affect your region and property.

BMP 3.2: Assess the extent of invasive species on and near the property by scouting and documenting infestations.

BMP 3.3: Assess current available resources and explore additional resources to prevent the introduction and manage the spread of invasive species.

BMP 3.4: Develop a plan for managing invasive species.

BMP 3.5: Provide training on identification, management, and prevention techniques of known invasive species to employees, contractors, volunteers, elected officials, owners, users, and the public.

ACTIVITY PLANNING

BMP 3.6: When planning for a specific management/maintenance activity, scout for invasive species both within and around the activity area.

BMP 3.7: Plan urban forest management/maintenance activities to limit the introduction and spread of invasive species.

BMP 3.8: Plan to monitor each site following management/maintenance activities; determine necessary treatments based on presence of invasive species.

BMP 3.9: As opportunities arise, interact with and engage researchers to further our understanding of invasives.





LAND USE PLANNING

Land use planning is a conceptual process that can be done for any property. It may consist of ideas and approaches that are never committed to paper, or can result in a detailed written document. Land use planning is a good way to identify long-term goals, set priorities, develop a timeline, and identify tools needed and available resources. It considers the rationale for various aspects of management and maintenance, including sustainability and providing services to its users. By evaluating the potential risk of invasive species on the property, one can develop a plan for managing those invasives; thus, helping achieve success for the overall management plan. Keep in mind that a good plan will be flexible and adaptive; for instance, priorities may change over time or impacts of invasion may be over- or under-estimated.

INVASIVE SPECIES AND URBAN AND COMMUNITY FOREST MANAGEMENT

There are many types of managed urban and community forest lands, including residential properties, subdivisions, street easements, city parks, school grounds, golf courses, corporate campuses, cemeteries, public gardens or arboreta, zoos, natural areas and nature centers to name a few. Land managers may be residents, owners, employees, contractors or even volunteers. They may or may not be trained in land management and landscape maintenance.

Land managers often find that their ability to meet site management goals and users' needs is inhibited, if not prevented, by the presence of invasive species. For example, invasive thorny shrubs may limit use by park visitors; invasive insects and diseases can kill trees and other vegetation; and some invasive plants, such as wild parsnip and giant hogweed, may present health risks. Furthermore, invasive species control efforts may divert resources from other property management and development activities.

Land management and invasive species control efforts can become more complicated when users, equipment and property staff inadvertently spread seeds, soil and propagules from infested sites to uninfested sites. Failure to promptly

address new infestations of invasive species can lead to a greater drain on future resources.

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Propagule (pröp' a gyool)

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 forest insects, this may be an egg, larva, pupa or adult. In forest diseases, this may be a spore, mycelial fragment (similar to roots) or a fruiting body.

BMP 3.1

KNOW WHICH INVASIVE species affect or could affect your region and property

CONSIDERATIONS

- A. See *Appendices C: Terrestrial Invasive Plants in Minnesota and D: Short List of Invasive Insects and Diseases for Minnesota.*
- B. Know which plant species on your property are susceptible to invasive insects and diseases.
- C. Understand how invasive species impact your valued resources.
- D. Register with the Minnesota Department of Agriculture's Minnesota Tree Care Registry if appropriate (<http://www.mda.state.mn.us/en/licensing/licensetypes/treecareregistry.aspx>).
All companies and persons that provide tree care or tree trimming services and/or who remove trees, limbs, branches, brush or shrubs for hire must register. This includes public, private, and governmental entities. The registry provides an effective way for the state to contact tree care providers about outbreaks and regulations.
- E. Confer with forest health specialists or other resource managers to identify forest health threats or invasive plant, insect or disease infestations of concern in the area.

BMP 3.2

ASSESS THE EXTENT of invasive species on and near the property by scouting and documenting infestations

CONSIDERATIONS

Knowing which invasive species are present, and their location, is the first piece of information needed to evaluate threats. There are several steps to consider when scouting for invasive species:

- A. Scout for invasive species at probable introduction sites such as access points (trails, roads, parking

lots, rest stops, major ports of entry e.g. shipping ports and other examples), transportation corridors, new plantings, construction areas, other disturbed areas and stands of dead/dying/stressed trees, wood waste sites, wood product companies, greenways, drainage ways, waterways and elsewhere.

- B. Identify specific management activities that will be occurring on and near the property in the short and long term. Scout for invasives both within and around those activity areas.
- C. Document invasive species in a manner consistent with established effective record-keeping practices. (*See Appendix B: Monitoring for examples.*)
- D. Cooperate with partners especially when dealing with invasives on a broader geographical scale or when multi-agency issues are involved.

BMP 3.3

ASSESS CURRENT AVAILABLE resources and explore additional resources to prevent the introduction and manage the spread of invasive species

CONSIDERATIONS

- A. Available resources include facilities, equipment, funding, knowledge base, and human resources (both staff and volunteers).
- B. Identify local and regional partners, such as neighborhood groups, with whom you may collaborate.
- C. Identify individuals or groups with a primary focus on invasive species; if these are volunteers, provide staff support and ways to sustain their commitment.
- D. Access information on grants, funding, and supportive organizations.
- E. Know which regulatory tools are available. For example, federal and state governments may utilize quarantines. Local Minnesota governments have the authority to enact and enforce their own nuisance ordinances. (*See Appendix G: Federal and Minnesota State Statutes and Administrative Rules Applicable to Invasive Plants and Pests.*)





BMP 3.4

DEVELOP A PLAN for managing invasive species

CONSIDERATIONS

The extent of the plan should take into consideration property size and management goals. An invasive species management plan may include some or all of the following elements, as appropriate:

- A. Preventative measures to limit introductions of invasive species to the property.
- B. Early detection of invasive species populations.
- C. Measures for an assessment of invasive species threats (prioritization) that considers the impact of invasive species on the property and feasibility of control.
- D. Goals for reducing impacts of invasive species present on the property. Sample goals might include:
 - Reduce abundance of host species (for insects and diseases) or habitat (for plants) by increasing vegetative diversity.
 - Revegetate disturbed areas with desirable, non-invasive plants and cover exposed soil with mulch in a timely manner to prevent the establishment of invasive species. Be sure that the mulch you are using is not a source of invasive species propagules.
 - Use regular monitoring and early detection to identify and control small populations of invasive species.
 - Use appropriate methods to prevent the introduction of soil, seeds and propagules into uninfested areas (e.g. slow spread, reduce abundance, eradicate).
- E. Methods for managing invasive species (e.g. manual, mechanical, chemical, biological, and cultural). Keep in mind the resources you have available to control invasive species. Identify key staff and volunteers, budget, and equipment.
- F. Strategic outreach and education work plan development and methods for educating and informing users, staff, contractors and volunteers on invasive species including identification, impacts and prevention.
- G. Discussions with neighbors and other land managers in your area. Consider cooperative projects and share your findings.

BMP 3.5

PROVIDE TRAINING ON identification, management, and prevention techniques of known invasive species to employees, contractors, volunteers, elected officials, owners, users, and the public

CONSIDERATIONS

- A. Encourage outreach, education, and prevention as part of land management activities. Post invasive species messages and prevention strategies at prominent locations on the property and surrounding community.
- B. Use targeted marketing to reach a broad audience such as including invasives information in your local newspaper, community newsletter, or social media. Identify collaborators and partnerships to conduct and facilitate outreach activities. Use clear, concise and consistent outreach and education messaging.
- C. Provide information to your local representatives whose decisions influence invasive species management as well as to the community tree and park managers.
- D. Provide information about where to report sightings of invasive species and locations of new infestations.
- E. Post informational signs at locations where invasive species management efforts are being implemented; explain impacts, control methods, and spread prevention strategies.
- F. Present targeted messages during peak use seasons and peak seasons of biological importance (i.e., seed production, flowering).
- G. Provide incentives for users, volunteers, and employees to support invasive species control and management goals; recognize those who contribute to these efforts.

ACTIVITY PLANNING

Once established, many invasive species can increase even as a result of well-intentioned management or maintenance activities. However, with planning routine management and maintenance activities

can help prevent or minimize the spread of invasive species. An activity, for purposes of this chapter, may include any practice that influences vegetation, soils, or other habitat conditions such as planting and installation, pruning, mowing, construction, or tree removal.

Activity planning may occur on properties of all sizes, uses, and types of ownership. Activity plans may be written documents; however, in many cases, activity planning is performed informally by land managers and not committed to paper. Recognizing that planning for activities is accomplished in a variety of ways, the goal of this chapter is to identify a set of steps and considerations that managers can utilize to prevent or minimize the spread of invasive species.

BMP 3.6

WHEN PLANNING FOR a specific management/maintenance activity, scout for invasive species both within and around the activity area

CONSIDERATIONS

- A. Identify management/maintenance activities that will be occurring on and near the property in the short and long term.
- B. Determine how management/maintenance activities may affect or may be affected by invasive species on and near the property.

BMP 3.7

PLAN URBAN AND community forest management/maintenance activities to limit the introduction and spread of invasive species

(See also BMP 7.1.)

CONSIDERATIONS

The planning phase is the time to consider whether

special precautions for invasive species are needed and how they will affect the planned activity. The following BMP Considerations are examples of possible ways to address the BMP Statement.

A. Timing

- Consider the need for invasive species control efforts, and determine whether those efforts should occur prior to, after or concurrent with the planned urban and community forest management/maintenance activity.
- If pre-treatment of invasive species is warranted, postpone activity until the infestation can be treated. Effective pre-treatments sometimes need to occur one to two years prior to the activity or even longer to deplete the seedbank.
- Consider practical seasonal timing options that minimize the risk of introducing or moving an invasive species. (See Figure 2.)
- Consider not carrying out an urban and community forest management/maintenance activity where spread of invasive species is likely.
- Prioritize and concentrate activities based on the most serious threat to make the most of limited human resources.

B. Boundaries

- Set up activity boundaries to exclude areas infested with invasive species that could be moved by equipment and workers.
- Make sure those involved in the activity are aware of the boundary locations and reasoning for their placement. Consider using signage so people not involved in the activity will be aware of the boundaries.
- Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.

C. Sequence

- Consider options for the sequence of operations within the activity area and, where feasible, plan to enter areas infested with invasive species last.

D. Cleaning

- Plan for appropriate cleaning of workers and equipment to limit the introduction and spread of invasive species. Make prior arrangements for any cleaning that may be needed in conjunction with the activity. Consider the risks different types of equipment pose to introducing/spreading invasive species. (See also Chapter 8: Sanitation and Debris Disposal.)

E. Compaction and Ground Disturbance

- Where feasible, prevent soil compaction and avoid





creating soil and site conditions that promote invasive plant germination and establishment. Minimize soil disturbance to no more than needed to meet project objectives.

- Consider the impacts of different types of equipment and, where feasible, plan to use equipment that minimizes soil disturbance and compaction.
- Use erosion control techniques to help prevent movement of soil which may contain invasive plants and their propagules.
- Plan ahead of soil disturbing activities to have planting materials and ground covers ready to install to prevent invasion.
- Plan to remediate soil disturbance and compaction caused during projects to allow for establishment of desirable species.

BMP 3.8

PLAN TO MONITOR each site following urban and community forestry management/maintenance activities; determine necessary treatments based on presence of invasive species

(See also Chapter 9: Monitoring and Research.)

CONSIDERATIONS

- A.** Conduct periodic inspections of each site following management/maintenance activities, anticipate responses of invasive species to activities and check for new infestations or the spread of existing populations. Inspect on an annual basis, at a minimum, for as long as there is an invasive problem.
- B.** Consider monitoring the entire property on a regular basis. This depends on the size and location of the property as well as the scale, extent and type of invasive species present.
- C.** Monitoring should be kept as simple as possible to meet invasive species management objectives. It can be integrated with other activities.
- D.** Determine appropriate control measures to respond to new infestations or spreading populations. Communicate these options with property owner ahead of time in case they don't want to use chemicals. You may need to allow time for other

options.

- E.** While monitoring sites for known invasive species, land managers should be alert for emerging invasive threats such as emerald ash borer.

BMP 3.9

AS OPPORTUNITIES ARISE, interact with and engage researchers to further our understanding of invasives

(See also BMP 9.6.)

Our understanding of invasive species ecology and prevention is increasing but still insufficient to contain or control invasives in many situations in which they occur. Our ability to predict what new species may become invasive and what landscape practices may provide habitat for these invasives is even more limited. Research conducted by universities and institutions is one source for learning about invasives. Researchers can also benefit by interacting with practitioners and discussing the emerging invasive species issues in the practice of urban and community forestry and landscaping.

CONSIDERATIONS

- A.** Develop on-going communications and partnerships with area universities, colleges, and institutions where the potential for research in matters of interest to urban and community forestry occur.
- B.** Consider the potential for cooperative research opportunities when undertaking new controls or practices for which little information is available.
- C.** Encourage research/testing of (new) urban landscape plants, either native or non-native, which exhibit tolerable levels of sterility and vegetative proliferation.
- D.** Researchers could be key partners in a monitoring program to help gauge which new plants, insects and diseases may become invasive and in which situations.

	GARLIC MUSTARD				COMMON BUCKTHORN			
	Germination	First-Year Basal Rosettes Actively Growing	Flowering	In-Seed	Germination, Spring Leaf-Out	Flowering	In-Fruit	Avoid Spring Sap Flow
JANUARY								“ ”
FEBRUARY								
MARCH	Burn Seedlings	Spray			Burn Stems ≤ 1 " D			
APRIL								
MAY				Hand Pull, Cut/Mow			Foliar Spray Mature Plants	
JUNE								Herbicide Cut Stumps Basil Bark Treatment
JULY				Avoid Traveling Through Areas When Propagules Present				
AUGUST						Avoid Traveling Through Areas When Propagules Present		
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								

Caution: Seeds and fruit may remain on plants through winter!

Figure 2: Identifying time windows for invasives species management. Time site preparation activities to avoid spreading invasive seeds and other propagules. The goal of this chart is to present basic planning concepts.





CHAPTER 4

DESIGN

CHAPTER 4

DESIGN

Good landscape design and proper installation can result in a healthier, more aesthetically pleasing, more ecologically sound, and more user friendly urban and community forest. The absence of a good design could actually contribute to invasive species infestations by intentionally introducing them or by ignoring existing invasive species populations and environmental site conditions. Planting species that are not appropriate for the site can lead to poor growth and less disease and insect resistance. Invasive species will often move in, taking advantage of such a situation. If invasive species are already present, this may influence the species used and the overall design.

BMP 4.1: Conduct a site assessment prior to site design.

BMP 4.2: Conduct an inventory for invasive species as part of a site assessment.

BMP 4.3: Do not include invasive species in planting designs.

BMP 4.4:
Design using plant materials that are site appropriate and less susceptible to highly damaging/detrimental pests and diseases.

BMP 4.5: Design planting conditions that foster the establishment and health of plants.

BMP 4.6: Diversify the planting material within the context of your design.

BMP 4.7:
Design with long-term management/maintenance in mind.





BMP 4.1

CONDUCT A SITE assessment prior to site design

CONSIDERATIONS

- A. A site visit to conduct the assessment is necessary. Multiple site visits to conduct the assessment may be necessary depending upon the time of year, ground cover, climatic conditions etc.
- B. Factors to consider include: existing hardscapes, below and above ground utilities, neighboring properties, soils, types of ecosystems, micro-climate, topography, slope, aspect, hydrology, wildlife, cultural resources, land use and trees and other vegetation including invasive species and potential invaders.
- C. Proper site assessment enables selection of vegetation appropriate for the site and therefore more resistant to insects and disease. It locates existing desirable species and conditions that may be utilized in the design. The process identifies areas of invasive species that may need to be treated before implementing a planting plan.

BMP 4.2

CONDUCT AN INVENTORY for invasive species as part of a site assessment

(See also Chapter 9: Monitoring and Research.)

CONSIDERATIONS

Knowing which invasive species are present, their location and extent is the first piece of information needed to evaluate threats. These are some steps to consider in inventorying invasive species:

- A. The extent and intensity of inventories should be appropriate to the threat posed by invasive species in or likely to be in the area and by the potential effects of development/design on the spread, release or control of those species.
- B. Inventories for invasive insects and diseases should occur at likely introduction sites such as roads and trails, construction sites, new plantings and stands

of dead/dying/stressed trees.

- C. If possible, include adjacent properties in invasive species inventories.
- D. Inventories could also include discussions with forest health specialists or other resource managers to identify invasive plants, insects or diseases of concern in the area as well as any other forest health threats.
- E. Be aware of species that look very similar to invasive species.

BMP 4.3

DO NOT INCLUDE invasive species in planting designs

(See also BMPs 5.1 & 6.2.)

CONSIDERATIONS

- A. See Appendix C: *Terrestrial Invasive Plants in Minnesota*.
- B. Consider replacing existing invasive plants in the final planting design. Agencies, organizations and groups can have differing points of view about invasiveness of some species. This is natural considering invasiveness varies due to location, habitat type, disturbance history, urban versus rural locations, proximity to propagules, cultivar and varietal differences, and many other factors. What may be invasive in one environment may not be invasive in another so long as it is unlikely that seeds or other propagules will be transported to other areas.

BMP 4.4

DESIGN USING PLANT materials that are site appropriate and less susceptible to highly damaging/detrimental pests and diseases

(See also BMP 6.4.)

