Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities

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EMERALD ASH BORER (EAB) RESOURCE MANAGEMENT GUIDE FOR SHEBOYGAN COUNTY COMMUNITIES

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Executive Summary

The Emerald Ash Borer (EAB) is an invasive insect species from Asia that arrived in the United States in wood packing material. The pest was first detected in Michigan in 2002 and has subsequently spread to Canada and 14 other states including Wisconsin. The pest is 100 percent fatal to native ash trees of any size, any age, healthy or unhealthy and it is estimated that more than 50 million ash trees are dead or dying in the Midwest because of this insect.

In August of 2008, the Department of Agriculture, Trade, & Consumer Protection (DATCP) announced that EAB had been found in the Village of Newburg, Ozaukee County. Since then, EAB has been found in Brown, Crawford, Milwaukee, and Vernon Counties causing a total of eleven counties to be quarantined statewide.

With the EAB find in Ozaukee County being only 15 miles from Sheboygan County, it now seems likely that Sheboygan County residents and local officials will be dealing with the impacts of EAB in the near future. Trees are not just an aesthetic amenity, but benefit our communities by providing many ecosystem services such as improving urban air quality, helping manage stormwater, improving property values, enhancing quality of life, and lowering building energy demand. Trees are one of the few types of public infrastructure that increases in value over time and reduces the need for much greater expenditures in gray infrastructure. The **public ash trees alone** in Sheboygan County provide many benefits.

- Electricity saved annually in Sheboygan County from both shading and climate effects of public ash trees totals 1,489.7 MWh, for a retail savings of $113,068. Total annual savings of natural gas total 201,221 (Therms), for a savings of $197,197. Total annual energy savings are valued at $310,265 or $47.72 per tree.
- Countywide, CO2 emission reductions due to sequestration by public ash trees is 2,102 tons, valued at $31,531. Release of CO2 from decomposition and tree-care activities is small (114 tons; $1,721). Net CO2 reduction is 3,236 tons, valued at $48,551 or $7.47 per tree
- Net air pollutants removed, released, and avoided is valued at $56,426 annually or $8.68 per tree.
- The ability of Sheboygan County's public ash trees to intercept rain—thereby reducing stormwater runoff— is substantial, estimated at 16,338,919 gallons annually, for a savings of $442,815 ($68.10 per tree).
- The estimated annual benefits associated with aesthetics, property value increases, and other less tangible benefits are approximately $474,537 or $72.98 per tree.
- Annual benefits total $1.33 million and average $205 per tree. Stormwater-runoff reduction, energy savings, and aesthetic/other benefits each account for approximately ninety percent of total benefits.[1]

In response to EAB being found in such close proximity to Sheboygan County and with the impact it will have on our communities, a Sheboygan County EAB Work Group consisting of representatives from state, county, city, village and town levels was formed in the spring of 2009 to explore the best way to plan for EAB in Sheboygan County. The EAB Work Group identified the development of an EAB guide as the top priority, with an inventory of public trees being the first step in developing the guide. With few communities in the county

[1] Numbers were calculated using i-Tree software. For more information refer to Section IV – Assessments, Associated Costs and Benefits.

having an up-to-date tree inventory, conducting a countywide public tree inventory was considered essential to understand and determine the potential impact of EAB on Sheboygan County communities. The countywide tree inventory will help communities plan for EAB, provided a cost saving service to the communities and in some cases a service that otherwise never would have been possible.

During the summer of 2009, a countywide public tree inventory was made possible by a $15,000 Sheboygan County Stewardship Grant. The inventory covered all public trees in the county and encompassed 18 municipalities including the county. A total of 30,270 trees were inventoried. Results showed that 23% (6,931) of the trees were ash. In addition, the percentage of ash per community varied from 5.5% in the Village of Glenbeulah to 76.7% in the Town of Sheboygan with an overall average of 26% per community. The cost to treat and/or remove 26% of the trees in each community will be a burden on municipal budgets and resources. In addition, the inventory does not factor in trees on private property and the resources homeowners will need to deal with EAB. When considering EAB will affect public and private properties alike, the long term affects on budgets, resources, and ecosystem services for each community will be significant.

Following completion of the tree inventory, Sheboygan County Land & Water Conservation Department applied for and received a 2010 WDNR Urban Forestry Grant for $5,000 to develop an EAB guide. The EAB work group guided the development of this guide to be a tool that will aid local communities and residents in planning for the arrival of EAB. This guide is not a mandate, but is intended to serve as a resource that will help prepare communities in implementing specific action plans that provide appropriate and effective response in managing EAB.

Throughout development of the guide, information was requested through a survey from municipalities to help determine the level of preparedness in the county. The survey results indicated that while many communities may know about EAB, very few have taken proactive steps. Only one community in the county has a plan for EAB and a budget for implementation. Three other communities are conducting some type of preemptive management efforts, although without specific plans in place.

This guide provides Sheboygan County communities the resource they need to develop their own EAB community response plan by consolidating essential information within one reference document. The guide provides a checklist and corresponding resource information that walks communities through the elements that are imperative to every EAB plan. The checklist is intended to help a community develop the framework for their own EAB community response plan.

The guide covers the history of EAB in North America and how to identify both EAB and an ash tree. The guide covers the most up to date techniques for EAB preparation, detection, and control along with potential wood utilization options for ash trees. The guide provides information on the steps that are taken once EAB is confirmed in the county and summarizes the regulations that Sheboygan County is currently under. There is information on outreach, education, and opportunities for funding. In addition, the results of the 2009 tree inventory and the 2010 municipal survey are summarized.

There is still much work to be done to fully prepare for EAB's ultimate arrival. However Sheboygan County communities are well positioned by showing a willingness to attain and distribute resources on EAB, to take proactive steps, and to partner when necessary.

Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities

Table of Contents

Figures

Tables

Maps

I. Introduction

Purpose of the Guide

The purpose of the Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities is to provide a tool that will aid local communities and residents in planning for the arrival of EAB. It is intended to provide information that will prepare communities in implementing specific action plans that provide appropriate and effective response in managing EAB. The following guidelines were considered in the development of the guide:

- To provide a resource that establishes countywide baseline tree inventory data that will help facilitate local response to EAB.
- To provide a tool that serves as a framework for local EAB preparedness and community action by outlining major issues and providing guidance on how to address them.
- Create partnerships between communities and with private entities that increase the efficiency and effectiveness in response to EAB.
- Help communities minimize the impacts and loss of trees on the health of urban forests by using the latest and best scientific knowledge and lowest effective cost to the community.
- Help communities minimize the impact of EAB and reduce any risk to the public.

Ultimately, it is desired that actions taken because of this guide will lead to municipalities and communities being well educated and versed in EAB resulting in a more diversified urban forest that the citizens of Sheboygan County are proud of.

Planning Process

In August of 2008, the Department of Agriculture, Trade, & Consumer Protection (DATCP) announced that Emerald Ash Borer (EAB) had been found in the Village of Newburg, Ozaukee County, just 15 miles from Sheboygan County. With Sheboygan County's close proximity to Ozaukee County, it now seems likely that Sheboygan County residents and local officials will be dealing with the impacts of EAB in the near future.

To help address the imminent arrival of EAB, the EAB Work Group was formed in the spring of 2009 to explore the best way to plan for EAB in Sheboygan County. The EAB Work Group members include representatives from: Sheboygan County Land & Water Conservation Department, Planning & Resources Department, Emergency Management Department, and UW-Extension; WDNR; DATCP; and public works and park and recreation officials from the cities, villages, and towns of Sheboygan County.

The EAB Work Group identified the development of an EAB Guide as top priority, with a tree inventory of public trees being the first step in developing the guide. With a $15,000 Sheboygan County Stewardship Grant awarded to the EAB Work Group, two summer LTEs were hired in 2009 to conduct tree inventories on municipal lands in cities, villages, and towns in Sheboygan County. Tree inventory data was collected for 18 municipalities including the county. Municipal lands inventoried included the cities of Plymouth (park trees only), Sheboygan, and Sheboygan Falls; the villages of Adell, Cascade, Cedar Grove, Elkhart Lake, Glenbeulah, Howards Grove, Kohler, Oostburg, Random Lake, and Waldo;

towns of Lima (unincorporated areas of Gibbsville and Hingham), Scott (unincorporated areas of Batavia and Beechwood), Sheboygan (park areas), and Sherman (unincorporated area of Silver Creek); and county owned properties.

The second step of developing the EAB Guide was applying for and receiving a 2010 WDNR Urban Forestry Grant for $5,000. The grant was awarded to the Sheboygan County Land & Water Conservation Department who hired an EAB Plan Coordinator to develop and write the guide with guidance, input, and direction from the Sheboygan County EAB Work Group.

The EAB Work Group met during the first half of 2010 to create the EAB guide. As part of the process a municipal survey was sent to all 28 municipalities in the county. The survey requested information regarding their current tree care program (i.e. ordinances, maintenance, budgets, training, etc.) along with any current and future EAB planning activities. In addition, public review of the guide was encouraged throughout the process. Ultimately, the EAB Work Group identified the EAB guide to be a resource document for county, city, village, and town officials and residents. It is intended to be a guide and provide direction for each municipality in preparing and managing for EAB, and is not intended to be a mandate.

Funding

Funding to complete the Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities was provided by two entities. Funding for the first part of the process, conducting a tree inventory, was provided by the Sheboygan County Planning, Resources, Agriculture, and Extension Committee through a Sheboygan County Stewardship Fund Grant. Funding for the second part of the process, to write the EAB Resource Management Guide, was funded with a grant from the Wisconsin Department of Natural Resources as authorized under Wis. Stat. 23.097 and with matching funds from Sheboygan County.

Elements of the Guide

The Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities is composed of ten sections including 14 appendixes that will help your community develop a framework for its EAB Response Guide that is appropriate for your community's goals and objectives.

Section I: Introduction - contains an overview of the purpose of the guide, guide development process, and funding for the guide.

Section II: EAB – provides a concise overview of the history of EAB in North America, describes the lifecycle of EAB and how to identify the pest; and describes how to identify an ash tree and the signs and symptoms if it is infested with EAB.

Section III: EAB Community Response Plan Elements – serves as a template and provides a checklist and summary of EAB plan elements that are fundamental to writing an EAB community response plan specific to their community's goals and objectives.

Section IV: Assessments – includes county and community specific data from the 2009 public tree inventory and 2010 EAB municipal survey; highlights the number of public ash

trees, along with the resources that are available in Sheboygan County communities to manage EAB and its effects.

Section V: EAB Preparation, Detection, and Control – contains the latest information on conducting tree inventories; EAB monitoring and detection techniques; and preemptive and reactive EAB management and control efforts.

Section VI: Wood Utilization – describes potential wood utilization and disposal options for EAB affected trees, and lists local wood users in the county.

Section VII: EAB Confirmation, Authority and Responsibility – describes the procedures for confirming EAB in the county, the current quarantine regulations, and lists the local contacts in Sheboygan County for urban forestry issues.

Section VIII: Communication and Education – presents a general overview of different EAB public education and outreach efforts that communities can conduct, and describes guidelines that homeowners can take to reduce the threat and spread of EAB.

Section IX: Funding – provides a listing of potential funding options for EAB management efforts.

Section X: Appendices – contains materials that support the information included within the various sections of the guide; this includes but not limited to publications that help identify EAB and ash trees, chemical and insecticide options for controlling EAB, woodlot management options, listing of alternative species for ash trees, contract and bid specifications, and additional EAB resources.