CONSIDERATIONS

- A. Site appropriate species are those that are suited to the climate, microclimate (includes wind and sun/shade) and soil type (pH, texture, moisture and drainage) where they are to be planted. In the urban environment, plant material must also be compatible with the hardscapes and maintenance needs.
- B. Plant materials (including seeds/seed mixes) from similar hardiness zones or provenances are more likely to be adapted to local growing conditions as long as the site hasn't been rendered unsuitable for a particular species through compaction or other activities. Avoid mail orders from sources outside your region unless the contents are guaranteed to be non-invasive in Minnesota.
- C. Design with plants which may fulfill multiple needs: e.g., ecological, aesthetic, and wildlife.

BMP 4.5

DESIGN PLANTING CONDITIONS that foster the establishment and health of plants

CONSIDERATIONS

- A. Healthy vegetation is better able to withstand infestations, infections, and competition from invasive plants.
- B. Minimize the amount and severity of soil disturbance to reduce introduction of invasive species to the site.
Preserve the existing soil structure if it is intact to foster plant establishment and health; otherwise consider the need for soil amendments.

BMP 4.6

DIVERSIFY THE PLANTING material within the context of your design

(See also BMP 6.5.)

CONSIDERATIONS

- A. Increased species diversity may reduce the impacts of invasive insects or diseases.
- B. A diversity of species may inhibit the spread of invasive insects and diseases.
- C. For designs other than natural areas or turf grass, consider striving for a species diversity of no more than 20% in one family, no more than 10% in one genus and no more than 5% of any single species, including cultivars and varieties.
- D. Consider the existing regional landscape and other designs in the region when diversifying your planting design.
- E. Consider a long term planting strategy to increase age diversity. Increased age diversity may reduce the overall impacts if invasive insects or diseases prefer to attack trees of a certain age or size.
- F. Consider plants that are hosts for beneficial insects and birds to improve their habitat and function.

BMP 4.7

DESIGN WITH LONG-TERM management/maintenance in mind

CONSIDERATIONS

- A. It may be prudent to delay planting or plant in stages to allow time for existing invasive species infestations to be treated prior to planting.
- B. Be familiar with invasive species in your region and those that are on their way.
- C. Recognize the duration, costs and funding for treatments for plants that are susceptible to invasive insects or diseases.





D. Formal designs typically need more maintenance long-term. If a long-term maintenance commitment cannot be met, the area may become invaded by invasive species.



CHAPTER 5

PLANT SELECTION
AND SALES

CHAPTER 5

PLANT SELECTION AND SALES

Though the majority of introduced landscape plants are non-invasive, some of our worst plant invaders were introduced as landscape plants. Research has shown that 85% of woody invasive species in North America were introduced for the landscape trade (Reichard and Hamilton 1997, Snow 2002). The green industry is driven by consumer demand; people are always searching for the latest-and-greatest plants, and new plant introductions are key to the multi-billion dollar nursery and landscape industry. Most introduced plants do not cause problems; however, those that do have significant economic and environmental costs. Therefore it is very important to educate growers and consumers about not using invasive plants and to offer a wide variety of non-invasive alternatives. It is also incumbent that plant breeding and selection programs include an assessment of potential invasiveness before new releases are approved.

When it comes to introduced invasive insects and diseases, the green industry is itself a victim. Stock infested or infected with invasive pests may need to be treated or destroyed, and the threat of pests can severely affect demand for host species. Once a big seller, sales of ash species bottomed out with the increasing threat of emerald ash borer leaving many growers with large inventories of ash that ultimately became a significant loss. Green industry professionals can continue to be vigilant about recognizing and responding to suspected invasive pest problems.

BMP 5.1: Do not purchase, sell or propagate known invasive plant species or their propagules.

BMP 5.2: Do not purchase or sell plant or landscape material you suspect may be infested or infected with invasive pests.

BMP 5.3: When available and appropriate, purchase, sell and propagate species, cultivars and varieties known to be less susceptible to invasive pests as alternatives to more susceptible ones.

BMP 5.4: Plant propagators, wholesalers and retailers are responsible for educating themselves and their customers about invasive plants and potential invasive insect and disease issues associated with host plant materials.





BMP 5.1

DO NOT PURCHASE, sell or propagate known invasive plant species or their propagules

(See also BMPs 4.3 & 6.2.)

CONSIDERATIONS

- A. See Appendix C: *Terrestrial Invasive Plants in Minnesota*.
- B. In general, lists on websites are updated more often than hard copy lists.
- C. Agencies, organizations and groups often have differing points of view about which species are invasive. This is natural considering invasiveness varies due to location, habitat type, disturbance history, urban versus rural, proximity to propagules and many other factors. What may be invasive in one environment may not be invasive in another.
- D. The United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) regulates the importing and exporting of plant, plant product and soil throughout the United States. Permits are required for the importation into the U.S. of regulated plants and plant products for consumption and propagation. APHIS does not generally regulate the movement of plants from one state to another, with the exception of parasitic plants, federal noxious weeds (which require a pest permit for interstate movement), and host plants regulated under specific domestic quarantines. (http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml) State Plant Health Director should be contacted to find out if a domestic quarantine applies to your plants.

BMP 5.2

DO NOT PURCHASE or sell plant or landscape material you suspect may be infested or infected with invasive pests

(See also BMP 6.3.)

CONSIDERATIONS

- A. See Appendix D: *Short List of Invasive Insects and Diseases for Minnesota*.
- B. See Appendix E: *Resources Sections 3 and 4 for more information on invasive insects and diseases*.
- C. Inspect plant and landscape material for signs and symptoms of invasive species.
- D. Be familiar with invasive plants and the signs and symptoms of invasive insects and diseases that affect or may affect your area.
- E. Plants should be purchased only from nurseries holding a valid Minnesota nursery stock dealer or grower certificate. The Minnesota Department of Agriculture inspects and certifies nursery stock and the growers and dealers holding that nursery stock. Certification assures purchasers that nursery stock is apparently free of harmful pests and in healthy condition. Certified nursery stock dealers and growers must sell only certified nursery stock and provide documents to verify certification of stock offered for sale, including for destinations out of state. Federally-issued phytosanitary certificates are necessary for shipment of certified nursery stock out of country.

BMP 5.3

WHEN AVAILABLE AND appropriate, purchase, sell and propagate species, cultivars and varieties known to be less susceptible to invasive pests as alternatives to more susceptible ones

CONSIDERATIONS

- A. Examples of this are the elm cultivars which are less susceptible to Dutch elm disease than the standard American elm.
- B. Educate buyers about these choices; this could be used as a marketing piece.
- C. This should not preclude the use of certain species to achieve biodiversity (e.g. red oak which is susceptible to oak wilt disease).

BMP 5.4

PLANT PROPAGATORS, WHOLESALERS and retailers are responsible for educating themselves and their customers about invasive plants and potential invasive insect and disease issues associated with host plant materials

CONSIDERATIONS

- A. Plant propagators, wholesalers and retailers should provide guidance to their customers about the invasive potential of these species and where they should or should not be used.
- B. Invasive potential should be assessed by the propagator or qualified experts using emerging risk assessment methods that consider plant characteristics and prior observations or experience with the plant elsewhere in the world.
- C. Additional insights may be gained through on-going monitoring in the nursery for potential invasiveness.
- D. Familiarize yourself with the Noxious Weed Law: (<http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx>). Learn which plants are prohibited from sale and which plants are “Specially Regulated Plants” with their own set of guidelines.





CHAPTER 6

**PLANTING AND
INSTALLATION**

CHAPTER 6

PLANTING AND INSTALLATION

Poor planting and installation practices can limit the establishment of desired species and introduce and spread invasive species. Poor or no topsoil and compacted soils should be avoided and mitigated to ensure good establishment of new landscape plants. Whenever possible, so long as the soil isn't contaminated with toxic materials, native topsoil should be protected and retained. Disturbed ground provides opportunities for invasives to germinate and should be managed accordingly. Plant and construction materials brought onto the site may be invasive or may harbor invasive species. Equipment used for planting and installation activities, as well as boots and clothing of personnel, may carry invasives or their propagules.

BMP 6.1: Limit the introduction and spread of invasives during site preparation activities.

BMP 6.2: Do not plant invasive species.

BMP 6.3: Do not plant material that you suspect may be infested or infected with invasive pests.

BMP 6.4: Select plant materials that are site appropriate, healthy, and less susceptible to highly damaging/detrimental pests and diseases.

BMP 6.5: Diversify the planting material within the context of your planting project.

BMP 6.6: Prepare site and plant trees according to current arboriculture industry standards for optimum tree health.

BMP 6.7: Reduce the introduction of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation.

BMP 6.8: Avoid unnecessary soil disturbance.

BMP 6.9: Stabilize disturbed soils in a timely manner to prevent the establishment of invasive species.

BMP 6.10: Use landscape materials that are free of invasive species and their propagules.

BMP 6.11: Monitor sites following planting and installation activities; determine necessary treatments based on presence of invasive species.

BMP 6.12: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting invasive plant propagules.

BMP 6.13: Remove soil, seeds, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area.





BMP 6.1

LIMIT THE INTRODUCTION and spread of invasives during site preparation activities

Site preparation methods should be determined by site conditions and site preparation objectives. Site preparation can be accomplished by mechanical or chemical methods or with the use of fire. Often these methods are used in conjunction to control competing vegetation.

Site preparation methods may involve disturbing the soil bed by removing existing vegetation, importing non-native soil and amendments such as compost, and exposing soil to create a favorable growing environment for trees or other desirable vegetation. Damaged soil structure, including compaction also commonly occur, especially when soils are worked when wet, and great care should always be taken to prevent such damage as it is very difficult to repair. The potential for such damage relative to the need to use large equipment versus more labor-intensive methods that are less likely to damage soils should also be seriously considered. It is important to keep in mind that the majority of site preparation methods will create conditions favorable to invasive plant colonization. New invasive species may become established and existing populations may spread. Imported soil and organic mulches (compost) that may harbor invasive species should be primary considerations.

CONSIDERATIONS

- A. In areas where invasive species are known to be present, including in the seed bank, it may be necessary to treat invasives as part of the site preparation process. Keep in mind it is almost always easier to treat invasives before an area is planted to its desired vegetation.
- B. Spot application of herbicides or fire (with the use of a weed torch) may reduce the impact to non-target plants.
- C. One goal of site preparation might be to promote invasive plant species germination or growth from the existing soil seedbank or root system—then treating—in order to eliminate some of the seed-

bank competition before planting desired vegetation.

- D. While ground disturbance may be necessary to aid the germination and establishment of desirable vegetation (especially when planting by seed), it should not extend beyond the area where revegetation is desired.
- E. Some seed planting may be accomplished by methods requiring little to no soil disturbance (e.g. no till drilling or broadcast seeding prairie in late autumn before first snow.)
- F. Avoid damaging branches, stems, or roots of trees and other vegetation to be retained in the landscape during mechanical site preparation. Reference American Standards for Tree Care Operations – Management of Trees and Shrubs During Site Planning (ANSI A300 Part 5).
- G. Time site preparation activities to avoid spreading invasive seeds and other propagules. (See Figure 2.)
- H. Inspecting areas at highest risk of invasion following soil disturbance activities may help to detect new invasions.
- I. Protect native topsoil, avoid using imported soil, and avoid overworking soils and soil compaction.
- J. Ensure imported soil and mulches (compost) will not be a source of invasive species.

BMP 6.2

DO NOT PLANT invasive species

(See also BMP 4.3.)

CONSIDERATIONS

- A. See Appendix C: Terrestrial Invasive Plants in Minnesota.
- B. See Appendix E: Resources Section 2 for plants to use as an alternative to invasives.
- C. In general, lists on websites are updated more often than hard copy lists.
- D. Federal and state agencies, business and community organizations, and other groups often have differing points of view about which species are invasive. This is natural considering invasiveness varies due to location, habitat type, disturbance history, urban versus rural locations, proximity to propagules, and many other factors. What may be

	GARLIC MUSTARD				COMMON BUCKTHORN			
	Germination	First-Year Basal Rosettes Actively Growing	Flowering	In-Seed	Germination, Spring Leaf-Out	Flowering	In-Fruit	Avoid Spring Sap Flow
JANUARY								« »
FEBRUARY								
MARCH	Burn Seedlings				Burn Stems ≤1" D			
APRIL								
MAY						Foliar Spray Mature Plants		
JUNE			Hand Pull, Cut/Mow					
JULY		Spray						
AUGUST				Avoid Traveling Through Areas When Propagules Present				Herbicide Cut Stumps
SEPTEMBER						Avoid Traveling Through Areas When Propagules Present		Basil Bark Treatment
OCTOBER								
NOVEMBER								
DECEMBER								

Caution: Seeds and fruit may remain on plants through winter!

Figure 2: Identifying time windows for invasive species management. Time site preparation activities to avoid spreading invasive seeds and other propagules. The goal of this chart is to present basic planning concepts.

invasive in one environment may not be invasive in another.

- E. The United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) regulates the importing and exporting of plant, plant product and soil through the United States. Permits are required for the importation into the U.S. of regulated plants and plant products for consumption and propagation. APHIS does not generally regulate the movement of plants from one state to another, with the exception of parasitic plants, federal noxious weeds (which require a pest permit for interstate movement) and host plants regulated under specific domestic quarantines. The APHIS State Plant Health Director should be contacted to find out if a domestic quarantine applies to your plants.

www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml

BMP 6.3

DO NOT PLANT material that you suspect may be infested or infected with invasive pests

(See also BMP 5.2.)

CONSIDERATIONS

- A. See Appendix D: Short List of Invasive Insects and Diseases for Minnesota.
- B. See Appendix E: Resources Sections 3 and 4 for more information on invasive insects and diseases.
- C. Inspect plant and landscape material for signs and symptoms of invasive species.
- D. Be familiar with invasive plants and the signs and symptoms of invasive insects and diseases that affect or may affect your area.
- E. Plants should be purchased only from nurseries holding a valid Minnesota nursery stock dealer or grower certificate. The Minnesota Department of Agriculture inspects and certifies nursery stock and the growers and dealers holding that nursery stock. Certification assures purchasers that nursery stock is apparently free of harmful pests and in healthy condition. Certified nursery stock dealers and growers must sell only certified nursery stock and provide documents to verify certification of stock offered for sale, including for destinations out of state. Federally-issued phytosanitary certificates are necessary for shipment of certified nursery stock out of country.
- F. A purchasing contract from the vendor supplying stock may help insure pest free materials if it is specified in the contract. Recognize that invasive species may inhabit the soil associated with nursery stock such as invasive plant propagules (including



weed seeds), specific invasive insect stages, invasive diseases, and even non-native earthworms (all earthworm species are non-native to Minnesota).

BMP 6.4

SELECT PLANT MATERIALS that are site appropriate, healthy, and less susceptible to highly damaging/detrimental pests and diseases

(See also BMP 4.4.)

CONSIDERATIONS

- A. Healthy trees are less susceptible to insect and disease outbreaks than stressed trees.
- B. Site appropriate species are those that are suited to the climate, microclimate (includes wind and sun/shade) and soil type (pH, texture, moisture and drainage) where they are to be planted. In the urban environment, plant material must also be compatible with the hardscapes and maintenance needs.
- C. Plant materials (including seeds/seed mixes) from similar hardiness zones or provenances are more likely to be adapted to local growing conditions. Avoid mail orders from sources outside your region unless the contents are guaranteed to be non-invasive.
- D. Examine stock before planting—be sure it is not diseased, infested with insects or mislabeled. All plant material shall conform to American Standards for Nursery Stock (ANSI Z60.1). (Note: It is not common for stock to be diseased. However, a disease like gall rust could easily be identified, and those plants could be culled.)
- E. Some trees and other vegetation are host species or alternative hosts for native diseases and insects. If the potential for damage is low, this should not preclude their use. If the potential for damage is a concern, consider using resistant varieties or a completely different species.
- F. Plant species that fulfill multiple needs (e.g., ecological, aesthetic, and wildlife).

BMP 6.5

DIVERSIFY THE PLANTING material within the context of your planting project

(See also BMP 4.6.)

CONSIDERATIONS

- A. Increased species diversity may reduce the impacts of invasive insects or diseases.
- B. A diversity of species may inhibit the spread of invasive insects and diseases.
- C. For designs other than natural areas or turf grass, consider striving for a species diversity of no more 20% in one family, no more than 10% in one genus and no more than 5% of any single species, including cultivars and varieties.
- D. Consider the existing regional landscape and other designs in the region when diversifying your planting design.
- E. Consider a long term planting strategy to increase age diversity. Increased age diversity may reduce the overall impacts if invasive insects or diseases prefer to attack trees of a certain age or size.
- F. Consider plants that are hosts for beneficial insects, birds, and other wildlife to improve their habitat and function.

BMP 6.6

PREPARE SITE AND plant trees according to current arboriculture industry standards for optimum tree health

CONSIDERATIONS

- A. Proper site preparation can lead to healthier trees which may be better able to withstand infestations, infections and competition from invasive plants.
- B. Selecting trees and other vegetation that are suitable for a given site based on soil conditions and other environmental factors will result in a less stressful environment and the likelihood that the desired plants will be better able to become established in the landscape and become established

more quickly.

- C. Avoid using soils known to be contaminated by herbicide residue, salt, or oil for a better planting medium.
- D. See *American Standards for Tree Care Operations-Transplanting (ANSI A300 Part 6)* and its companion publication *Best Management Practices: Tree Planting from the International Society of Arboriculture*.

BMP 6.7

REDUCE THE INTRODUCTION of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation

(See also BMP 7.4.)

CONSIDERATIONS

- A. Avoid wounding as a general practice, but especially avoid wounding during periods of high risk transmission. Wounding can include accidental damage to trees, but can also include purposeful damage such as pruning. Refer to current Minnesota Department of Natural Resources and University of Minnesota Extension research and literature for specifics, for example, oak wilt and Dutch elm disease. Be sure to check your local ordinances first; local ordinances may use more restrictive dates than the state recommends.
- B. Erect barriers to protect existing trees and other vegetation from injury during planting and installation activities occurring in the same general area. See *American Standards for Tree Care Operations – Management of Trees and Shrubs During Site Planning (ANSI A300 Part 5)*.

BMP 6.8

AVOID UNNECESSARY SOIL disturbance

(See also BMP 7.7.)

CONSIDERATIONS

- A. Ground disturbance may uproot existing vegetation and expose soil, creating a seedbed for invasive plants that can overwhelm desirable vegetation.
 - B. Topsoil may be lost to wind or water erosion; local ordinances and state ordinances for silt fencing and other erosion control practices may apply.
 - C. 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.
 - D. Disking or tillage operations may propagate invasive plants that spread by rhizomes, root fragments or seed and should, therefore, be used cautiously.
 - E. 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.
 - F. After a soil disturbance, monitor the area and treat new invasive plant infestations.
- Check with the Minnesota Pollution Control Agency and your local municipal officials to see if your project's soil disturbance requires a NPDES/SDS permit or local permit or erosion control practices such as silt fencing.

Provenance (prov' uh nuh)

The geographic source (i.e., where the seed, seedling, cutting, scion, or root-stock originated). Assures that the plant will be adaptable to the general climatic conditions of that geographic area.

Microclimate

The climate of small spaces, such as an inner city, a residential area, an east or west exposure, or a mountain valley. Microclimate includes factors such as sun/shade, wind, temperature, precipitation, and drainage.



BMP 6.9

STABILIZE DISTURBED SOILS in a timely manner to prevent the establishment of invasive species

(See also BMP 7.8.)

CONSIDERATIONS

- A. After a soil disturbance, encourage prompt regeneration of desirable vegetation or cover exposed soil with a layer of good quality, weed-free mulch to reduce germination or introduction of invasive plants.
- B. Stabilizing disturbed soils includes: revegetating, mulching (straw, woodchips, leaves, etc.), the use of biologs or erosion matting, etc.
- C. A non-persistent cover crop like annual rye or oats can be used to temporarily stabilize the soil and discouraging the establishment of invasive species.
- D. Use weed-free oat or wheat straw where available; “marsh hay” may contain reed canary grass.
- E. In areas where invasive species are known to be in the seed bank, treat invasives before revegetating.
- F. You may purposely not plant a disturbed area if your goal is to promote invasive plant species germination from the existing seedbank—then treating it—in order to eliminate some of the invasive plant seedbank.
- G. Inspecting areas at highest risk of invasion following soil disturbance activities may help to detect new invasions.

BMP 6.10

USE LANDSCAPE MATERIALS that are free of invasive species and their propagules

(See also BMPs 7.6. and 8.7.)

CONSIDERATIONS

- A. Landscape materials include: nursery stock (especially container grown and balled and burlapped (B&B) stock where soil accompanies the plants

and may harbor invasive species), fill, top soil, soil amendments (peat moss, etc.), compost, erosion control materials, stone, and mulch.

- B. Knowing the source of landscape materials may help you avoid infested source material.
- C. Treat infested source material to render invasive species as non-viable prior to its use.
- D. Stockpile displaced topsoil for future use on the same site in an invasives free area. Be aware that if the topsoil is piled too deep, advantageous fungi may be destroyed. This effect varies by soil type, climate, and other factors.
- E. Keep stockpiled material free of invasive species.
- F. Use weed-free oat or wheat straw where available; “marsh hay” may contain reed canary grass seeds or rhizomes and propagules of other undesirable species. The Minnesota Crop Improvement Association certifies agricultural grain straw as weed-free.
- G. Avoid contaminants such as salt, oil and herbicide residue for a better planting medium.
- H. Consider reusing or recycling landscape materials on site to avoid potentially transporting invasives.

BMP 6.11

MONITOR SITES FOLLOWING planting and installation activities; determine necessary treatments based on presence of invasive species

(See also BMPs 7.6. and 8.7.)

CONSIDERATIONS

Anticipate responses of invasive species to planting and installation activities and check for new infestations or the spread of existing populations. Determine appropriate control measures to respond to new infestations or spreading populations. Monitoring should be kept as simple as possible to meet invasive species management objectives.

BMP 6.12

PRIOR TO RELOCATING EQUIPMENT, vehicles, and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting invasive plant propagules

(See also BMPs 7.11 & 8.1.)

EQUIPMENT CLEANING

Invasive species can spread by equipment used in urban and community forestry, landscaping, and landscape maintenance activities, as well as by the workers themselves. Seeds, plant parts, and fungal spores can move in soil or mud in undercarriages, tire tread, and on other areas of equipment. Insects in all life stages can also be moved by equipment. Mud and debris stuck to boots, clothing or tools can also transport invasive plant material, insects, and diseases. Invasive species covered under this BMP include plants (fruit, seed, bud, tuber, root, etc.), insects (egg, larvae, pupae, overwintering adults, etc.) or diseases (fungi, bacteria, viruses, etc.).

CONSIDERATIONS

- A. Equipment should be free of invasive species when it arrives at the work site.
- B. Clean equipment after operating in an area with invasive species and before relocating to new areas and especially those that are free of invasives. Cleaning should occur before leaving the project site, at the site of infestation.
- C. Preferred locations for equipment cleaning areas are those where:
 - Equipment is unloaded and loaded.
 - Invasives are less likely to spread from cleaned equipment (e.g. a blacktopped parking lot). Collect, bag and dispose of invasive species properly. (See also BMP 8.5.)
 - Invasive species are already established.
 - Monitoring can be conducted at a later date.
- D. To limit the spread of invasives downstream, do not clean equipment, vehicles or trailers in or near wa-

- terways or storm sewers or on impervious surfaces that drain to a storm sewer or a surface water.
- E. Contain or filter wash-water on-site, if possible.

BMP 6.13

REMOVE SOIL, SEEDS, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area

(See also BMPs 7.12 & 8.2.)

CONSIDERATIONS

- A. Preferred locations for cleaning your person are those where:
 - Equipment is cleaned.
 - Invasives are less likely to spread (e.g. a blacktopped parking lot). Collect, bag and dispose of invasive species properly. (See also BMP 8.5.)
 - Invasive species are already established.
- B. Check places like hoods, pockets, seams, and Velcro fasteners.

Propagule (pröp' a gyool)

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 forest insects, this may be an egg, larva, pupa or adult. In forest diseases, this may be a spore, mycelial fragment (similar to roots) or a fruiting body.



FOR PURPOSES OF THESE BMPS...

“equipment” refers to off-road, rubber-tired and tracked equipment including mowers, skid steers, bucket loaders, dozers, graders, chippers and other construction equipment.

“relocating” refers to moving off the work site OR moving within the work site from an infested to a non-infested area.

“disposal” refers to methods to dispose of invasive species which can include burning, treating and containment (i.e., bagging). (See also Chapter 8: Sanitation and Debris Disposal.)



CHAPTER 7

LANDSCAPE
MANAGEMENT/
MAINTENANCE

CHAPTER 7
**LANDSCAPE
MANAGEMENT/
MAINTENANCE**

Proper care of landscapes is essential for maintaining and improving the health of our urban and community forests. Routine maintenance and/or management helps to maximize the benefits they provide and minimize the costs associated with management. However, these activities often unknowingly introduce and spread invasive species. Maintenance/management activities include, but are not limited to: pruning, removals, mulching, watering, fertilizing, and lawn care.

BMP 7.1: Plan landscape management/maintenance activities to limit the introduction and spread of invasive species.

BMP 7.2: When working in an area infested or previously infested with invasive species, review monitoring survey data and control records for the property and address as needed in the current work plan.

BMP 7.3: Minimize the movement of invasive species to non-infested areas during landscape management/maintenance activities.

BMP 7.4: Reduce the introduction of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation.

BMP 7.5: Perform activities in a way that promotes healthy plants.

BMP 7.6: Use landscape materials that are free of invasive species and their propagules.

BMP 7.7: Avoid unnecessary soil disturbance and soil compaction.

BMP 7.8: Stabilize disturbed soils in a timely manner to prevent the establishment of invasive species.

BMP 7.9: Keep records of activities that could affect the introduction and establishment of invasive species.

BMP 7.10: Monitor recent work sites for invasive species.

BMP 7.11: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting propagules of invasive species.

BMP 7.12: Remove soil, seeds, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area.

BMP 7.13: Properly treat or dispose of invasive species or materials that may harbor invasive propagules, insects or diseases.

BMP 7.14: If pre- or post-activity invasive species control treatments are planned, ensure they are applied within the appropriate time window and under the correct environmental conditions.





BMP 7.1

PLAN LANDSCAPE MANAGEMENT/maintenance activities to limit the introduction and spread of invasive species

(See also BMP 3.7.)

CONSIDERATIONS

The planning phase is the time to consider whether special precautions to prevent the introduction and spread of invasive species are needed and how they will affect the planned activity. The following BMP Considerations are examples of possible ways to address the BMP Statement.

A. Timing

- Consider the need for invasive species control efforts, and determine whether those efforts should occur prior to, after or concurrent with the planned landscape management/maintenance activity.
- If pre-treatment of invasive species is warranted, postpone activity until the infestation can be effectively treated. Effective pre-treatments sometimes need to occur one to two years prior to the activity or even longer to ensure control of existing plants and to deplete the seedbank.
- Consider practical seasonal timing options that minimize the risk of introducing or moving invasive species. (See Figure 2.)
- Consider not carrying out a landscape management/maintenance activity where the spread of invasive species is likely.
- Prioritize and concentrate invasive species management activities based on the most serious threat to make the most of limited human resources.

B. Boundaries

- Set up activity boundaries to exclude areas infested with invasive species that could be moved by equipment and workers.
- Make sure those involved in the activity are aware of the boundary locations and reasoning for their placement. Consider using signage so people not involved in the activity will be aware of the boundaries.

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

C. Sequence

- Consider options for the sequence of operations within the activity area and, where feasible, plan to enter areas infested with invasive species last.

D. Cleaning

- Plan for appropriate cleaning of workers and equipment to limit the introduction and spread of invasive species. Make prior arrangements for any cleaning that may be needed in conjunction with the activity. Consider the risks different types of equipment pose to introducing/spreading invasive species. (See also Chapter 8: Sanitation and Debris Disposal.)

E. Compaction and 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 project objectives.
- Consider the impacts of different types of equipment and, where feasible, plan to use equipment that minimizes soil disturbance and compaction.
- Use erosion control techniques to help prevent movement of soil which may contain invasive plants and their propagules.
- Plan ahead of soil disturbing activities to have planting materials and ground covers ready to install to prevent invasion.
- Plan to remediate soil disturbance and compaction caused during projects to allow for establishment of desirable species.

BMP 7.2

WHEN WORKING IN AN AREA INFESTED OR PREVIOUSLY INFESTED WITH INVASIVE species, review monitoring survey data and control records for the property and address as needed in the current work plan

CONSIDERATIONS

- A. This can help you plan the sequencing of opera-

tions so that you're working from non-infested to infested areas.

- B. This will also let you know whether or not previous invasives management techniques have been working and what you could do to achieve better success.

BMP 7.3

MINIMIZE THE MOVEMENT of invasive species to non-infested areas during landscape management/maintenance activities

CONSIDERATIONS

- A. Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.
- B. Set up activity boundaries to exclude areas with an invasive species infestation that could easily be disturbed by equipment, workers or users.
- C. Clean equipment before moving from infested to non-infested areas.
- D. Carry out work under conditions that minimize the risk of spread; e.g., frozen ground, snow cover, absence of seeds/propagules, etc. (See Figure 2.)
- E. Exclude infested areas from equipment travel corridors.
- F. Disinfect pruning equipment between cuts when pruning out diseased or damaged portions of plants.
- G. Take measures to minimize the spread of pests when management cannot occur at optimal times. For example, immediately paint wounds on oak trees when they must be pruned during the active oak wilt season.
- H. Check for compliance with local ordinances when conducting maintenance activities and when disposing of debris that is infested or infected with invasive species.

BMP 7.4

REDUCE THE INTRODUCTION of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation

CONSIDERATIONS

- A. Avoid wounding as a general practice, but especially avoid wounding during periods of high risk transmission. Refer to current Minnesota Department of Natural Resources and UM Extension research and literature for specifics, for example, oak wilt and Dutch elm disease. Be sure to check your local ordinances first; local ordinances may use more restrictive requirements and dates than state recommendations.
- B. Erect barriers to protect existing trees and other vegetation from injury during planting and installation activities occurring in the same general area. At minimum, these areas should extend from the trunk to the dripline. See *American Standards for Tree Care Operations – Management of Trees and Shrubs During Site Planning (ANSI A300 Part 5)*.

BMP 7.5

PERFORM ACTIVITIES IN a way that promotes healthy plants

CONSIDERATIONS

Healthy plants are better able to survive and compete against invasive plants, insects, and diseases. Follow ANSI (American National Standards Institute) A300 Standards for Tree Care Operations. For example follow proper procedures for pruning, watering, mulching, fertilizing, etc.





Pathogen (păth'ə-jən)

An agent that causes disease, especially a living microorganism such as a bacterium or fungus.

	GARLIC MUSTARD				COMMON BUCKTHORN			
	Germination	First-Year Basal Rosettes Actively Growing	Flowering	In-Seed	Germination, Spring Leaf-Out	Flowering	In-Fruit	Avoid Spring Sap Flow
JANUARY								“ ”
FEBRUARY								
MARCH	Burn Seedlings	Spray			Burn Stems ≤1" D			
APRIL								
MAY				Hand Pull, Cut/Mow			Foliar Spray Mature Plants	Herbicide Cut Stumps Basil Bark Treatment
JUNE								
JULY				Avoid Traveling Through Areas When Propagules Present				
AUGUST						Avoid Traveling Through Areas When Propagules Present		
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								

Caution: Seeds and fruit may remain on plants through winter!

Figure 2: Identifying time windows for invasives species management. Time site preparation activities to avoid spreading invasive seeds and other propagules. The goal of this chart is to present basic planning concepts.

BMP 7.6

USE LANDSCAPE MATERIALS that are free of invasive species and their propagules

(See also BMP 6.7.)

CONSIDERATIONS

- A. Landscape materials include: nursery stock [especially container grown and balled and burlapped (B&B) stock where soil accompanies the plants and may harbor invasive species], fill, top soil, soil amendments (e.g., peat moss), compost, erosion control materials, stone, and mulch.
- B. Knowing the source of landscape materials may help you avoid infested source material.
- C. Treat infested source material to render invasive species as non-viable prior to its use.
- D. Stockpile displaced topsoil for future use on the same site in an invasives free area. Be aware that if the topsoil is piled too deep, advantageous fungi may be destroyed. This effect varies by soil type, climate and other factors.
- E. Keep stockpiled material free of invasive species.
- F. Use weed-free oat or wheat straw where available; “marsh hay” may contain reed canary grass seed and rhizomes and propagules of other invasive species.
- G. Avoid contaminants such as salt, oil and herbicide residue for a better planting medium.
- H. Consider reusing or recycling landscape materials on site to avoid potentially transporting invasives.

BMP 7.7

AVOID UNNECESSARY SOIL disturbance and soil compaction

(See also BMP 6.8.)

CONSIDERATIONS

- A. Ground disturbance may uproot existing vegetation and expose soil, creating a seedbed for inva-

sive plants that can overwhelm desirable vegetation.

- B. Topsoil may be lost to wind or water erosion; local ordinances for silt fencing and other erosion control practices may apply.
- C. Soil disturbance (cultivation), when combined with aggressive follow-up control measures, may be used to control invasive species within infested areas by depleting the seed bank.
- D. Disking or tillage operations may propagate invasive plants that spread by rhizomes, root fragments or seed and should, therefore, be used cautiously.
- E. After a soil disturbance, encourage decompaction and prompt regeneration of desirable vegetation or cover exposed soil with a layer of mulch to reduce germination or introduction of invasive plants.
- F. After a soil disturbance, monitor the area and treat new invasive plant infestations.
- G. Check with the Minnesota Pollution Control Agency and your local municipal officials to see if your project’s soil disturbance requires a NPDES/SDS permit or local permit or erosion control practices such as silt fencing.

BMP 7.8

STABILIZE DISTURBED SOILS in a timely manner to prevent the establishment of invasive species

(See also BMP 6.9.)

CONSIDERATIONS

- A. 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.
- B. Stabilizing disturbed soils includes: revegetating, mulching (straw, woodchips, leaves, and the use of biologs or erosion matting, etc.
- C. A non-persistent cover crop like cereal rye or oats can be used to temporarily stabilize the soil and discourage the establishment of invasive species.
- D. Use weed-free oat or wheat straw where available; “marsh hay” may contain reed canary grass.
- E. In areas where invasive species are known to be in





the seed bank, treat invasives before revegetating.

- F. You may purposely not plant a disturbed area if your goal is to promote invasive plant species germination from the existing seedbank—then treating it—in order to eliminate some of the invasive seedbank.
- G. Inspecting areas at highest risk of invasion following soil disturbance activities may help to detect new invasions.