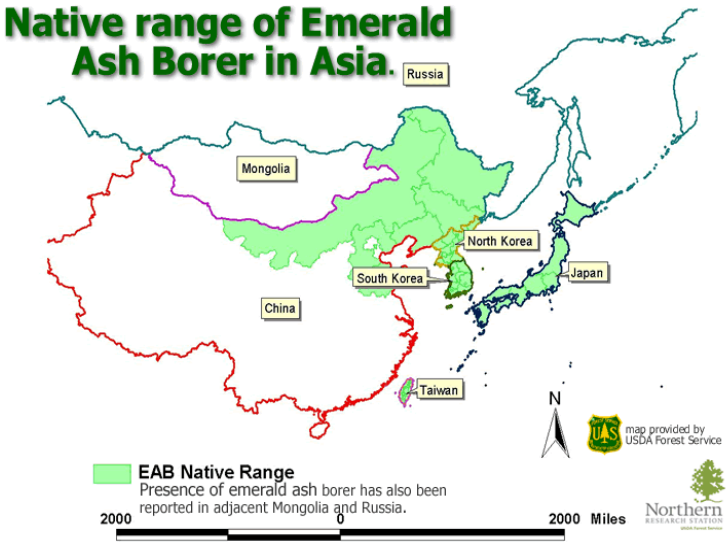
II. Emerald Ash Borer (EAB)

History

Emerald Ash Borer (*Agrilus planipennis*) is a non-native wood-boring insect that feeds on North American ash trees. EAB is native to Asia, in particular northeast China, Korea, Japan, Taiwan, and a small area in adjacent Russia and Mongolia.

EAB is thought to have been introduced to southeastern Michigan through solid wood packing material, such as crates and pallets, originating from Asia. The insect was found in 2002, but is believed to have arrived in the early 1990's. Experts suspect that the insect was present for 12 years before it was identified.

Emerald Ash Borer
Source: Wisconsin



EAB Native Range
Source: USDA Forest

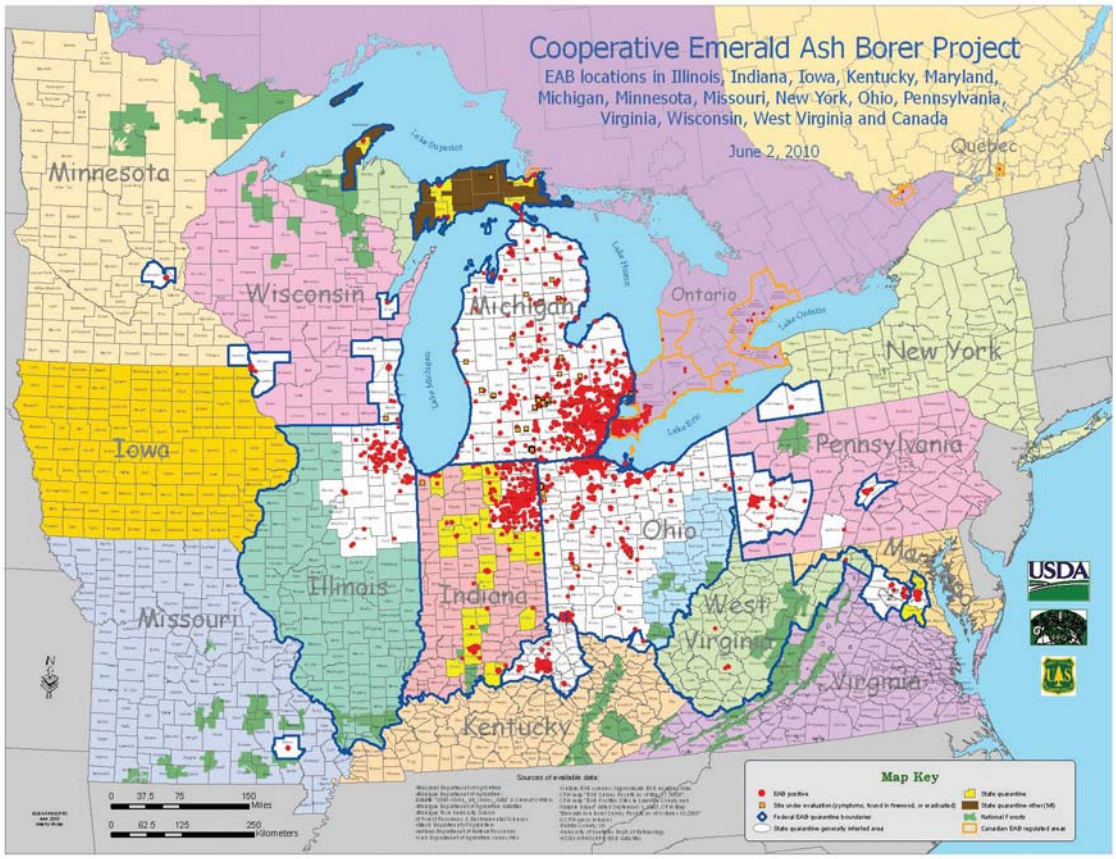
In its native range, EAB feeds on a variety of plant species and is only considered a minor pest. This is partly due to the fact that Asian ash trees have been able to develop co-evolutionary resistant to EAB attacks and populations are also kept in check by predators and pathogens. However, this is not the case in North America where ash trees have no natural resistance and EAB has few predators. In North America, woodpeckers and a native wasp have been shown to attach EAB eggs and larvae, but with little impact on populations. In addition, research is being conducted with three species of wasps from China that show some promise of control (refer to *Section V – Preparation, Detection, and Control* for more information).

In North America, EAB attacks all ash trees in the genus *Fraxinus*, including green ash (*F. pennsylvanica*), white ash (*F. americana*), black ash (*F. nigra*), pumpkin ash (*F. profunda*), blue ash (*F. quadrangulata*), and other native species in the same genus. Mountain ash (*Sorbus* spp.), not a true ash, is unaffected.