BMP 7.9

KEEP RECORDS OF activities that could affect the introduction and establishment of invasive species

(See also Chapter 9: Monitoring and Research.)

CONSIDERATIONS

- A. This BMP refers to records of maintenance activities such as pruning, removals, mulching, watering, fertilizing and lawn care. It does not refer to records of invasive control techniques, although that may be part of the maintenance activities. If invasive species control techniques are part of the activities, consider using monitoring methods specific to infestations.
- B. Record keeping should be consistent with your current management/maintenance recording methods.
- C. Records should be complete and accurate.
- D. Records should be easily accessible for future reference.
- E. Examples of information to include in your records are: times, places, activities and maps.
- F. See Appendix B: Monitoring for examples of recording sheets.

BMP 7.10

MONITOR RECENT WORK sites for invasive species

(See also BMP 9.3.)

CONSIDERATIONS

- A. Conduct periodic inspections of each site following landscape management/maintenance activities.
- B. Anticipate responses of invasive species to activities and check for new infestations, infections or the spread of existing populations during the appropriate life stage timing for the specific invasive in question.
- C. Determine appropriate control measures to respond to new infestations or spreading populations of invasive species.
- D. If it is not possible to conduct follow-up monitoring (e.g. business hired for one job), then it becomes an opportunity to educate the customer on the need for monitoring and possible follow-up on their part.

EQUIPMENT CLEANING

Invasive species can spread by equipment used in urban and community forestry and landscaping and landscape maintenance activities, as well as by the workers themselves. Seeds, plant parts, and fungal spores can move in soil or mud in undercarriages, tire tread and on other areas of equipment. Insects in all life stages can also be moved by equipment. Mud and debris stuck to boots, clothing or tools can also transport invasive plant material, insects, and diseases. Invasive species covered under this BMP include plants (fruit, seed, bud, tuber, root, etc.), insects (egg, larvae, pupae, overwintering adults, etc.) or diseases (fungi, bacteria, viruses, etc.).

BMP 7.11

PRIOR TO RELOCATING EQUIPMENT, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting propagules of invasive species

(See also BMPs 6.12 & 8.1.)

CONSIDERATIONS

- A. Equipment should be free of invasives when it arrives at the work site.
- B. Clean equipment after operating in an area with invasive species and before relocating to an area free of invasives. Cleaning should occur before leaving the project site, at the site of infestation.
- C. Preferred locations for equipment cleaning areas are those where:
 - Equipment is unloaded and loaded.
 - Invasives are less likely to spread from cleaned equipment (e.g. a blacktopped parking lot). Collect, bag and dispose of invasive species properly. (See also BMP 8.5.)
 - Invasive species are already established.
 - Monitoring can be conducted at a later date.
- D. To limit the spread of invasives downstream, do not clean equipment, vehicles or trailers in or near waterways or storm sewers or on impervious surfaces that drain to a storm sewer or surface water.
- E. Contain or filter wash water on-site, if possible.

BMP 7.12

REMOVE SOIL, SEEDS, vegetative matter (including fruits) and other debris from shoes, clothing and tools prior to leaving an area

(See also BMPs 6.13 & 8.2.)

CONSIDERATIONS

- A. Preferred locations for cleaning your person are those where:
 - Equipment is cleaned.
 - Invasives are less likely to spread (e.g. a blacktopped parking lot). Collect, bag, and dispose of invasive species properly. (See also BMP 8.5.)
 - Invasive species are already established.
- B. Check places like hoods, pockets, seams, and Velcro fasteners.

BMP 7.13

PROPERLY TREAT OR dispose of invasive species or materials that may harbor invasive propagules, insects or diseases

(See also BMP 8.5.)

CONSIDERATIONS

- A. In general, the movement of invasive species offsite is not recommended.
- B. If you must dispose of invasive plants off-site, be aware that transport of noxious weeds may require a permit from the County Agricultural Inspector (CAI) for the county or counties the transportation is occurring within. To obtain a current list of regulated noxious weeds in Minnesota and contacts for County Agricultural Inspectors statewide, visit the Minnesota Department of Agriculture's Noxious Weed Program Website (<http://www.mda.state.mn.us/weedcontrol>). The MN Department of Agriculture can also issue permits to transport when necessary for DNR projects that involve multiple counties. However, CAIs should be contacted to communicate what, where, when, and why noxious weeds are being collected and transported in their jurisdictions.
- C. 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.
- D. Materials may be burned. Regulations and permits may apply. For more information, contact the MN DNR Forestry Division. (<http://www.dnr.state.mn.us/forestry/fire/questions.html>)
- E. Materials may be buried. Burial depth is specific to the invasive. An average minimum depth would be three feet, but some invasives need to be buried even deeper. For example, Japanese knotweed can grow through five feet of soil. Be aware that if you later dig into this soil you may be exposing propagules.
- F. Materials might be utilized for value added products (e.g., fuel, furniture, etc.).
- G. Chipping woody debris may kill invasive pests if chipped to a size specific to the target insect. However, wood chips may still contain other invasive propagules that may spread if the chips are used in





- an area other than from where they originated.
- H. Materials taken from sites that contain invasive plants should not be used away from the site of infestation until all viable plant material is destroyed. Material from areas containing invasive plants may be reused within the exact limits of the infestation.
 - I. Any excavated material that contains viable plant material that is not reused within the limits of the infestation should be stockpiled on an impervious surface until viable plant material is destroyed (Perron 2008).
 - J. Do not dump yard waste in parklands, natural areas and waterways.
 - K. Do not home compost invasive species or their propagules. Backyard compost piles and bins do not reliably generate enough heat for a long enough period of time to destroy weed seeds.
 - L. If possible, use invasive species control options that don't create waste. For example, use a basal bark treatment on woody invasives which kills the invasive as it is left in place instead of a cut stump treatment which creates woody debris.

measures prior to commencing and activity.

- E. Determine appropriate control measures to respond to new infestations or spreading populations. Communicate these options with property owner ahead of time in case they don't want to use chemicals. You may need to allow time for other options.
- F. Environmental conditions are very important for the proper application of herbicides; rain, sun, temperature, and wind can all affect the effectiveness of herbicide applications. Be sure to use the proper rate to achieve control yet not over apply. Federal law requires the applicator to always follow label instructions.

BMP 7.14

**IF PRE- OR post-activity
invasive species control
treatments are planned, ensure
they are applied within the
appropriate time window and
under the correct environmental
conditions**

CONSIDERATIONS

- A. Consider life history of target invasive species in relation to seasonal timing of control methods. (See Figure 2.)
- B. The party responsible for creating activity plans should be responsible for planning pre- or post-activity invasive species treatments.
- C. Allow time and resources for post-activity follow-up control measures, due to persistent seed-bank, resprouting and other factors.
- D. Plan ahead and allow enough time for control



CHAPTER 8

**SANITATION AND
DEBRIS DISPOSAL**

CHAPTER 8

SANITATION AND DEBRIS DISPOSAL

The spread of invasive species has been perpetuated by the improper disposal of invasives and invasive propagules. Inadequate sanitation procedures of equipment used or located in an area that includes invasives only compounds the problem. Most often, improper disposal and sanitation results from a lack of knowledge about invasive species and the damage they cause, rather than from intentional means. The spread of invasives and new introductions can be reduced by properly disposing of debris and by using effective sanitation procedures.

BMP 8.1: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing, or using other methods designed to minimize the risk of transporting propagules.

BMP 8.2: Remove soil, seeds, vegetative matter, and other debris from shoes, clothing, and tools prior to leaving an area.

BMP 8.3: Minimize the offsite transport of invasives and materials that may contain invasive species.

BMP 8.4: When necessary to transport invasives and materials that may contain invasives off site, cover or otherwise contain those materials.

BMP 8.5: Properly treat or dispose of invasive species or materials that may harbor invasive propagules, insects, or diseases.

BMP 8.6: Allow compost piles to heat to appropriate temperatures and times and with proper procedures to reduce the viability of invasives contained within.

BMP 8.7: Avoid the use of wood chips and compost that may contain invasive propagules.





EQUIPMENT CLEANING

Invasive species can spread by equipment used in urban and community forestry, landscaping, and landscape maintenance activities, as well as by the workers themselves. Seeds, plant parts, and fungal spores can move in soil or mud in undercarriages, tire tread, and on other areas of equipment. Insects in all life stages can also be moved by equipment. Mud and debris stuck to boots, clothing, or tools can also transport invasive plant material, insects and disease. Invasive species covered under this BMP include plants (fruit, seed, bud, tuber, root, etc.), insects (egg, larvae, pupae, overwintering adults, etc.), or diseases (fungi, bacteria, viruses, etc.).

FOR PURPOSES OF THESE BMPS...

“equipment” refers to off-road, rubber-tired and tracked equipment including mowers, skid steers, bucket loaders, dozers, graders, chippers and other construction equipment.

“relocating” refers to moving off the work site OR moving within the work site from an infested to a non-infested area.

“disposal” refers to methods to dispose of invasive species which can include burning, treating and containment (i.e., bagging). (See also Chapter 8: Sanitation and Debris Disposal.)

BMP 8.1

PRIOR TO RELOCATING equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods designed to minimize the risk of transporting propagules of invasive species

(See also BMPs 6.12 & 7.11.)

CONSIDERATIONS

- A. Equipment should be free of invasives when it arrives at the work site.
- B. Clean equipment after operating in an area with invasive species and before relocating to an area free of invasives. Cleaning should occur before leaving the project site, at the site of infestation.
- C. Preferred locations for equipment cleaning areas are those where:
 - Equipment is unloaded and loaded.
 - Invasives are less likely to spread from cleaned equipment (e.g., a blacktopped parking lot). Collect, bag, and dispose of materials properly. *(See also BMP 8.5.)*
 - Invasive species are already established.
 - Monitoring can be conducted at a later date.
- D. To limit the spread of invasives downstream, do not clean equipment, vehicles or trailers in or near waterways or storm sewers or on impervious surfaces that drain to a storm sewer or surface water.
- E. Contain or filter wash-water on-site, if possible.

BMP 8.2

REMOVE SOIL, SEEDS, vegetative matter (including fruits) and other debris from shoes, clothing, and tools prior to leaving an area

(See also BMPs 6.13 & 7.12.)

CONSIDERATIONS

- A. Preferred locations for cleaning your person are those where:
- Equipment is cleaned.
 - Invasives are less likely to spread (e.g. a blacktopped parking lot). Collect, bag, and dispose of invasive species properly. (See also BMP 8.5.)
 - Invasive species are already established.
- B. Check places like hoods, pockets, seams, and Velcro fasteners.

LONG-RANGE TRANSPORT

Movement of invasive species occurs naturally in a wide variety of ways. Some species of plants, insects, and fungi have very small reproductive propagules that can be moved long distances by wind, water, and animals, without the influence of human activity.

REGULATORY CONSIDERATIONS

It is a violation of state and federal laws to transport designated regulated articles outside of a quarantined area. USDA Animal Plant Health Inspection Service (APHIS) and the Minnesota Department of Agriculture (MDA) are responsible for designating quarantined areas, determining what materials

Be aware of all state and federal quarantine rules related to transportation of regulated articles out of a quarantined area.

will be regulated and enforcing the quarantines. Movement of regulated articles may be allowed under certain circumstances; details of exceptions are provided in a compliance agreement, which is issued by USDA APHIS and/or MDA. Additionally, be aware of county and municipal ordinances related to the transportation of invasive materials.

BMP 8.3

MINIMIZE THE OFFSITE transport of invasives and materials that may contain invasive species

CONSIDERATIONS

- A. Consider storing and reusing excavated materials, such as soil, on the same site. Use proper topsoil storage techniques to help ensure survival of advantageous fungi and microbes (e.g. beneficial organisms found in topsoil may die if the soil is piled to high which affects oxygen and temperature levels.) Treat infested excavated material to remove invasive species prior to reuse.
- B. Consider using invasive control options that don't create waste, and thus, don't require the removal and transport of debris. For example, use a basal bark treatment on woody invasives which kills the invasive species as it is left in place instead of a cut stump treatment which creates woody debris.
- C. Consider leaving invasive material and pests within the area of infestation (e.g. pile invasive brush at a site within the infested area).
- D. Time the removals of invasive plants so the removals will occur when there are the fewest propagules present (e.g., invasive brush removal and transport should occur after the fruit has dropped).





BMP 8.4

WHEN NECESSARY TO transport invasives and materials that may contain invasives off site, cover or otherwise contain those materials

CONSIDERATIONS

- A. Materials may include but are not limited to: woody debris, propagules, and soil.
- B. Be aware of all state and federal quarantine rules related to the transportation of regulated articles out of a quarantine area. Secure compliance agreements for moving this material out of quarantined areas when necessary.
- C. Be aware of local ordinances related to the transportation of invasive materials.
- D. Covering and containment are not necessary if invasive propagules are not present. For example, bush honeysuckle debris would not need to be covered if it's removed when fruits are not present.

BMP 8.5

PROPERLY TREAT OR dispose of invasive species or materials that may harbor invasive propagules, insects, or diseases

(See also BMP 7.13.)

CONSIDERATIONS

- A. In general, the movement of invasive species offsite is not recommended.
- B. If you must dispose of invasive plants off-site, be aware that transport of noxious weeds may require a permit from the County Agricultural Inspector (CAI) for the county or counties the transportation is occurring within. To obtain a current list of regulated noxious weeds in Minnesota and contacts for County Agricultural Inspectors statewide, visit the Minnesota Department of Agriculture's Nox-

ious Weed Program Website: (<http://www.mda.state.mn.us/weedcontrol>)

The MN Department of Agriculture can also issue permits to transport when necessary for DNR projects that involve multiple counties. However, CAIs should be contacted to communicate what, where, when, and why noxious weeds are being collected and transported in their jurisdictions. See *MDA's Guide to Removal and Disposal of Noxious weeds for more information* (<http://www.mda.state.mn.us/en/plants/pestmanagement/weedcontrol/disposalnoxweed.aspx>).

- C. 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.
- D. Materials may be burned. Regulations and permits may apply. For more information, contact the MN DNR Forestry Division. (<http://www.dnr.state.mn.us/forestry/fire/questions.html>)
- E. Materials may be buried. Burial depth is specific to the invasive. An average minimum depth would be three feet, but some invasives need to be buried even deeper. For example, Japanese knotweed (*Polygonum cuspidatum*) can grow through five feet of soil. Be aware that if you later dig into this soil you may be exposing propagules.
- F. Materials might be utilized for value added products (e.g., fuel, furniture, etc.).
- G. Chipping woody debris may kill invasive pests if chipped to a size specific to the target insect. However, wood chips may still contain other invasive propagules that may spread if the chips are used in an area other than from where they originated.
- H. Material taken from sites that contain invasive plants should not be used away from the site of infestation until all viable plant material is destroyed. Material from areas containing invasive plants may be reused within the exact limits of the infestation.
- I. Any excavated material that contains viable plant material that is not reused within the limits of the infestation should be stockpiled on an impervious surface until viable plant material is destroyed (Perron 2008).
- J. Do not dump yard waste in parklands, natural areas, waterways, and roadsides.
- K. Do not home compost invasive species or their propagules. Backyard compost piles and bins do not reliably generate enough heat for a long enough period of time to destroy weed seeds.
- L. If possible, use invasive control options that don't

create waste. For example, use a basal bark treatment on woody invasives which kills the invasive as it is left in place instead of a cut stump treatment which creates woody debris.

BMP 8.6

ALLOW COMPOST PILES to heat to appropriate temperatures and times and with proper procedures to reduce the viability of invasives contained within

CONSIDERATIONS

- A. For in-vessel or static aerated pile composting, maintain a temperature of 131 – 170 °F for 3 consecutive days.
- B. For windrow composting, maintain a temperature of 131 – 170 °F for 15 days during which, the compost is to be turned a minimum of five times.
- C. Legumes or other hard coated seeds will likely not be destroyed during composting.
- D. Backyard compost piles and bins do not reliably generate enough heat for a long enough period of time to destroy weed seeds and fungal spores and so they are not recommended as invasive species could still be spread with the compost.
- E. In general, the movement of invasive species offsite is not recommended, but if you must dispose of invasive plants off-site, be aware that transport of noxious weeds may require a permit from the County Agricultural Inspector (CAI) for the county or counties the transportation is occurring within. To obtain a current list of regulated noxious weeds in Minnesota and contacts for County Agricultural Inspectors statewide, visit the Minnesota Department of Agriculture’s Noxious Weed Program Website: (<http://www.mda.state.mn.us/weedcontrol>)

The MN Department of Agriculture can also issue permits to transport when necessary for DNR projects that involve multiple counties. However, CAIs should be contacted to communicate what, where, when, and why noxious weeds are being collected

and transported in their jurisdictions. See MDA’s Guide to Removal and Disposal of Noxious weeds for more information: (<http://www.mda.state.mn.us/en/plants/pestmanagement/weedcontrol/disposalnoxweed.aspx>.)

BMP 8.7

AVOID THE USE OF wood chips and compost that may contain invasive propagules

(See also BMPs 6.10. and 7.6.)

CONSIDERATIONS

- A. Woodchips and compost suspected of containing invasive materials should be used in a manner that will minimize the reintroduction of propagules back into the environment (e.g., Don’t use woodchips containing buckthorn fruit in wooded areas that will not be chemically treated).
- B. Knowing the source of woodchips and compost may help you avoid infested material; do not transport woodchips containing seeds or other invasive species propagules to new areas.
- C. Notify the public that wood chips and compost could harbor invasive species. They may need to monitor and treat if used.
- D. If material is used that may contain invasive propagules, monitor the site and treat if necessary.
- E. The Minnesota Crop Improvement Association certifies agricultural grain straw as weed-free.





CHAPTER 9

MONITORING
AND RESEARCH

CHAPTER 9

MONITORING AND RESEARCH

Monitoring is the periodic inspection of post-activity sites to detect new invasions and evaluate the success of invasive species management plans and control measures. It records specific information in a constant manner over time to help better understand the invasive and its management. Scouting refers to an inspection to locate invasive species. Research is crucial to further our understanding of invasives, future invasives and ways to control them. Both monitoring and scouting provide opportunities to cooperate with universities, groups or individuals who are conducting research.

Monitoring and scouting can be informal processes, or they can be highly formal. While powerful tools like Geographic Positioning Systems (GPS), Geographic Information Systems (GIS) and computer software do exist to aid these processes; efforts should be kept as simple as possible to meet invasive species management objectives. The ability to perform monitoring or scouting depends on who is doing it, the extent of the property and the resources available. For example, property managers may be better equipped to scout and monitor a property on a regular basis. Those hired to carry out a one-time job may not be able to follow-up with monitoring.

BMP 9.1: Create an invasive species monitoring plan for properties under your management.

BMP 9.2: Assess the extent of invasive species on and near the property by scouting, locating and documenting infestations.

BMP 9.3: Monitor sites under your management following management/maintenance activities; determine necessary follow-up based on presence of invasive species.

BMP 9.4: Keep records when scouting and monitoring.

BMP 9.5: Report new infestations of known invasive species to the appropriate authority.

BMP 9.6: As opportunities arise, interact with and engage researchers to further our understanding of invasives.





BMP 9.1

CREATE AN INVASIVE species monitoring plan for properties under your management

CONSIDERATIONS

- A. Integrate monitoring with other general management activities that occur on the property.
- B. Consider monitoring the entire property on a regular basis. Methods will depend on the size and location of the property, as well as the scale, extent and type of invasive species present.
- C. Periodically inspect high risk areas for introductions.
- D. Organize monitoring/inventory/scouting work to begin in non-infested areas and work towards the infested areas.
- E. Utilize any available history of the property's prior invasions.
- F. Consider long term management when creating a monitoring plan.
- G. Take surrounding properties into consideration.
- H. Discuss the plan with neighboring property managers and consider cooperative projects with them.
- I. If it is not possible to conduct follow-up monitoring (e.g., business hired for one job), then it becomes an opportunity to educate the customer on the need for monitoring and possible follow-up on their part.

BMP 9.2

ASSESS THE EXTENT of invasive species on and near the property by scouting, locating and documenting infestations

CONSIDERATIONS

- A. Scout for invasive species at probable introduction sites such as access points (trails, roads, parking lots, rest stops, major ports of entry, etc.), new

plantings, construction areas, and other disturbed areas, areas with dead/dying/stressed trees and other vegetation, greenways, drainage ways, corridors, adjacent properties, and more.

- B. Organize monitoring/inventory/scouting work to begin in non-infested areas and work towards the infested areas.
- C. Keep assessments as simple as possible to meet invasive species management objectives.
- D. Document invasive species in a manner consistent with established effective record-keeping practices.
- E. Mapping is a very a useful tool for documenting and monitoring infestations.
- F. When scouting it may be useful to bring a GPS or compass, flagging ribbon, sample bags or plant press, map or air photo, pens, camera, and a clipboard.
- G. While assessing sites for invasive species, land managers should be alert for emerging invasive threats such as emerald ash borer.
- H. Identify potential future invaders during scouting or monitoring procedures.
- I. Confer with forest health specialists or other resource managers to identify forest health threats or invasive plant, insect, or disease infestations of concern in the area.
- J. Cooperate with partners, especially when dealing with invasives on a broader geographical scale or when multi-agency issues are involved.
- K. When planning for a specific management or maintenance activities: Identify activities that will be occurring on and near the property in the short and long term. Scout for invasive species both within and around the activity area. Determine how those activities will affect and will be affected by invasive species on and near the property.

Knowing which invasive species are present and their locations, is the first piece of information needed to evaluate threats and develop a management plan.

BMP 9.3

MONITOR SITES UNDER your management following management/maintenance activities; determine necessary follow-up based on presence of invasive species

(See also 7.10.)

CONSIDERATIONS

- A. Conduct periodic inspections of each site following management/maintenance activities.
- B. Inspect on an annual basis, at a minimum, as long as there is an invasive problem.
- C. Consider monitoring the entire property on a regular basis. This depends on the size and location of the property, as well as the scale, extent, and type of invasive species present.
- D. Anticipate responses of invasive species to activities and check for new infestations, infections or the spread of existing populations during the appropriate life stage timing for the specific invasive in question.
- E. Monitor sites not only for known invasive species, but also emerging invasive threats such as the emerald ash borer.
- F. Keep monitoring as simple as possible to meet invasive species management objectives; integrate with other activities.
- G. Determine appropriate control measures to respond to new infestations or spreading populations; evaluate them for their efficiency and impact.
- H. If it is not possible to conduct follow-up monitoring (e.g., business hired for one job), then it becomes an opportunity to educate the customer on the need for monitoring and possible follow-up on their part.

BMP 9.4

KEEP RECORDS WHEN scouting and monitoring

CONSIDERATIONS

- A. Include information about the current infestation, as well as, areas on the fringe of the infestation, areas heavily used, disturbed areas and other areas you suspect may be invaded by invasive species.
- B. Consider the use of mapping as a tool for recording and monitoring infestations.
- C. Be consistent with your monitoring methods.
- D. Be complete; they should be easily understood by another person.
- E. Have them easily accessible for future reference.
- F. See *Appendix B: Monitoring for example recording sheets.*

BMP 9.5

REPORT NEW INFESTATIONS of known invasive species to the appropriate authority

CONSIDERATIONS

- A. Alert the property owners and others involved in its management.
- B. Report infestations of target species and species that are new to Minnesota to the Minnesota Department of Agriculture by contacting "Arrest the Pest" at 651-201-6684 (metro), 1-888-545-6684 (toll free) or arrest.the.pest@state.mn.us.





AS OPPORTUNITIES ARISE, interact with and engage researchers to further our understanding of invasive species and how they might be managed

(See also BMP 3.9.)

Our understanding of invasive species ecology and prevention is increasing but still insufficient to contain or control invasives in many situations in which they occur. Our ability to predict what new species may become invasive and what landscape practices may provide habitat for these invasives is even more limited. Research conducted by universities and institutions is one source for learning about invasives. Researchers can also benefit by interacting with practitioners and discussing the emerging invasive species issues in the practice of urban and community forestry and landscaping.

CONSIDERATIONS

- A. Develop on-going communications and partnerships with area universities, colleges, and institutions where the potential for research in matters of interest to urban and community forestry occur.
- B. Consider the potential for cooperative research opportunities when undertaking new controls or practices for which little information is available.
- C. Encourage research/testing of (new) urban landscape plants, native or non-native, which exhibit tolerable levels of sterility and vegetative proliferation.
- D. Researchers could be key partners in a monitoring program to help gauge which new plants, insects and diseases may become invasive and in which situations.

A photograph of a dirt path winding through a dense forest. The path is shaded by the trees, and the foliage is lush and green. In the center of the image, there is a red rectangular box containing the text 'CHAPTER 10' in white, and a white rectangular box containing the text 'OUTREACH, EDUCATION, AND COMMUNICATION' in black.

CHAPTER 10

**OUTREACH,
EDUCATION, AND
COMMUNICATION**

CHAPTER 10

OUTREACH, EDUCATION, AND COMMUNICATION

Outreach, education, and communication are important in the prevention and control of invasive species. Creating stakeholder awareness and understanding of invasive species issues and how to manage and prevent their spread is essential to the foundation of partnerships between property owners, urban and community forestry practitioners, local, state and federal governments, special interest groups and the public, all of whom have an investment and a role to play in the management of invasive species. A collaborative approach to invasive species management will greatly increase success in conserving future resources.

BMP 10.1: Educate yourself about invasive species.

BMP 10.2: Educate employees and volunteers about invasive species.

BMP 10.3: Educate clients, customers, and users about invasive species.

BMP 10.4: Educate public officials and other decision makers about invasive species.





BMP 10.1

EDUCATE YOURSELF ABOUT invasive species

CONSIDERATIONS

- A. Be able to identify invasive species and keep current with the changing information on invasive species.
- B. Keep up to date with your professional accreditations and certifications.
- C. See Appendix E: Resources Section 14 for a list of on-going educational opportunities.
- D. Pass your knowledge onto others and seek out collaborative partnerships to expand outreach and education scope.

BMP 10.2

EDUCATE YOUR EMPLOYEES and volunteers about invasive species

CONSIDERATIONS

- A. Include information about identification, impacts, prevention, and management in your organization's training programs and materials. Use consistent communications and outreach messaging.
- B. Instruct your employees and volunteers on the practical use of the Urban and Community Forestry Best Management Practices for Invasive Species and evaluate their implementation.
- C. Effectively seal (e.g. in plastic) any potential propagules, insects or diseases that you intend to use as educational "props." Effectively seal (e.g. in plastic) any potential propagules, insects or diseases that you intend to use as educational "props." Contact your local County Agricultural Inspector for a permit if you will be using noxious weed propagules as educational items (<http://www.mda.state.mn.us/en/plants/pestmanagement/weedcontrol/cailist.aspx>). Contact the Minnesota Department of Agriculture for training aids (such as specimens and wood samples) and necessary documentation regarding invasive insects, such as emerald ash

borer, at Arrest.The.Pest@state.mn.us or 888-545-6684.

- D. Encourage employees to pursue or continue with professional accreditations and certifications.
- E. Encourage employees to seek additional invasives information. (See Appendix E: Resources Section 14 for a list of on-going educational opportunities.)
- F. Encourage employees to share their knowledge with others.

BMP 10.3

EDUCATE CLIENTS, CUSTOMERS, and users about invasive species

CONSIDERATIONS

- A. Include information about identification, impacts, prevention and management in your organization's newsletters, marketing materials and face-to-face meetings. Use consistent communications and outreach messaging.
- B. Instruct clients, customers and users on the practical use of the Urban and Community Forestry BMPs for Invasive Species.
- C. Effectively seal (e.g. in plastic) any potential propagules, insects or diseases that you intend to use as educational "props." Contact your local County Agricultural Inspector for a permit if you will be using noxious weeds with propagules as educational items (<http://www.mda.state.mn.us/en/plants/pestmanagement/weedcontrol/cailist.aspx>). Contact the Minnesota Department of Agriculture for training aids (such as specimens and wood samples) and necessary documentation regarding invasive insects, such as emerald ash borer, at Arrest.The.Pest@state.mn.us or 888-545-6684.
- D. Encourage clients, customers and users to seek additional invasives information. (See Appendix E: Resources Section 14 for a list of on-going educational opportunities.)
- E. Encourage clients, customers and users to pass their knowledge onto others.
- F. Work with faculty and other educators to inform students, Master Gardeners, the general public, and industry professionals about the Urban and Community Forestry Best Management Practices for Invasive Species.

EDUCATE PUBLIC OFFICIALS and other decision makers about invasive species

CONSIDERATIONS

- A. Educate public officials and decision makers about the threat of invasive species, the role they play in preventing the introduction and spread of invasive species, and the benefits of managing invasive species to their constituents.
- B. Include information about identification, impacts, prevention and management.
- C. Coordinate education efforts with the County Agricultural Inspector. (*See Appendix G: Federal and Minnesota State Statutes and Administrative Rules Applicable to Invasive Plants and Pests.*)
- D. Effectively seal (e.g. in plastic) any potential propagules, insects or diseases that you intend to use as educational “props.” Contact your local County Agricultural Inspector for a permit if you will be using noxious weed propagules as educational items (<http://www.mda.state.mn.us/en/plants/pest-management/weedcontrol/cailist.aspx>). Contact the Minnesota Department of Agriculture for training aids (such as specimens and wood samples) and necessary documentation regarding invasive insects, such as emerald ash borer, at Arrest.The.Pest@state.mn.us or 888-545-6684.
- E. Encourage public officials and decision makers to seek additional invasives information. (*See Appendix Resources Section 14 for a list of on-going educational opportunities.*)
- F. Encourage municipalities to make invasives information available to the public and to seek out collaborative partnerships with resource stakeholders.



A large, dark silhouette of a pine tree stands in the foreground, its branches reaching across the upper half of the frame. The background features a calm lake reflecting the warm, orange and yellow hues of a sunset sky. The horizon line is visible in the distance, with a dark treeline. The overall scene is serene and natural.

CHAPTER 11

**INVASIVE SPECIES
MANAGEMENT PLAN
EVALUATION AND
UPDATE**

CHAPTER 11

INVASIVE SPECIES MANAGEMENT PLAN EVALUATION AND UPDATE

It must be recognized that attempts to prevent the introduction, establishment, and spread of invasive species will entail significant challenges and uncertainties and must be flexible in nature if they are to be effective. As a result, any plan for preventing the introduction, establishment, and spread of invasive species must be strategic in nature and should be systematic and iterative and should be based on the principles of adaptive, outcome-based planning and management.

Adaptive, outcome-based management is a learn as you go process whereby project managers can change course based on monitoring data, documented successes and failures, and an ongoing analysis of whether the desired outcomes of a project, the project-specific goals and objectives, are likely to be achieved as intended. Simply put, the adaptive management process is dynamic; it involves constant monitoring and analysis and the ability to change tactics as needed to achieve the defined goals and objectives associated with a particular project or activity.

The foundation of adaptive, outcome-based management is a closed-loop cycle that begins with a detailed assessment of the project. Additional steps include developing a strategic plan of action including goals and objectives (planning), implementation of the plan based on clearly-defined work plans focused on what, who, when, and how (implementation), monitoring (involving all aspects of the project from people, to budget, to the successful achievement of desired outcomes), evaluation (an analysis of what's working and what isn't, whether the project is on track to achieve the desired outcomes, and whether changes are needed), and adjustments to the strategic plan as needed.

The Conservation Measures Partnership (CMP) has developed a document called Open Standards for the Practice of Conservation which provides excellent guidance for developing such a plan. The document is licensed under a Creative Commons license (http://creativecommons.org/licenses/by-sa/3.0/deed.en_US) and may be adapted as needed under the conditions of the license. Information about the Conservation Measures Partnership and the Open Standards document can be accessed through the following URLs:

The Conservation Measures Partnership (CMP)

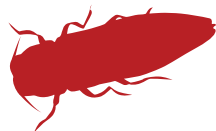
<http://www.conservationmeasures.org>

The Conservation Measures Partnership (CMP): Standards for Project Management

<http://www.conservationmeasures.org/initiatives/standards-for-project-management>

Open Standards for the Practice of Conservation (Version 3.0 / April 2013)

<http://www.conservationmeasures.org/wp-content/uploads/2013/05/CMP-OSV3-0-Final.pdf>



APPENDIX A

BRIEF 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 very labor intensive, and thus, not economically feasible.

Mechanical control techniques include mowing, girdling, cutting, chopping, tilling, hoeing, and constructing barriers using tools or machines. These techniques are most useful in areas with large infestations where the landscape 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. Not all of them will be appropriate for every situation. The choice of pesticide depends on the species, stage of growth, the presence of desirable species that may be affected, the proximity of water resources and environmental conditions. Pesticides must always be applied in accordance with the label. Property owners 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. There may be instances when chemical control is inappropriate or simply not allowed. Densely populated urban areas, adjacent property owners and local ordinances are just a few examples of things that can affect chemical control plans.

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 they will remain specific to the target population and will not harm other species. Biological control typically does not eliminate the invasive species and it usually takes several years to show results. Biological control has been effective for some species such as the Galerucella beetle which has been used with some success to control purple loosestrife (*Lythrum salicaria*), and Btk, *Entomophaga maimaiga* and the nuclear polyhedral virus for gypsy moth control.

Cultural Control is the manipulation of urban forest composition, growing conditions and tree health to control invasive species or limit their effects if invasion occurs. Trees and other vegetation that are potentially susceptible host species can be reduced as an urban forest component, thus limiting outbreaks of insects and disease-causing organisms. Alternately, species that are resistant to invasive insects and diseases may be planted instead of nonresistant species. Our urban forests include native and non-native plant species. Creating or selecting proper planting locations for them is another illustration of cultural control. For example, plants that spread aggressively by rhizomes would be best planted in a contained area. Minimizing stress to a plant through actions such as mulching, watering or fertilizing often enables it to better withstand and outcompete invasive infestations. Another example of a cultural control activity is maintaining a level of canopy closure that impedes shade intolerant invasive species. *See Appendix E: Resources Section 13 for information about the proper management of trees, shrubs, and other vegetation.*



APPENDIX B

MONITORING

The following are examples of data sheets for inventorying, monitoring, and managing invasive species. The Midwest Invasive Plant Network keeps a list of data sheet examples at <http://www.mipn.org/edrrDataForms.html>. Urban and community forestry practitioners need to use the data sheet that works best for their situation.