EAB is known to attack both healthy and declining ash trees and can infest branches as small as one inch in diameter. Left on its own, EAB can travel ½ mile to several miles per year during its flight period. However, due to human activities EAB has spread over much greater distances than it could have moved naturally. The number one human activity that has lead to the spread of EAB is the movement of firewood. In addition, the movement of nursery stock has also played a role in its movement.

EAB has had a devastating effect on North American forests and has been compared to the effects of chestnut blight and Dutch elm disease. To date, EAB has killed 15 million ash trees in a 20-county area around Detroit and has been found in 14 states, and Ontario,

Canada. If it is not contained or its effects mitigated, it will continue to infest and kill all species of ash tree in the genus *Fraxinus*.



Distribution Map of Emerald Ash Borer in North America as of June 2, 2010.
Source: USDA – APHIS.

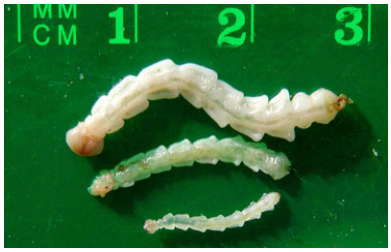
In addition, if left unchecked, EAB could result in the losses of millions of dollars to the lumber and nursery industries as well as urban communities. Preliminary findings by the USDA Forest Service estimate that EAB's potential impact to the national urban landscape is a potential loss of between 0.5 to 2 percent of the total leaf area (30-90 million trees) and a value loss of between $20-60 billion. In addition, if EAB is not contained or eradicated it could cause approximately $7 billion in additional costs to state and local governments and landowners to remove and replace dead and dying ash trees in urban and suburban areas over the next 25 years.[2]

[2] New Pest Response Guidelines, Emerald Ash Borer *Agrilus planipennis* (Fairmaire), USDA-APHIS 2008.

Identification and Lifecycle[3]

Emerald Ash Borer
Source: Wisconsin Emerald Ash Borer Information Source

Emerald ash borer adults are very small, metallic green beetles. They are only 3/8 - 1/2 inch long and 1/16 inch wide (about the size of a cooked grain of rice). Adult emerald ash borers emerge from beneath the bark of ash trees in late May through mid-July, creating a D-shaped exit hole as they chew their way out of the tree. Adult beetles are most active during the day and prefer warm, sunny weather. They never wander far from where they exit a tree (less than one mile) in search of a mate. Once they find a mate, the female will lay 60 - 90 eggs, one at a time, in the crevices of ash tree bark. The adult beetles will feed lightly on ash tree leaves, but do not cause much harm by doing so. The adult beetles live a total of three to six weeks.



Emerald Ash Borer Larvae
Source: Iowa DNR Forestry

Emerald Ash Borer Galleries
Source: University of Wisconsin, Department of Entomology

Emerald ash borer eggs are very small (1 mm), difficult to find and are rarely seen. Female adult beetles deposit them in the bark crevices and as larvae hatch from the egg, they immediately chew their way into the tree.

Emerald ash borer larvae are white and slightly flattened, with a pair of brown pincher-like appendages on the last abdominal segment. Their size varies as they feed under the bark on the ash tree's tissues and grow. Full grown larvae average 1½ inches in length. They wind back and forth as they feed, creating characteristic S-shaped patterns called galleries under the bark (starting in the phloem and extending into the xylem layers). Larvae will feed under the bark for one sometimes two years in healthier trees, and can survive in green wood, such as firewood, even if the tree is no longer standing.

In autumn, after of feeding under the bark, larvae will create a chamber for themselves in the tree's sapwood. They stay in this chamber over winter and pupate in the spring, turning into adult beetles. The adults emerge from the pupa case and then emerge from the tree through D-shaped exit holes, completing the life cycle. The pupae, like the larvae, cannot be seen unless the bark is pulled away from the tree.

Keep in mind when identifying EAB that there are numerous metallic green insects common to Wisconsin that could easily be confused with EAB. In addition, there are several native pests other than EAB that attacks ash trees. For more information on these pests please refer to Appendix A.

[3] Wisconsin's Emerald Ash Borer Information Source, http://www.emeraldashborer.wi.gov/index.jsp.

Ash Tree Identification

Since EAB attacks only ash trees, monitoring for its presence means knowing how to identify ash. Ash trees are most easily identified by their compound leafs (leafs are composed of 5-11 leaflets) and opposite branching pattern where branches, buds, and leaves grow directly across from each other not staggered and. The only other oppositely branched tree with compound leaves is boxelder (*Acer negundo*), which almost always has three to five leaflets. The bark on mature ash trees is tight with a distinct pattern of diamond-shaped ridges. On young trees, bark is relatively smooth. For more information on ash tree identification refer to Appendix B.

Opposite branching and buds.
Source: WDNR EAB Field Guide

Green ash compound leaf
Source: WDNR EAB Field Guide

Example of diamond pattern bark typical of green and white ash.
Source: WDNR, Brian Schwingle

Ash Tree Signs and Symptoms

It is important to remember that since EAB is a wood-boring insect and spends most of its life under the bark of the tree, it is difficult to detect in ash trees. It is also difficult to detect because the decline of infected ash tree's e is usually gradual. Looking for visible signs and symptoms is one method for detecting EAB. Symptoms of an infestation might include dead branches near the top of a tree or wild, leafy shoots growing out from its lower trunk. However, D-shaped exit holes and bark splits exposing S-shaped tunnels are significant signs of EAB.

Woodpecker damage to EAB infested trees.
Source: WDNR EAB Field Guide

A signs that a tree has become infested by EAB is bark with a mottled appearance and/or jagged holes, both caused by woodpeckers looking for pre-pupal larvae. Another sign are the D-shaped exit holes present on the branches and the trunk left by emerging adults. For D-shaped holes to be present a tree has to be infested for at least one year. Since EAB prefers warm sunny areas of the tree the infestation usually begins in the tops of ash trees making if difficult to find D-shaped holes in the early stages of infestation. In addition, if a tree has EAB the bark may split vertically above larval feeding galleries. When the bark is removed from infested trees, the

EAB adult emerging through D-shaped exit hole.
Source: USDA-Forest Service

distinct, frass-filled larval tunnels that etch the outer sapwood and phloem are readily visible on the trunk and branches. An elliptical area of discolored sapwood, usually a result of secondary infection by fungal pathogens, sometimes surrounds larval feeding galleries.

The S-shaped tunnels excavated by feeding larvae interrupt the transport of nutrients and water within the tree during the summer causing foliage to wilts and the tree's canopy becomes increasingly thin and sparse as branches die. Many trees appear to lose about 30% to 50% of the canopy after 2 years of infestation and trees often die after 3-4 years of infestation. Often at the margin of live and dead tissue, epicormic shoots may arise on the trunk of the tree. And dense root sprouting sometimes occurs after trees die.

Epicormic branching and dying branches possibly associated with infested ash tree.
Source: WDNR, EAB Field Guide

III. EAB Community Response Plan Elements: Recommendations, Policies and Actions

Each community in the county will address EAB differently and according to their local circumstances. While each community will respond differently to EAB, all communities should be prepared. The elements described in this section will serve as a template and help your community develop the framework of its EAB community response plan. These elements are offered as suggestions. While all elements may not be included in your plan or appropriate to your community's goals and objectives, it is important to have at least considered them.

The elements along with the background information provided in other sections, will allow your community to put together specific recommendations, policies, and actions to manage their ash trees and help guide decision-making. When establishing recommendations, policies, and actions think carefully about your community's unique needs and weigh all the various options for every item. The plan your community develops should be specific to your community's needs and circumstances, while being flexible and including realistic tasks, goals, timelines, and budgets.

Below in Figure 1, is a checklist of the elements that should be considered in every EAB Response Plan with the sections below providing a short explanation of each item.

Tree Inventories

The first and most important step in preparing for EAB is to determine the potential risk to your community's urban forest resource. This can be quickly identified using information contained in a tree inventory. If your community has a tree inventory, it should be used or updated. If your community does not have a tree inventory, this should be one of your first priorities. For information on the different tree inventories types and methods refer to *Section V – Preparation, Detection, and Control.*

Tree Management Considerations

Your community will need to decide how it is going to manage its ash tree population both before and after EAB is detected. Management options vary and there is no one all-inclusive method. *Section V – Preparation, Detection, and Control* lists factors that should be reviewed and considered when determining management options and describes the most up-to-date management techniques available. However, along with determining management options there are additional items that need to be considered and are explained below. Your community will need to weigh the options carefully and select the combination of methods that works best for them.

Figure 1: EAB Community Response Plan Elements Checklist

Tree Inventories

- □ Does your community have a tree inventory? If yes, does it need to be updated?

Tree Management Considerations

- □ Monitoring and Detection Methods
  What method(s) will your community use to help monitor and detect EAB?
- □ Preemptive vs. Reactive
  What method(s) will your community use to treat and/or remove trees?
- □ In-House vs. Contract
  Will your community use contractors or conduct everything in-house?
- □ Prioritization of Management Schedules
  How will your community determine what trees are treated or removed and in what order?
- □ Replacement Plan
  What species and size will be used for replacements?
  What locations will be planted? (Right tree in right place)
  How much will replacements costs?
  Who will ensure proper planting and maintenance of trees?
  Will volunteers be used?
- □ Staffing, Training, and Equipment
  What personnel and volunteer resources are available to help complete tasks in plan?
  Do they need training to accomplish tasks?
  What equipment/facilities are needed and is there a budget to purchase, lease, and/or repair them?
- □ Costs/Budget
  How much will it cost your community to treat, remove, and replace infected ash trees?
  How will the cost be covered?
- □ Trees on Private Property
  How will your community deal with ash trees on private property and the wood waste generated from them?
- □ Ordinance Review
  Does your community need to review, update, and/or create community tree ordinances and policies?

Wood Utilization

- □ Utilization/disposal methods
  How will your community utilize and/or dispose of wood debris generated from EAB?
- □ Local users
  Are there local businesses that can use the wood debris?
- □ Marshalling yard
  What location will your community use as a marshalling yard?

Authority and Contacts

- □ Who will be the person(s) responsible for coordinating all EAB activities?

Community Outreach and Education

- □ Will your community conduct any public awareness activities for EAB and/or its EAB plan?

Monitoring and Detection

The State of Wisconsin is and has been conducting survey and detection efforts across the state in hopes to detect EAB early. Although their efforts are substantial, it is still a good idea for every community to be conducting its own efforts. The earlier EAB is detected, the easier it will be to manage. Therefore, your community's EAB Response Plan should cover how it will monitor for EAB. This usually includes surveys which are explained further in *Section V – Preparation, Detection, and Control* of this plan. Another important aspect of monitoring and detection is to conduct community outreach programs that encourage residents to report suspected cases. For more information refer to *Section VIII - Communication and Education.*

Preemptive vs. Reactive Management Methods

Communities will need to determine if they are going to preemptively remove trees, reactively remove trees, or conduct a combination of the two. As listed in *Section V – Preparation, Detection, and Control* there are pros and cons to both preemptive and reactive management methods. Please review these along with the items below to determine what is best for your community.

In-house vs. Contract[4]

The consideration of using in-house vs. contract labor will most likely come into question when considering removals or insecticide treatments of your plan. Your community will need to consider if these items can be conducted in-house, using a contractor, or a combination of both. For example, your community may choose to use in-house crews to remove ash trees up to a 10" DBH and hires a contractor for anything larger.