INVASIVE SPECIES INVENTORY FIELD REPORT FORM

Observation Date: _____
Name: _____ Association: _____
Address: _____ City: _____ State: _____ Zip: _____
Phone: _____ Email: _____

Species Information - Name and Locations

Common Name: _____ Scientific (if known): _____
Locality Name (lake or twnshp): _____ County: _____
Site address (if any): _____ City: _____ Zip: _____
Property Ownership (i.e, Private, county, state, federal, etc.): _____

Provide one or more of the following location methods below:

PLS: ¼ ¼ Sec _____ ¼ Sec _____ Sec _____ Twp _____ Range _____

GPS: X Coordinate (Lat./Easting): _____

Y Coordinate (Long./Northing): _____

Number of individuals observed (Check one): < 20 20 - 99 100 - 999 < 1000

Distribution of infestation: occurs singly scattered pockets continuous/extensive

Size of infested area (acres): < 1 1 - 5 5 - 10 10 - 50 > 50

Diagram: Show roads, nearest intersections, distances, compass direction and rough outline in invasive species population.

(Attached diagram if filling out form digitally.)

Verbal directions (if PLS/GPS information unavailable):

Mail form to: Minnesota Department of Natural Resources
Division of Forestry
Attn: Invasive Species Specialist
500 Lafayette Rd
St. Paul, MN 55155-4025

Email to: susan.burks@dnr.state.mn.us

For more information visit:

http://files.dnr.state.mn.us/assistance/backyard/treecare/forest_health/invasivereportform.pdf

Setting Objectives for Invasive Species*

	Weighted Score**
Current Extent of the Species***	
1. Species present in early stage or emerging satellite populations	5
2. Species present in large infestations and still expanding rapidly	3
3. Species present in large infestations and no longer expanding	1
Score :	

Current and Potential Impacts	
1. Species that alter ecosystem processes	5
2. Species that out-compete native vegetation without disturbance, but not #1	3
3. Species that only out-compete with native vegetation following disturbance	1
Score :	

Value of Habitats Affected	
1. Infestations occurring in high quality, high diversity or otherwise significant habitats	5
2. Infestations occurring in already de-graded, low-diversity, or less significant sites	2
Score :	

Feasibility of Control and Successful Outcomes	
1. Species likely to be controlled or eradicated with available methods and resources	5
2. Species difficult to control or eradicate with available resources and methods	3
3. Species unlikely to be controlled with available resources and methods	1
Score :	
Score - 15-20: Consider "Zero Tolerance" (Eradication) Objective	ZT
Score 9-14: Consider "Acceptable Threshold" Objective	AT
Score 5-8: Consider "Slow the Spread" Objective	SS
Total Score :	

* Adapted from "Site Weed Management Plan Template" by Mandy Tu of The Nature Conservancy's Wildland Invasive Species Program. For the complete document see: www.wilderness.net/toolboxes/documents/invasive/Mgt_Plan_Template_TNC.doc

** Managers should select the condition that best describes their situation for each of the 4 criteria areas. The scoring ranges and associated objectives are recommended and managers may need to consider other information in setting objectives.

*** On larger properties consider creating multiple management units to reflect different conditions and levels of infestation.

APPENDIX C

TERRESTRIAL INVASIVE PLANTS IN MINNESOTA

There exists both formal and informal invasive plant lists for the state of Minnesota 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 urban and community forestry practitioner in Minnesota, we have put together a list of invasive plant lists pertinent to our region 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 that lists are continually being updated as new invasive plant species appear in Minnesota 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

MINNESOTA DEPARTMENT OF Agriculture Noxious Weed List

Plants on the Noxious Weed List are regulated by the Minnesota Department of Agriculture.

The Noxious Weed Law is enforced by County Agricultural Inspectors.

Species on the Noxious Weed List can be found at: (<http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx>)

To be listed as a noxious weed, plants undergo a risk assessment conducted by the Noxious Weed Advisory Committee.

This list can change over time. See website for the most up to date list. From the Minnesota Department of Agriculture as of May 1, 2015:

PROHIBITED NOXIOUS WEEDS

Attempts must be made by all landowners to control or eradicate species on these lists. These species cannot be transported without a permit or sold in Minnesota.

ERADICATE LIST

Must be eradicated by killing the above and belowground parts of the plant.

1. Yellow Star Thistle, *Centaurea solstitialis* L.
2. Grecian Foxglove, *Digitalis lanata* Ehrh.
3. Oriental Bittersweet, *Celastrus orbiculatus* Thunb.
4. Japanese Hops, *Humulus japonicus* Siebold & Zucc.
5. Dalmatian Toadflax, *Linaria dalmatica* (L.) Mill.
6. Common Teasel, *Dipsacus fullonum* L.
7. Cutleaf Teasel, *Dipsacus laciniatus* L.
8. Giant Hogweed, *Heracleum mantegazzianum* Sommier & Levier
9. Brown Knapweed, *Centaurea jacea* L.
10. Meadow Knapweed, *Centaurea x moncktonii* C.E. Britton
11. Black Swallow-wort, *Cynanchum louiseae* Kartesz & Gandhi
12. Palmer amaranth, *Amaranthus palmeri* S. Watson





CONTROL LIST

Must be controlled preventing the maturation and spread of propagating parts.

1. Leafy Spurge, *Euphorbia esula* L.
2. Canada Thistle, *Cirsium arvense* (L.) Scop. EXT
3. Plumeless Thistle, *Carduus acanthoides* L. EXT
4. Purple Loosestrife, *Lythrum salicaria* L., *L. virgatum* L., EXT
5. Wild Parsnip, *Pastinaca sativa* L. (Except for non-wild cultivated varieties)
6. Common Tansy, *Tanacetum vulgare* L.
7. Spotted Knapweed, *Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek
8. Narrowleaf Bittercress, *Cardamine impatiens* L.

RESTRICTED NOXIOUS WEEDS

May not be sold, transported without a permit, or intentionally planted in Minnesota.

1. Common or European Buckthorn, *Rhamnus cathartica* L. EXT
2. Glossy Buckthorn (and all cultivars), *Frangula alnus* Mill.
3. Multiflora Rose, *Rosa multiflora* Thunb.
4. Common Reed – non-native subspecies, *Phragmites australis* (Cav.) Trin. ex Steud. ssp. *australis*
5. Garlic Mustard, *Alliaria petiolata* (M. Bieb.) Cavara & Grande

SPECIALLY REGULATED PLANTS

Shall be controlled or eradicated according to specified regulations.

1. Poison Ivy, *Toxicodendron radicans* (L.) Kuntze & T. rydbergii (Small) Green *Must be eradicated or controlled for public safety along rights-of-ways, trails, public accesses, business properties open to the public or on parts of lands where public access for business or commerce is granted. Must also be eradicated or controlled along property borders when requested by adjoining landowners.*
2. Japanese Knotweed, *Polygonum cuspidatum* Seib. & Zucc.
3. Giant Knotweed, *Polygonum sachalinense* F. Schmidt ex Maxim.
Any person, corporation, business or other retail entity distributing Japanese and/or giant knotweeds for sale within the state, must have information directly affixed to the plant or container packaging that it is

being sold with, indicating that it is inadvisable to plant this species within 100 feet of a water body or its designated flood plain as defined by Minnesota Statute 103F.111, Subdivision 4.

4. Japanese barberry, *Berberis thunbergii* DC.

The following cultivars and parent species are to be phased out and then prohibited from sale. These plants average greater than 600 seeds per plant and will begin a three-year phase-out period in Minnesota beginning January 1, 2015. At the end of the phase-out period (December 31, 2017), these species will become Restricted Noxious Weeds in Minnesota and will be illegal to sell and propagate.

- ‘Angel Wings’
- ‘Antares’
- var. *atropurpurea*
- ‘Bailtwo’ (Burgundy Carousel®)
- ‘Monomb’ (Cherry Bomb™)
- ‘Crimson Velvet’
- ‘Erecta’
- ‘Gold Ring’
- ‘Bailsel’ (Golden Carousel®; *B. koreana* xB. thunbergii hybrid)
- ‘Inermis’
- ‘Bailgreen’ (Jade Carousel)
- ‘iN Redleaf’ (Ruby Jewel TM)
- ‘iN Variegated’ (Stardust TM)
- ‘Kelleris’
- ‘Kobold’
- ‘Anderson’ (Lustre GreentM)
- ‘Marshall Upright’
- ‘Painter’s Palette’
- ‘Pow Wow’
- ‘Red Rocket’
- ‘Rose Glow’
- ‘Bailone’ (Ruby Carousel T)
- ‘Silver Mile’
- ‘Sparkle’
- ‘Tara’ (Emerald Carousel; *B. koreana* xB. thunbergii hybrid)
- Wild Type (parent species — green barberry)

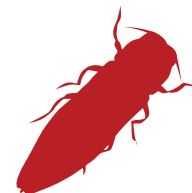
MINNESOTA INVASIVE SPECIES Advisory Committee (MISAC) Rankings of Species Threats to Minnesota

The MISAC Invasive Plant List from “A Minnesota State Management Plan for Invasive Species” is dated from Oct. 20, 2009.

In this list a * indicates ornamental plants in which previous experience has shown these species to be problematic under certain conditions, but the invasiveness of these species in all Minnesota conditions has yet to be determined. The Minnesota Nursery and Landscape Association (MNLA) was not involved in creation of the MISAC invasive plant list. (http://files.dnr.state.mn.us/natural_resources/invasives/state_invasive_species_plan.pdf)



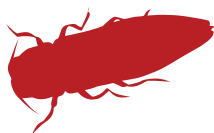
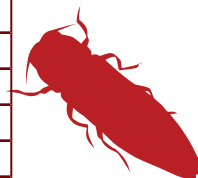
TERRESTRIAL PLANTS



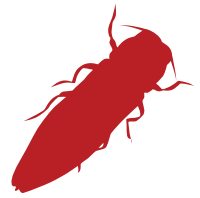
Ranking	Common Name	Genus	Species
Severe	Alyssum, hoary	<i>Berteroa</i>	<i>incana</i>
Severe	Autumn olive	<i>Elaeagn</i>	<i>umbellata</i>
Severe	Bird's-foot trefoil	<i>Lotus</i>	<i>corniculatus</i>
Severe	Black swallow-wort	<i>Vincetoxicum</i>	<i>nigrum</i>
Severe	Buckthorn, common or European	<i>Rhamnus</i>	<i>cathartica</i>
Severe	Buckthorn, glossy (all cultivar)	<i>Frangula</i>	<i>alnus</i>
Severe	Crown vetch	<i>Coronilla</i>	<i>varia</i>
Severe	European or common barberry	<i>Berberis</i>	<i>vulgaris</i>
Severe	Foxglove, Grecian	<i>Digitalis</i>	<i>lanata</i>
Severe	Garlic mustard	<i>Alliaria</i>	<i>petiolata</i>
Severe	Giant hogweed	<i>Heracleum</i>	<i>mantegazzianum</i>
Severe	Giant knotweed	<i>Polygonum</i>	<i>sachalinense</i>
Severe	Honeysuckle, Amur	<i>Lonicera</i>	<i>maackii</i>
Severe	Honeysuckle, Bela	<i>Lonicera</i>	<i>x bella</i>
Severe	Honeysuckle, Morrow's	<i>Lonicera</i>	<i>morrowii</i>
Severe	Japanese knotweed	<i>Polygonum</i>	<i>cuspidatum</i>
Severe	Knapweed, spotted	<i>Centaurea</i>	<i>maculosa</i>
Severe	Lespedeza, Chinese	<i>Lespedeza</i>	<i>cuneata</i>
Severe	Locust, black*	<i>Robinia</i>	<i>pseudoacacia</i>
Severe	Maple, Norway*	<i>Acer</i>	<i>platanoides</i>
Severe	Multiflora rose	<i>Rosa</i>	<i>multiflora</i>
Severe	Oriental bittersweet	<i>Celastrus</i>	<i>orbiculatus</i>
Severe	Purple loosestrife	<i>Lythrum</i>	<i>salicaria</i>
Severe	Reed canary grass	<i>Phalaris</i>	<i>arundinacea</i>
Severe	Spurge, leafy	<i>Euphorbia</i>	<i>esula</i>
Severe	Tansy	<i>Tanacetum</i>	<i>vulgare</i>
Severe	Tartarian honeysuckle	<i>Lonicera</i>	<i>tatarica</i>
Severe	Thistle, Canada	<i>Cirsium</i>	<i>arvense</i>
Severe	Thistle, marsh	<i>Cirsium</i>	<i>palustre</i>
Severe	Thistle, milk	<i>Silybum</i>	<i>marianum</i>
Severe	Thistle, musk	<i>Carduus</i>	<i>nutans</i>
Severe	Thistle, plumeless	<i>Carduus</i>	<i>acanthoides</i>
Moderate	Buttercup, tall	<i>Ranunculus</i>	<i>acris</i>
Moderate	Carrot, wild	<i>Daucus</i>	<i>carota</i>
Moderate	Clover, white	<i>Trifolium</i>	<i>repens</i>
Moderate	Creeping Charlie	<i>Glechoma</i>	<i>hederacea</i>
Moderate	Daisy, oxeye	<i>Leucanthemum</i>	<i>vulgare</i>
Moderate	Dalmatian toadflax	<i>Linaria</i>	<i>dalmatica</i>
Moderate	Dame's rocket	<i>Hesperis</i>	<i>matronalis</i>
Moderate	Elecampane	<i>Inula</i>	<i>britannica</i>
Moderate	European highbush cranberry*	<i>Viburnum</i>	<i>opulus</i>
Moderate	Field bindweed	<i>Polygonum</i>	<i>convolvulus</i>
Moderate	Globe thistle	<i>Echinops</i>	<i>sphaerocephalus</i>
Moderate	Japanese barberry	<i>Berberis</i>	<i>thunbergii</i>

TERRESTRIAL PLANTS

Ranking	Common Name	Genus	Species
Moderate	Lily-of-the-valley*	<i>Convallaria</i>	<i>majalis</i>
Moderate	Maple, Amur*	<i>Acer</i>	<i>ginnala</i>
Moderate	Mulberry, white	<i>Morus</i>	<i>alba</i>
Moderate	Orange day lily	<i>Hemerocalus</i>	<i>fulva</i>
Moderate	Quackgrass	<i>Elytrigia</i>	<i>repens</i>
Moderate	Sowthistle, perennial	<i>Sonchus</i>	<i>arvensis</i>
Moderate	Spurge, cypress	<i>Euphorbia</i>	<i>cyparissias</i>
Moderate	St. John's wort	<i>Hypericum</i>	<i>perforatum</i>
Moderate	Teasel, cut leaf	<i>Dipsacus</i>	<i>laciniatus</i>
Moderate	Teasel, common	<i>Dipsacus</i>	<i>sylvestris</i>
Moderate	Willow, hybrid	<i>Salix</i>	<i>x rubens</i>
Minimal	Barnyard grass	<i>Echinochloa</i>	<i>Echinochloa</i>
Minimal	Big-leaf lupine	<i>Lupinus</i>	<i>polyphyllus</i>
Minimal	Bittersweet nightshade	<i>Solanum</i>	<i>dulcamara</i>
Minimal	Black medic	<i>Medicago</i>	<i>lupulina</i>
Minimal	Bouncing bet	<i>Saponaria</i>	<i>officinalis</i>
Minimal	Burdock, common	<i>Arctium</i>	<i>minus</i>
Minimal	Butter-and-eggs	<i>Linaria</i>	<i>vulgaris</i>
Minimal	Campion, bladder	<i>Silene</i>	<i>vulgaris</i>
Minimal	Campion, white	<i>Silene</i>	<i>latifolia</i>
Minimal	Clover, red	<i>Clover, red</i>	<i>pratense</i>
Minimal	Common bugloss	<i>Anchusa</i>	<i>arvensis</i>
Minimal	Creeping bellflower	<i>Campanula</i>	<i>rapunculoides</i>
Minimal	European mountain-ash*	<i>Sorbus</i>	<i>aucuparia</i>
Minimal	Goutweed	<i>Aegopodium</i>	<i>podagraria</i>
Minimal	Helleborine	<i>Epiactis</i>	<i>helleborine</i>
Minimal	Hemp	<i>Cannabis</i>	<i>sativa</i>
Minimal	Motherwort	<i>Leonurus</i>	<i>cardiaca</i>
Minimal	Mullein	<i>Verbascum</i>	<i>thaspus</i>
Minimal	Poplar, white	<i>Populus</i>	<i>alba</i>
Minimal	Russian olive*	<i>Eleagnus</i>	<i>angustifolium</i>
Minimal	Thistle, bull	<i>Cirsium</i>	<i>vulgare</i>
Minimal	Willow, crack	<i>Salix</i>	<i>fragilis</i>
Minimal	Willow, white	<i>Salix</i>	<i>alba</i>
Watch	Amur cork tree*	<i>Phellodendron</i>	<i>amurense</i>
Watch	Baby's-breath*	<i>Gypsophila</i>	<i>paniculata</i>
Watch	Burdock, woodland	<i>Arctium</i>	<i>nemorosum</i>
Watch	Burning bush, winged Euonymus*	<i>Euonymus</i>	<i>alatus</i>
Watch	Celandine	<i>Chelidonium</i>	<i>majus</i>
Watch	Chicory	<i>Chicorium</i>	<i>ntybus</i>
Watch	Daisy, Portuguese	<i>Leucanthemum</i>	<i>lacustre</i>
Watch	English ivy*	<i>Hedera</i>	<i>helix</i>
Watch	Everlasting pea	<i>Lathyrus</i>	<i>latifolius</i>
Watch	Foxglove, garden*	<i>Digitalis</i>	<i>purpurea</i>
Watch	Japanese honeysuckle*	<i>Lonicera</i>	<i>japonica</i>
Watch	Japanese hops	<i>Humulus</i>	<i>japonicus</i>



TERRESTRIAL PLANTS



Ranking	Common Name	Genus	Species
Watch	Locust, bristly	<i>Robinia</i>	<i>hispidia</i>
Watch	Locust, clammy	<i>Robinia</i>	<i>niscosa</i>
Watch	Porcelain berry	<i>Ampelopsis</i>	<i>brevipedunculata</i>
Watch	Princess tree*	<i>Paulownia</i>	<i>tomentosa</i>
Watch	Queen of the meadow	<i>Filipendula</i>	<i>ulmaria</i>
Watch	Rugosa rose*	<i>Rosa</i>	<i>rugosa</i>
Watch	Sawtooth oak*	<i>Quercus</i>	<i>acutissima</i>
Watch	Timothy	<i>Phleum</i>	<i>pratense</i>
Not Likely to Establish	Chinese yam	<i>Dioscorea</i>	<i>oppositifolia</i>
Not Likely to Establish	Japanese stilt grass	<i>Microstegium</i>	<i>vimineum</i>
Not Likely to Establish	Kudzu	<i>Pueraria</i>	<i>montana</i>
Not Likely to Establish	Mimosa	<i>Albizia</i>	<i>julibrissin</i>
Not Likely to Establish	Tree of heaven*	<i>Ailanthus</i>	<i>altissima</i>
Considered/not ranked	Black alder*	<i>Alnus</i>	<i>glutinosa</i>
Considered/not ranked	Cinquefoil, silver	<i>Potentilla</i>	<i>argentina</i>
Considered/not ranked	Cinquefoil, sulphur	<i>Potentilla</i>	<i>recta</i>
Considered/not ranked	Clover, alsike	<i>Trifolium</i>	<i>hybridum</i>
Considered/not ranked	Lombardy poplar*	<i>Populus</i>	<i>nigra</i>
Considered/not ranked	Osage orange	<i>Maclura</i>	<i>pomifera</i>
Considered/not ranked	Sweet woodruff	<i>Galium</i>	<i>odoratum</i>

MINNESOTA DEPARTMENT OF NATURAL RESOURCES EDUCATIONAL LIST OF PLANTS THAT CAN BE INVASIVE IN MINNESOTA

Plants on the MN DNR's invasive terrestrial plants website are listed for educational purposes to help people identify invasive plants, and learn about their impacts, control methods, and alternative plantings.