When determining if removals/treatments can be conducted in-house, your community will need to consider if it is a safe and economical choice. Listed below are items that will need to be considered:

- What is the size of the community's forestry staff and is it appropriate for the number of removals/treatments needed?
- Does your community have proper equipment? i.e. chainsaws, personal protective equipment, chippers, trucks/trailers, loaders
- Is the staff properly trained? Can they legally apply the insecticide if this option is chosen? Are they working around electrical hazards and are they trained for this?
- What size(s) of tree can staff safely remove?
- What is your budget for tree removal?
- What is the timeline for tree removals?
- Does your community have a Union and what are their conditions for contracting?
- What is the plan for utilization and disposal of chips?

Remember to always discuss removals/treatments with local utility companies, County road commissions, and the Wisconsin Department of Transportation when appropriate.

When considering the use of a contractor for a portion or all of your tree removals/treatments, it is important to understand the bid process and have clear

[4] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

expectations for the contractor. Be very specific when developing the bid/contract language. Appendix C provides elements of a tree removal contract and bid language that can be considered for a community bid. For additional samples of tree removal, chipping, and stump grinding specifications please refer to the *Emerald Ash Borer Toolkit for Wisconsin Communities* by WDNR. When choosing a contractor it is recommended that communities choose companies who are fully insured, have experience and educational backgrounds in forestry, arboriculture, or related fields, and are members of an industry association. Do not be afraid to ask for reference or talk to other communities that use contractors for tree removal and tree care activities.

Prioritization of Management Schedules[5]

Regardless of whether your community is removing trees proactively or reactively, there should be a process for prioritizing the order of tree removal. The key to this process is using a current inventory of ash trees. The inventory and database will help determine location, size and condition of trees; and track and prioritize removals/treatments.

When prioritizing removals, these general rules usually apply:

1. Hazardous trees
2. Dead, dying, diseased trees
3. Poor structure/condition trees
4. Trees causing infrastructure damage
5. Trees planted or growing in undesirable locations
6. All other trees

In addition, utility contractors should be encouraged to remove ash trees within their easements as part of regular line clearance activities.

When considering and prioritizing insecticide treatments, the following items should be kept in mind:

- Insecticide options are hard to apply on a large scale and can be expensive.
- Focus on healthy trees that are significant to the community or landscape.
- Trees must be healthy for treatment to be effective. Canopy loss should be no more than 25 to 50%

Replacement Plans

Another important element of your EAB Response Plan will be to plan for how trees are going to be replaced. Unfortunately, in many situations replanting is often delayed or eliminated because of budgetary problems, but that should not be considered an option due to the many benefits that trees provide to the residents that live, work, and play in your community. Trees remove pollutants from the air, help improve summer and winter temperatures, reduce storm water runoff, increase property values, attract business and tourism, and provide social and psychological benefits. They are also one of the few components of the urban forest and a community's infrastructure that actually increases in value each year.

[5] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

When establishing your community's replacement plan the following items should be considered.

- Diversity of the tree species and size of planting stock. Refer to *Section V – Preparation, Detection, and Control* for the importance of diversification in your urban forest. The size of planting stock also needs to be considered because it will affect costs and the labor needed to plant it, i.e. a 5" caliper tree will cost more than a 2" caliper. It will also require machinery to move it.
- Cost of replacements (Refer to the *Costs/Budget* section below in help with determining costs)
- Planting the right tree in the right place. Trees species should be selected according to the location. Factors that should be considered include soil and light conditions, the mature size of the tree selected, size of planting location and space, and the location of overhead and underground utilities. Make sure the tree species selected are appropriately sized so that they do not interfere with power lines when they reach mature size.
- Proper planting and mulching. Many trees do not survive due to improper planting techniques, such as planting too shallow or too deep, digging hole too small, not backfilling correctly, and improper mulching. For information on how to properly plant new trees, see brochure by WDNR in Appendix D.
- Maintenance. An equally important component as proper planting is to ensure the long-term survival of the tree. The first three years trees will require maintenance such as watering, pruning, and mulching.
- Volunteers. Utilizing volunteers is a good way to make sure community resources go farther while providing residents with an opportunity to make a positive difference in their community. In addition, a volunteer tree planting campaign can provide your community with the opportunity to educate residents on proper tree planting and maintenance techniques that they can apply to the project and at home.

Staffing, Training, and Equipment

When developing your community's EAB Response Plan, it is important to understand the personnel resources needed to accomplish tasks within it. This includes every task in your community's plan, from surveys, to removals, to replanting. Items that need to be considered are:

- The number of staff available to complete each task.
- The number of hours/days per week each staff can devote.
- Is the staff properly trained to complete tasks safely and efficiently?
- Will the staff need additional training to accomplish tasks?
- Can volunteers be used for tasks and will they require any training?

In addition, facilities and equipment to complete tasks will need to be considered. Inventory facilities owned or leased by your community and identify if it sufficient to accomplish the tasks at hand. Also, identify if there is a budget to purchase, lease, and/or repair needed equipment, facilities, or space. Understanding the personnel, volunteer, and equipment/facilities needs will help to determine if some tasks need to be contracted out and in creating a timeline for implementing each task?

Costs/Budgets[6]

With the arrival of EAB, communities will see an impact to their tree removal and disposal costs. In order to minimize the effect, communities will need to evaluate and implement cost-effective options. This includes not only looking at removal and treatment costs but also by finding cost-effective and creative ways to utilize products from tree removals. By doing this communities can often lessen the economic impact of the pest's damage, provide local wood resources for needed projects, stimulate community interest in recycling and reuse, and strengthen local wood products industries. For more information on utilization techniques refer to *Section VI - Wood Utilization* and for a listing of potential funding options for EAB management efforts refer to *Section IX: Funding*.

When determining the effects that EAB will have on your budget, consider the cost for removal/disposal, replacement, and treatment of ash trees. Determining tree removal/disposal costs can be accomplished by using your community's tree inventory and through tree removal estimates and bids. The inventory should have an actual or estimated total number of ash trees along with their size, and health/condition. (For more information on inventories please refer to subsections within this section, *Section IV - Assessments*, and *Section V – Preparation, Detection, and Control*). Combining this information with an estimated removal costs allows your community to estimate the total removal cost for ash trees on public property. Estimated costs can come from previous or current estimates/bids your community has obtained. If this is not available WDNR put together a document to help communities to determine tree removal and replacement costs, refer to Appendix E.

Example: Total number of ash trees in Town A: 500
Average diameter of ash trees in Town A: 12"
Estimated removal costs for a 12" tree in Town A: $340
Town A's estimated total ash removal costs: $170,000

Another method for calculating costs is to us the ***EAB Cost Calculator*** created by Purdue University. With the *EAB Cost Calculator* anyone can:

- Compare the annual and cumulative costs over a 25 year period for any management strategy that includes a mixture of tree removal, replacement, and insecticide treatment.
- Compare size of the forest remaining over a 25 year period for any management strategy that includes a mixture of tree removal, replacement, and insecticide treatment.
- Generate printed reports of projected costs of up to 3 management strategies at a time.

To run the calculator the following information will be needed:

- An inventory of the number and size of your community's ash trees.
- An estimate of costs for removing and treating trees based on the size of each tree.
- An estimate of costs for replacing each ash tree that is removed.

The *EAB Cost calculator* can be found at
http://extension.entm.purdue.edu/treecomputer/index.php

[6] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture 11/19/2008.

Local disposal costs will also need to be estimated as part of the total removal costs. Keep in mind that disposal costs may be lowered by partnering with neighboring communities or industries that can utilize the trees.

Replacement costs can be determined by estimating the number of trees to be removed due to EAB and the cost of the replacement tree. To get replacement costs, contact local nurseries to get price estimates on the size and species of tree your community would like to use in replanting. Remember to go back with a diversity of species. Also, the cost of planting the trees may need to be considered in some instances, especially if using contracted labor.

Trees on Private Property[7]

The majority of a community's trees are typically located on private property. In the case of ash trees a general rule of thumb is 10 private ash trees for every 1 ash street tree. In most situations, the responsibility of tree removal on private property will belong to the property owner. However, where a hazardous condition exists with a private tree that impacts a public right-to-way (ROW), communities should address the problem. This may be accomplished through discussions with the property owner or through corrective actions taken by the community to resolve the issue. Authorities related to private tree removals are often contained in municipal ordinance and codes. For more information on ordinances refer to the section below. In addition, to assist private property owners with ash tree removals, your community may wish to offer curbside pickup, chipping, and disposal of infested trees.

Ordinances

As your community prepares its EAB Response Plan, it would be a good time to review, update, and/or create community tree ordinances and policies. Local ordinances and policies can help prevent or control damage from emerald ash borer. Ordinances and policies should be based on local circumstances, management needs, goals and capacity. Keep in mind that ordinance provisions and policies that work well in one municipality might be poorly suited for another. The typical tree ordinance outlines the authorities and persons responsible for tree planting, care, and removal of trees on public property and in some cases on private property. Some basic components of a tree ordinance include:

- Goals
- Tree Board Establishment
- Authorities/Responsibilities
- Basic Performance Standards
- Enforcement/Penalties

Through a code/ordinance a community may exercise authority to enable the declaration and abatement of public nuisance trees. For example, a code/ordinance could require infested trees on private property to be removed to prevent further spread of the insect or disease. Removal costs are subsequently billed to the property owner directly or add to their property taxes.

[7] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

Although ordinances should be broad enough to cover local circumstances, management needs, and goals, there are some specifics that should be considered specifically for EAB. They are:

- Establishment of authority for the municipality and forester (or other assigned person) for EAB control and management.
- Adopt ordinance language allowing EAB to be declared a public nuisance and authorizing control on both public and private property
- Adopt ordinance provisions or establish formal policies about firewood movement or storage.

For a listing of communities in Sheboygan County who have a tree ordinance in place please refer to *Section IV – Assessments, Support Resources*. In addition, the *Emerald Ash Borer Toolkit for Wisconsin Communities* by WDNR gives sample language of ordinances that can be used as a template.

Wood Utilization[8]

EAB has the potential to generate a significant amount of wood debris in any one community. Most likely this will be a gradual increase initially, but later increasing rapidly as EAB populations increase. It will also depend on the number of ash trees in your community, how many were treated before hand with insecticides, and the management approach taken for tree removals (i.e. preemptive vs. reactive removals).

The big question every community will face is: What do you do with the wood debris? When facing this question items that will need to be considered are:

- How can the wood debris be utilized and/or disposed of?
- Are there local businesses that can use the wood debris?
- Where will the wood debris be stored (marshalling yards)?

For more information on wood utilization, local users, and marshalling yards refer to *Section VI – Wood Utilization*.

Authority and Contacts

A successful EAB plan will always designate who is responsible for directing the response. When there is a confirmation of EAB in your community APHIS, DATCP and WDNR will assist in the initial response (refer to *Section VII - EAB Confirmation, Authority and Responsibility*). However, along with their help your community will need a person(s) to coordinate all EAB related activities. The person(s) will have many responsibilities and duties. This can include:

- Coordination with state and local officials
- Updating city administration and advisory board members
- Coordinating public and media education and outreach
- Prioritizing and budgeting tree treatments, removals, and replanting
- Designating crew leadership and crew work duties
- Enforcement of ordinances

[8] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

- Investigating and setting up wood utilization operations
- Purchasing equipment as needed
- Investigate contracting and mutual aid agreements

Keep in mind that one person can fill all the roles or the responsibilities can be split among several people. In addition, activities and tasks may want to be designated pre-EAB and after EAB confirmation.