List found at: <http://www.dnr.state.mn.us/invasives/terrestrialplants/index.html>

MIDWEST INVASIVE PLANT NETWORK

This non-profit organization shares information about invasive plants in the Midwest region, including species found to be invasive in other states, but not known to be present in Minnesota. (<http://mipn.org/>)

WISCONSIN INVASIVE PLANT LISTS

Wisconsin Department of Natural Resources (WDNR)—Invasive Plant Species Proposed to be Regulated Under NR 40 and Plant Species Not Regulated by NR 40 (<http://dnr.wi.gov/invasives/classification/>)

Wisconsin Department of Natural Resources (WDNR)—Invasive Species Plants. (<http://dnr.wi.gov/invasives/plants.asp>)

Invasive Plants Association of Wisconsin—IPAW Working List of the Invasive Plants of Wisconsin. (<http://www.ipaw.org/list/index.htm>)



APPENDIX D

SHORT LIST OF INVASIVE INSECTS AND DISEASES FOR MINNESOTA

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 Minnesota's urban and community 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 Minnesota.

Those species assessed by Wisconsin's 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 proposed Invasive Species Identification, Classification, and Control Rule (NR 40).

The lists are not comprehensive. *See Appendix E: Resources* Sections 3 and 4 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)	hardwoods; oaks preferred
Japanese beetle	<i>Popillia japonica</i>	many hosts
Emerald ash borer	<i>Agrilus planipennis</i>	all species of ash (<i>Fraxinus spp.</i>)
Asian longhorned beetle	<i>Anoplophora glabripennis</i>	hardwoods; maples preferred
Sirex woodwasp	<i>Sirex noctilio</i>	pinus
Hemlock woolly adelgid	<i>Adelges tsugae</i>	Eastern and Carolina hemlock
Asian gypsy moth	<i>Lymantria dispar</i> (Asian race)	hardwoods & conifers
Invasive Diseases		
Disease Name	Scientific Name of Pathogen	Preferred Host Species
Diplodia shoot blight	<i>Diplodia pinea</i>	pinus; red, scots, jack & Austrian preferred
Cytospora canker	<i>Cytospora kunzei</i> var. <i>piceae</i>	Norway & Colorado blue spruce preferred
Oak wilt	<i>Ceratocystis fagacearum</i>	oaks; red/black family preferred
White pine blister rust	<i>Cronartium ribicola</i>	5-needled pines
Dutch elm disease	<i>Ophiostoma ulmi</i> , <i>O. novo-ulmi</i>	American elm most susceptible
Fireblight	<i>Erwinia amylovora</i>	rose, apple, pear, and other rosaceous plants
Sudden oak death	<i>Phytophthora ramorum</i>	many hosts
Butternut canker	<i>Sirococcus clavigignenti-juglandacearum</i>	butternut
<p>Species in bold were assessed by Species Assessment Groups comprised of experts in their respective fields and stakeholder 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 proposed Invasive Species Identification, Classification and Control Rule (NR 40). http://dnr.wi.gov/invasives/classification/</p>		

Note: The term "invasive disease" is used throughout this document. Although diseases themselves are not technically invasive, the pathogens that cause plant diseases (including but not limited to fungi, bacteria, viruses and phytoplasmas) can be invasive when they infect a susceptible host and conditions are favorable for disease to develop.

APPENDIX E

RESOURCES

1. Invasive Plants
2. Plants to Use as an Alternative to Invasives
3. Invasive Insects and Diseases
4. Invasive Insects and Diseases Lists
5. All Invasives
6. General Invasive Plant Management
7. Cooperative Weed Management Areas (CWMAs)
8. Biocontrol
9. Herbicide
10. Prescribed fire
11. Early Detection and Rapid Response
12. Prioritizing Management
13. General Sites of Interest
14. Educational Opportunities and Events

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INVASIVE PLANTS

(See also All Invasives)

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

This website 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.

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 website provides information on prevention, early detection and rapid response, control and management, education, research, and more.

Minnesota Department of Agriculture: Noxious Weeds (<http://www.mda.state.mn.us/plants/badplants/noxiousweeds.aspx>)

This site provides information on the noxious weed law, lists of regulated plants, and identification and management information.

Minnesota Department of Natural Resources: Invasive Terrestrial Plants

(<http://www.dnr.state.mn.us/invasives/terrestrialplants/index.html>)

This site provides information on the identification, impacts, and control measures for invasive plants.

Plant Conservation Alliance (PCA), Weeds Gone Wild, Alien Plant Invaders of Natural Areas (<http://www.nps.gov/plants/alien/>)

This website provides a list of invasive plants in the US, background information on the threats and impacts of invasive species, fact sheets, and relevant links.

The Nature Conservancy (TNC), Invasive Species Plant Summaries

(<http://www.imapinvasives.org/GIST/ESA/index.html>)Elemental Stewardship Abstracts are no longer maintained by the Nature Conservancy but still provide good information on invasive plants.

University of Wisconsin Extension—Weed Identification and Management (<http://weedid.wisc.edu>)

This site houses an interactive weed identification database of 280 of the most common weeds/invasive plants in Wisconsin.



University of Minnesota Bell Museum Herbarium

[\(http://www.bellmuseum.umn.edu/ResearchandTeaching/Collections/ScientificCollection/PlantCollection/\)](http://www.bellmuseum.umn.edu/ResearchandTeaching/Collections/ScientificCollection/PlantCollection/)

The Herbarium's web site has identification information and is fully searchable for Minnesota plant specimens.

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PLANTS TO USE AS alternatives to invasive species

Alternative to Ash Trees: Commercially Available Species and Cultivars

<http://www.uwex.edu/ces/wihort/landscape/AshAlternatives.doc>

By Dr. Laura G. Jull, Dept. of Horticulture, University of Wisconsin-Madison

Alternative to Ash Trees: Short List

<http://www.entomology.wisc.edu/emeraldashborer/Alternatives%20to%20Ash%20for%20Homeowners.pdf>

By Dr. Laura G. Jull, Dept. of Horticulture, University of Wisconsin-Madison

Meijer & The Nature Conservancy's Recommended Non-Invasives List

http://www.nature.org/wherewework/northamerica/states/michigan/files/meijer_plant_list.pdf

Landscape Alternatives for Invasive Plants of the Midwest.

<http://mipn.org/MIPN%20redraft2.pdf>

Lists the invasive and its alternatives

3

INVASIVE INSECTS AND diseases

(See also All Invasives)

Emerald Ash Borer: What you need to know

[\(http://www.emeraldashborer.info/\)](http://www.emeraldashborer.info/)

This website is part of a multi-state effort to provide the latest information about EAB to the public.

Minnesota Department of Agriculture

(MDA): Insects and Pests

<http://www.mda.state.mn.us/en/plants/insects.aspx>

MDA is responsible for the prevention, introduction and spread of plant pests. This webpage provides information on specific pests, rules, and firewood regulations and certifications. Provides links to information on emerald ash borer and gypsy moth.

Minnesota Department of Agriculture

Tree Care Registry

<http://www.mda.state.mn.us/en/licensing/licensetypes/treecareregistry.aspx>

All companies and persons that provide tree care or tree trimming services and/or who remove trees, limbs, branches, brush or shrubs for hire must register. The registry provides an effective way to contact tree care providers about outbreaks and regulations.

Minnesota Department of Natural Resources:

Forest Health Program Web Page

http://www.dnr.state.mn.us/treecare/forest_health/index.html) Newsletter: <http://www.dnr.state.mn.us/fid/index.html>)

DNR Forestry's forest health unit is responsible for surveys, evaluations, and impact assessments of forest pests and diseases as well as technical assistance for public and private landowners on tree and forest health and invasive species.

Minnesota Department of Natural Resources:

Invasive Terrestrial Animals and Pathogens

<http://www.dnr.state.mn.us/invasives/terrestrialanimals/index.html>)

<http://www.dnr.state.mn.us/invasives/terrestrialpathogens.html>)

These pages provide information on identification, prevention, and management of invasive insects and pathogens.

National Agricultural Pest Information

System (NAPIS)—Pest Tracker

<http://ceris.purdue.edu/napis/>)

This website 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)

The Exotic Forest Pest Information System for North America.

(<http://spfnic.fs.fed.us/exfor/index.cfm>)

This web site contains a database of invasive insects, mites, and diseases with background information for each pest.

U S Department of Agriculture (USDA) Animal Plant Health Inspection Service (APHIS)

(http://www.aphis.usda.gov/plant_health/)

APHIS safeguards agriculture and natural resources from the risks associated with the entry, establishment, or spread of animal and plant pests. The site has links to information on specific plant pests, pest detection and identification information, and plant protection and quarantine manuals.

US Department of Agriculture (USDA) Forest Service—North Central Research Station

Emerging Forest Insect Pests:

(http://www.ncrs.fs.fed.us/4501/focus/emerging_pests/)

The North Central Research Station web site provides information on exotic forest insects, describes current research, and features publications and maps for a 20-state region spanning the Midwest and Northeast.

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INVASIVE INSECTS AND diseases lists

Minnesota DNR Forest Health Program Annual Reports

(http://www.dnr.state.mn.us/treecare/forest_health/annualreports.html)

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://www.invasive.org/gist/products/gallery/regionlist.html>)

USDA Forest Service Invasive Species Program Web pages

(<http://www.fs.fed.us/invasivespecies/speciesprofiles/index.shtml>)

USDA Forest Service North Central Research Station

(http://www.ncrs.fs.fed.us/4501/focus/emerging_pests/)

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ALL INVASIVE SPECIES

Minnesota Invasive Species Advisory Council

(<http://www.mda.state.mn.us/misac>)

This is a gateway to information about invasive species and the efforts to address them in Minnesota.

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 Team.

(<http://tncinvasives.ucdavis.edu>)

This web site is no longer maintained by the Nature Conservancy but it is archived on various other web sites. It 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, 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.

Minnesota Department of Natural Resources (DNR)

(<http://mndnr.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.

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GENERAL INVASIVE PLANT management

Center for Invasive Plant Management (CIPM)—Weed Control Methods

(<http://www.weedcenter.org/management/control.html>)

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.

Midwest Invasive Plant Network Control Database

(<http://mipncontroldatabase.wisc.edu/>)

This interactive website contains information on how to control many invasive plants common to the Midwestern United States.

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.

Shaw Nature Reserve Native Landscaping Manual—Chapter Three-Control and Identification of Invasive Species: A Management Guide for Missouri.

(<http://www.shawnature.org/nativeland/NativeLandscapingManual/ChapterThree.aspx>)

This manual describes mechanical and chemical control methods and revegetation. It provides good illustrations of management.

The Nature Conservancy (TNC)—Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas

(<http://www.invasive.org/gist/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/prevention/dangeroustravelers.shtml>)

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

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COOPERATIVE WEED MANAGEMENT areas (CWMAs)

A cooperative Weed Management Area is a partnership of federal, state and local government agencies; tribes; individuals; and other interested groups that manage invasive plants in a defined geographic area. CWMAs are local organizations that provide a mechanism for sharing invasive plant management resources across jurisdictional boundaries in order to achieve widespread invasive plant prevention and control. CWMAs operate under a formal agreement to ensure longterm, on-going resource-sharing and collaboration.

MN Board of Soil and Water Resources

(<http://www.bwsr.state.mn.us/grantscostshare/CWMA.html>)

CWMAS IN MINNESOTA

Midwest Invasive Plant Network

(<http://mipn.org/cwma.html>)

A local Midwest resource for starting a CWMA.

Center for Invasive Plant Management

(www.weedcenter.org)

Information and resources on how to start a CWMA.

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BIOCONTROL

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

(<http://www.nysaes.cornell.edu/ent/biocontrol/>)

This website provides photographs and descriptions of biocontrol agents of insect, disease and weed pests in North America.

**Invasive Plants of the Eastern U S—
Biological Control of Invasive Plants in the
Eastern United States (USDA Forest Service
Publication FHTET-2002-04, 413 p.)**

(<http://www.invasive.org/eastern/biocontrol>)

This web site serves as a reference guide for field workers and land managers concerning the historical and current status of the biological control of select invasive plants in the eastern United States.

Minnesota Department of Agriculture: Biocontrol

(<http://www.mda.state.mn.us/plants/pestmanagement/biocontrol.aspx>)

Information on biological control and its use in Minnesota.

**Minnesota Department of Natural
Resources: Purple loosestrife biocontrol**

(<http://www.dnr.state.mn.us/invasives/aquaticplants/purpleloosestrife/biocontrol.html>)

Information on purple loosestrife biological control and its use in Minnesota.

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HERBICIDE

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

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

Minnesota Department of Agriculture: Pesticides

(<http://www.mda.state.mn.us/chemicals/pesticides.aspx>)

Pesticide programs at MDA regulate the sale, use, and disposal of pesticides.



The Nature Conservancy (TNC)—Safe Herbicide Handling in Natural Areas: A Guide for Land Stewards and Volunteer Stewards.

(<http://www.invasive.org/gist/products/library/herbsafe.pdf>)

The Nature Conservancy (TNC)—Upkeep and Maintenance of Herbicide Equipment: A guide for natural area stewards

(<http://www.invasive.org/gist/products/library/herbupkeep.pdf>)

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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/store/docs/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.

Minnesota Department of Natural Resources: Prescribed Burns

(<http://dnr.state.mn.us/rxfire/index.html>)

The purpose of these pages is to support DNR personnel in the use and improvement of prescribed fire in the DNR. These pages contain key department policies, procedures, forms, and other information staff may need for prescribed burning.

The Nature Conservancy (TNC)—Fire Management Manual

(<http://www.tncfiremanual.org/index.htm>)

The manual serves as the Conservancy's guiding document on all aspects of wildland fire management.

USDA Forest Service—Fire Effects Information System (FEIS)

(<http://www.fs.fed.us/database/feis/>)

FEIS features a searchable database that summarizes and synthesizes research about living organisms in the United States —their biology, ecology, and relationship to fire.

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.

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EARLY DETECTION AND rapid response

EDDMaps: Early Detection and Distribution Mapping System

(<http://www.eddmaps.org/>)

EDDMapS is a web-based mapping system for documenting invasive species distribution. Smartphone apps also available: *(<http://apps.bugwood.org/gledn.html>)*

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.

Midwest Invasive Plant Network (MIPN)—Early Detection and Rapid Response

(<http://www.mipn.org/detectionresponse.html>)

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

([http://invasivespecies.nbio.gov/portal/community/Communities/Ecological_Topics/Invasive_Species/Early_Detection,_Rapid_Response_\(EDRR\)/](http://invasivespecies.nbio.gov/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 North American Invasive Species Management Association

(www.naisma.org)

The North American Invasive Species Management 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, choose the “Access our Industry Standards” link.

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

(http://www.fs.fed.us/foresthealth/publications/EWSfinal_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
- 4) respond

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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.)

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GENERAL SITES OF interest

AmericanHort

(<http://www.americanhort.org/>)

This website provides education, research, public relations, and representation services to members of the nursery and landscape industry.

International Society of Arboriculture

(<http://www.isa-arbor.com/home.aspx>)

This is a worldwide professional organization dedicated to fostering a greater appreciation for trees and to promoting research, technology, and the professional practice of arboriculture.

Invaders of the Forest

(<http://dnr.wi.gov/org/caer/ce/eeek/teacher/invasiveplantguide.htm>)

This is an educators' guide to invasive plants of Wisconsin forests. The guide provides classroom and field activities for formal and non-formal educators working with kindergarten through adult audiences. Lessons are correlated to Wisconsin's academic standards.



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Minnesota Department of Natural

Resources: Community Forestry

(<http://www.dnr.state.mn.us/forestry/urban/index.html>)

Resources on tree care, resources for communities, and grant programs.

Minnesota Shade Tree Advisory Committee

(<http://www.mnstac.org>)

Their mission is to advance Minnesota's commitment to the health, care, and future of all community forests.

Minnesota Society of Arboriculture

(<http://msa-live.org/>)

The Minnesota Society of Arboriculture is an organization that promotes the planting and preservation of shade and ornamental trees. The Society of Arboriculture supplies current information on events happening in the fields of arboriculture and urban and community forestry.

Trees are Good: International Society of Arboriculture

(<http://www.treesaregood.com>)

This site helps to educate the general public about the importance and value of proper tree care.

University of Minnesota Extension

(<http://www1.extension.umn.edu/>)

The site has links to the Master Gardener program, the Plant Disease Diagnostic Clinic, and urban and community horticulture topics.

University of Minnesota Extension

My Minnesota Woods

(<http://www.myminnesotawoods.umn.edu/>)

Woodland stewardship advice and information.

University of Wisconsin Urban Horticulture

(<http://wihort.uwex.edu/>)

This site houses the Wisconsin Garden Facts (X-file series), phenological information, Wisconsin horticultural updates and pest information including invasive plant publications.

EDUCATIONAL OPPORTUNITIES AND events

International Society of Arboriculture

(<http://www.isa-arbor.com/home.aspx>)

Minnesota Invasive Species Advisory Council

(<http://www.mda.state.mn.us/plants/pestmanagement/misac/misacevents.aspx>)

Minnesota Society of Arboriculture

(<http://msa-live.org/eventsnews/events>)

PlayCleanGo: Stop Invasive Species in Your Tracks

(<http://www.playcleango.org/pcgday.html>)

APPENDIX F

FINANCIAL ASSISTANCE FOR MANAGING INVASIVE SPECIES

Gypsy Moth Suppression Program

When gypsy moth populations reach outbreak levels, the federal government may provide funds to the MN DNR to facilitate a spray program. As of 2013, gypsy moth populations had not reached the levels needed to create this program. Please visit the DNR gypsy moth webpage to see if there are updates. (<http://www.dnr.state.mn.us/invasives/terrestrialanimals/gypsymoth/index.html>)

Pulling Together Initiative

The Pulling Together Initiative seeks proposals that will help control invasive plant species, mostly through the work of public/private partnerships such as Cooperative Weed Management Areas. 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 and for-profit businesses are not eligible to receive PTI grants, but are encouraged to work with eligible applicants to develop and submit applications to PTI. (www.nfwf.org/pti)

United States Department of Administration Forest Service Wood Education and Resource Center (WERC)

The Wood Education and Resource Center (WERC) funds projects that create opportunities for sustained forest products production for primary and secondary hardwood industries located in the eastern hardwood forest region. Examples of proposals that would be given priority include:

- Develop technology and markets to address emergency issues including:
 - 1) Phytosanitation of wood packaging materials, firewood and similar products to eliminate these pathways for the transport of insect and disease pests, and
 - 2) development of markets for and utilization of unpredicted increases in volume of urban and rural wood due to incidents like new

pest introductions (e.g. Emerald Ash Borer). (<http://www.na.fs.fed.us/werc/grants.shtm>)

Minnesota DNR Forestry – Community Forests Bonding Grants Program

This is a state program administered by the Minnesota DNR, Division of Forestry - Urban Forestry Program. As funding allows, DNR provides grants for planting a diverse community forest, removal and replacement of emerald ash borer-infested public ash trees, and replacement of trees lost to storms. No match is required for these grant funds. However, applicants must complete all contractual obligations as stated in the “Components Required Upon Project Completion” section of these guidelines. The use of these funds is specifically restricted to activities of a capital nature conducted on publicly owned land. See website for additional information. (<http://www.dnr.state.mn.us/grants/forestmgmt/commforestbondgrant/index.html>)





OTHER INVASIVE SPECIES funding

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

Midwest Invasive Plant Network

(<http://www.mipn.org/grants.html>)

National Urban and Community Forestry Advisory Council

(<http://www.treelink.org/nucfac/>)

USDA grant and partnership programs that could be used to fund invasive species related projects

(<http://www.invasivespeciesinfo.gov/docs/toolkit/usdagrants2009.pdf>)

All federal grants

(<http://www.grants.gov/>)

APPENDIX G

FEDERAL AND MINNESOTA STATE STATUTES AND ADMINISTRATIVE RULES APPLICABLE TO INVASIVE PLANTS AND PESTS

The links and statutes listed below are for the federal and statewide level. Local municipal and county ordinances should also be checked for laws applicable to invasive plants, pests and control treatments. Reference the Minnesota State Law Library for access to many of these county and municipal ordinances: (<http://mn.gov/lawlib/ordinance.html>)

INVASIVE TERRESTRIAL PLANTS

State Prohibited and Restricted Noxious Weeds - Minnesota Department of Agriculture (MDA)

For explanation of laws and current list of Minnesota prohibited and restricted noxious weeds see MDA Noxious Weed List: (<http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx>) and Minnesota Statutes 18.75 - 18.91: (<https://www.revisor.mn.gov/statutes/?id=18>) and 160.23: (<https://www.revisor.mn.gov/statutes/?id=160.23>)

Federal Noxious Weeds - US Department of Agriculture - Animal and Plant Health Inspection Service (USDA - APHIS)

USDA - APHIS Federal Noxious Weeds
([http://www.aphis.usda.gov/plant_](http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/)
[health/plant_pest_info/weeds/](http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/))

INSECTS AND DISEASES

Minnesota Department of Agriculture Tree Care Registry

([http://www.mda.state.mn.us/en/licensing/
licensetypes/treecareregistry.aspx](http://www.mda.state.mn.us/en/licensing/licensetypes/treecareregistry.aspx))

All companies and persons that provide tree care or tree trimming services and/or who remove trees, limbs, branches, brush or shrubs for hire must register. The registry provides an effective way to contact tree care providers about outbreaks and

regulations. The Minnesota legislature created this registry as part of the Plant Protection and Export Certification Law, Minnesota Statutes Chapter 18G.07, and directed the Minnesota Department of Agriculture (MDA) to maintain it.

State Plant Pest Act - Minnesota Department of Agriculture

The Minnesota Department of Agriculture regulates insects through the State Plant Pest Act. This includes, but is not limited to, an invasive species or any pest of plants, agricultural commodities, horticultural products, nursery stock, or noncultivated plants by organisms such as insects, snails, nematodes, fungi, viruses, bacteria, microorganisms, mycoplasma-like organisms, weeds, plants, and parasitic plants

Minnesota Statutes Chapter 18G

(<https://www.revisor.mn.gov/statutes/?id=18G>)

Minnesota Statutes Chapter 18J

(<https://www.revisor.mn.gov/statutes/?id=18J>)

*For More Information, see Minnesota
Department of Agriculture Plant Protection
Division ([http://www.mda.state.mn.us/en/
about/divisions/plantprotection.aspx](http://www.mda.state.mn.us/en/about/divisions/plantprotection.aspx))*

FEDERAL LAWS AND REGULATIONS

PUBLIC LAW 106-224 114 STAT. 438- 455 TITLE IV - Plant Protection Act

([http://www.aphis.usda.gov/plant_health/
plant_pest_info/weeds/downloads/PPAText.pdf](http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/PPAText.pdf))





**7CFR 301.53 – 301.53-9 – Emerald
Ash Borer Regulations**

[http://www.access.gpo.gov/nara/cfr/
waisidx_05/7cfr301_05.html](http://www.access.gpo.gov/nara/cfr/waisidx_05/7cfr301_05.html)

**7CFR 319.40 – Logs, Lumber, and Other
Unmanufactured Wood Articles Regulations**

[http://www.access.gpo.gov/nara/cfr/
waisidx_01/7cfr319_01.html](http://www.access.gpo.gov/nara/cfr/waisidx_01/7cfr319_01.html)

APPENDIX H

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APPENDIX I

GLOSSARY

Control

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

Cooperative Weed Management Area (CWMA)

A formal partnership of federal, state and local government agencies; tribes; individuals; and other interested groups that share resources to manage invasive plants in a defined geographic area.

County Agricultural Inspector

A position which a county may appoint as having responsibility over noxious weeds and other duties as assigned by the entity.

Cultivar

A cultivated variety of a plant. Cannot be reproduced without human assistance. Usually propagated asexually (cloned).

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.

Ecosystem

The complex of a community of organisms and its environment.

Forb

A non-woody (*herbaceous*) flowering plant other than a grass.

Invasive Disease

Although diseases themselves are not technically invasive, the pathogens that cause plant diseases (including but not limited to fungi, bacteria, viruses and phytoplasmas) can be invasive when

they infect a susceptible host and conditions are favorable for disease to develop.

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 and/or regulatory tactics and strategies that are ecologically and economically efficient and socially acceptable.

Introduction

The intentional or unintentional escape, release, dissemination or placement of a species into an ecosystem as a result of human activity.

Inventory

The collection of data about the number, condition and distribution of trees and other vegetation in order to manage the resource.

Microclimate

The climate of small spaces, such as an inner city, a residential area or a mountain valley. Microclimate includes: sun/shade, wind, temperature and precipitation.

Monitoring

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

Native species

With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

Pathogen

An agent that causes disease, especially a living microorganism such as a bacterium or fungus.



**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.

Provenance

The geographic seed source (i.e. where the seed or seedling originated). Assures that the seed or seedling will be adaptable to the general climatic conditions of that geographic area.

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. planting or direct seeding).

Restoration

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

Revegetation

The reestablishment and development of vegetation.

Richness

Species richness is the number of different species present in an area. It is a count of species and it does not take into account the abundances of the species.

Soil seedbank

The collective name for the store of viable, unsprouted seeds in the soil. For example, although most seeds sprout in the first few years after they fall onto the soil, spotted knapweed seeds can last 10 years in the soil before they sprout.

Species

A group of organisms, all of which have a high degree of physical and genetic similarity, that generally interbreed only among themselves and show persistent differences from members of allied groups of organisms.

Urban Forest

All the trees, shrubs, groundcovers and associated vegetation in and around a city, village or town in association with the buildings, infrastructure, soil, water, air, topography, animals and people.

Urban and Community Forestry

The art, science and technology of managing the urban and community forest landscape for the environmental, ecological, physiological, sociological, economic and aesthetic benefits trees, shrubs, groundcovers, and associated vegetation provide.

Variety

A naturally occurring subdivision of a species having a distinct difference and breeding true to that difference.

APPENDIX J

LIST OF INVASIVE SPECIES BMPS

CHAPTER 3: PLANNING

LAND USE PLANNING

BMP 3.1: Know which invasive species affect or could affect your region and property.

BMP 3.2: Assess the extent of invasive species on and near the property by scouting and documenting infestations.

BMP 3.3: Assess current available resources and explore additional resources to prevent the introduction and manage the spread of invasive species.

BMP 3.4: Develop a plan for managing invasive species.

BMP 3.5: Provide training on identification, management, and prevention techniques of known invasive species to employees, contractors, volunteers, elected officials, owners, users, and the public.

ACTIVITY PLANNING

BMP 3.6: When planning for a specific management/maintenance activity, scout for invasive species both within and around the activity area.

BMP 3.7: Plan urban and community forest management/maintenance activities to limit the introduction and spread of invasive species.

BMP 3.8: Plan to monitor each site following management and maintenance activities; determine necessary treatments based on presence of invasive species.

BMP 3.9: As opportunities arise, interact with and engage researchers to further our understanding of invasives.

CHAPTER 4: DESIGN

BMP 4.1: Conduct a site assessment prior to site design.

BMP 4.2: Conduct an inventory for invasive species as part of a site assessment.

BMP 4.3: Do not include invasive species in planting designs.

BMP 4.4: Design using plant materials that are site appropriate and less susceptible to highly damaging/detrimental pests and diseases.

BMP 4.5: Design planting conditions that foster the establishment and health of plants.

BMP 4.6: Diversify the planting material within the context of your design.

BMP 4.7: Design with long-term management/maintenance in mind.

CHAPTER 5: SALES

BMP 5.1: Do not purchase, sell or propagate known invasive plant species or their propagules.

BMP 5.2: Do not purchase or sell plant or landscape material you suspect may be infested or infected with invasive pests.

BMP 5.3: When available and appropriate, purchase, sell and propagate species, cultivars and varieties known to be less susceptible to invasive pests as alternatives to more susceptible ones.

BMP 5.4: Plant propagators, wholesalers and retailers are responsible for educating themselves and their customers about invasive plants and potential invasive insect and disease issues associated with host plant materials.





CHAPTER 6: PLANTING AND INSTALLATION

BMP 6.1: Limit the introduction and spread of invasives during site preparation activities.

BMP 6.2: Do not plant invasive species.

BMP 6.3: Do not plant material that you suspect may be infested or infected with invasive pests.

BMP 6.4: Select plant materials that are site appropriate, healthy and less susceptible to highly damaging/detrimental pests and diseases.

BMP 6.5: Diversify the planting material within the context of your planting project.

BMP 6.6: Prepare site and plant trees according to current arboriculture industry standards for optimum tree health.

BMP 6.7: Reduce the introduction of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation.

BMP 6.8: Avoid unnecessary soil disturbance.

BMP 6.9: Stabilize disturbed soils in a timely manner to prevent the establishment of invasive species.

BMP 6.10: Use landscape materials that are free of invasive species and their propagules.

BMP 6.11: Monitor sites following planting and installation activities; determine necessary treatments based on presence of invasive species.

BMP 6.12: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting invasive plant propagules.

BMP 6.13: Remove soil, seeds, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area.

CHAPTER 7: MANAGEMENT/ MAINTENANCE

BMP 7.1: Plan management/maintenance activities to limit the introduction and spread of invasive species.

BMP 7.2: When working in an area infested or previously infested with invasive species, review monitoring survey data and control records for the property and address as needed in the current work plan.

BMP 7.3: Minimize the movement of invasive species to non-infested areas during landscape management/maintenance activities.

BMP 7.4: Reduce the introduction of pathogens and insects by avoiding unnecessary wounding of trees and other vegetation.

BMP 7.5: Perform activities in a way that promotes healthy plants.

BMP 7.6: Use landscape materials that are free of invasive species and their propagules.

BMP 7.7: Avoid unnecessary soil disturbance.

BMP 7.8: Stabilize disturbed soils in a timely manner to prevent the establishment of invasive species.

BMP 7.9: Keep records of activities that could affect the introduction and establishment of invasive species.

BMP 7.10: Monitor recent work sites for invasive species.

BMP 7.11: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods to minimize the risk of transporting propagules of invasive species.

BMP 7.12: Remove soil, seeds, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area.

BMP 7.13: Properly treat or dispose of invasive species or materials that may harbor invasive propagules, insects or diseases.

BMP 7.14: If pre- or post-activity invasive species control treatments are planned, ensure they are applied within the appropriate time window and under the correct environmental conditions.

CHAPTER 8: SANITATION AND DEBRIS DISPOSAL

BMP 8.1: Prior to relocating equipment, vehicles and trailers, remove soil and debris from exterior surfaces by scraping, brushing, washing or using other methods designed to minimize the risk of transporting propagules.

BMP 8.2: Remove soil, seeds, vegetative matter and other debris from shoes, clothing and tools prior to leaving an area.

BMP 8.3: Minimize the offsite transport of invasives and materials that may contain invasives.

BMP 8.4: When necessary to transport invasives and materials that may contain invasives off site, cover or otherwise contain those materials.

BMP 8.5: Properly treat or dispose of invasive species or materials that may harbor invasive propagules, insects, or diseases.

BMP 8.6: Allow compost piles to heat to appropriate temperatures and times and with proper procedures to reduce the viability of invasives contained within.

BMP 8.7: Avoid the use of wood chips and compost that may contain invasive propagules.

CHAPTER 9: MONITORING AND RESEARCH

BMP 9.1: Create an invasive species monitoring plan for properties under your management.

BMP 9.2: Assess the extent of invasive species on and near the property by scouting, locating and documenting infestations.

BMP 9.3: Monitor sites under your management following management/maintenance activities; determine necessary follow-up

based on presence of invasive species.

BMP 9.4: Keep records when scouting and monitoring.

BMP 9.5: Report new infestations of known invasive species to the appropriate authority.

BMP 9.6: As opportunities arise, interact with and engage researchers to further our understanding of invasives.

CHAPTER 10: OUTREACH, EDUCATION AND COMMUNICATION

BMP 10.1: Educate yourself about invasive species.

BMP 10.2: Educate employees and volunteers about invasive species.

BMP 10.3: Educate clients, customers, and users about invasive species.

BMP 10.4: Educate public officials and other decision makers about invasive species.