Community Outreach and Education

Due to the importance of public awareness in slowing the spread of EAB, an outreach and education component should be fundamental to every EAB plan. *Section VIII - Communication and Education* of this plan provides a general overview of different public outreach efforts that communities can conduct. When determining what method is best for your community consider who your target audience is and what key messages do you want to get across.

IV. Assessments

Forest Resources

2009 Sheboygan County Municipality Tree Inventory

In the spring of 2009, the Sheboygan County EAB work group determined that, a county-wide publicly owned land tree inventory should be conducted in order to develop an EAB Response Management Guide. The tree inventory was conducted in the summer of 2009 by three limited term employees. The inventory included public street trees and park trees in high use areas. The inventory did not include public passive park and recreation spaces such as natural and wood areas. In addition, the inventory may have inadvertently left out trees where the right-of-way is not clearly defined.

The inventory mapped and digitized all tree locations, along with their associated information. The information collected on each tree can be found in Table 1. Funding to conduct the inventory was financed by a grant from the Sheboygan County Stewardship Fund. Municipal lands inventoried included the cities of Plymouth (park trees only), Sheboygan, and Sheboygan Falls; the villages of Adell, Cascade, Cedar Grove, Elkhart Lake, Glenbeulah, Howards Grove, Kohler, Oostburg, Random Lake, and Waldo; towns of Lima (unincorporated areas of Gibbsville and Hingham), Scott (unincorporated areas of Batavia and Beechwood), Sheboygan (park areas), and Sherman (unincorporated area of Silver Creek); and county owned properties.

County owned properties inventoried included boat landings at Crystal Lake, Elkhart Lake, Gerber Lake, Jetzers Lake, and Little Elkhart Lake; the Old Plank Road Trail trailheads at Erie Ave, Meadowlark Rd, Village of Plymouth, and Town of Greenbush; the wayside on County Road LS; UW Sheboygan Campus; Esslingen Park; and Sheboygan County Marsh Park.

Table 1: Tree inventory data collected

Tree Type	DBH*	Condition	Site Characteristics
Ash	0 - 6"	Good	Overhead Utilities
Honey Locust	6" - 12"	Fair	
Linden	> 12"	Poor	
Maple		Dead	
Oak			
Ornamental Tree			
Other			

*Diameter at Breast Height (4 ½ feet)

Inventory results

The following pages summarize the 2009 tree inventory data along with the 2003 City of Plymouth data[9]. It should be noted, since passive recreation areas were not inventoried, communities with these areas may have in reality a substantially higher tree total than what is noted in the tables.

Tables 2 through 6 show a side by side comparison of all the municipalities inventoried according to the specific tree inventory data collection variable. There is a table for tree type, DBH, condition, ash trees by DBH, and ash trees by condition. As shown by the data, all trees except for in the City of Sheboygan and the Village of Kohler had a condition rating of good. Tables 7 through 65 show data for each individual municipality by tree type, DBH and ash trees by DBH (Tables for the City of Sheboygan also show condition ratings.)

Maps showing the location of all trees by tree type for each municipality can be found at the end of this section. If additional information concerning the data or maps is needed please contact Sheboygan County Land and Water Conservation or Planning Departments.

[9] For the City of Plymouth, the 2009 inventory was conducted only on park trees due to an existing inventory of street trees. Combining the two inventories allows for a complete analysis of their public trees.

Table 2: Tree type and percentage by municipality

Municipality	Tree Species														Total per Municipality
	Ash	%	Honeylocust	%	Linden	%	Maple	%	Oak	%	Ornamental	%	Other	%	
City of Plymouth (Park Trees, 2009)	190	22.9	22	2.7	27	3.3	254	30.6	17	2.1	33	4.0	286	34.5	829
City of Plymouth (Street Trees, 2003)	371	20.8	40	2.2	193	10.8	664	37.2	14	0.8	---	---	505	28.3	1,787
City of Sheboygan	5,154	22.6	605	2.7	4,550	20.0	8,254	36.3	620	2.7	1,435	6.3	2,141	9.4	22,759
City of Sheboygan Falls	179	23.6	27	3.6	23	3.0	304	40.1	5	0.7	42	5.5	178	23.5	758
Village of Adell	17	20.0	---	---	5	5.9	52	61.2	---	---	---	---	11	12.9	85
Village of Cascade	27	40.3	---	---	3	4.5	10	14.9	1	1.5	3	4.5	23	34.3	67
Village of Cedar Grove	14	7.6	1	0.5	6	3.2	115	62.2	---	---	3	1.6	46	24.9	185
Village of Elkhart Lake	34	14.4	1	0.4	24	10.2	68	28.8	1	0.4	19	8.1	89	37.7	236
Village of Glenbeulah	11	5.5	2	1.0	1	0.5	57	28.6	4	2.0	---	---	124	62.3	199
Village of Howards Grove	112	40.3	22	7.9	11	4.0	41	14.7	3	1.1	2	0.7	87	31.3	278
Village of Kohler	282	17.3	99	6.1	262	16.1	246	15.1	101	6.2	155	9.5	487	29.8	1632
Village of Oostburg	16	8.8	4	2.2	3	1.7	60	33.1		0.0	82	45.3	16	8.8	181
Village of Random Lake	57	35.8	1	0.6	11	6.9	40	25.2	1	0.6	7	4.4	42	26.4	159
Village of Waldo	15	25.4	---	---	---	---	2	3.4	---	---	1	1.7	41	69.5	59
Town of Lima	7	17.5	---	---	1	2.5	18	45.0	---	---	1	2.5	13	32.5	40
Town of Scott	8	13.6	1	1.7	5	8.5	39	66.1	---	---	---	---	6	10.2	59
Town of Sheboygan	23	76.7	---	---	---	---	2	6.7	---	---	1	3.3	4	13.3	30
Town of Sherman	5	33.3	---	---	---	---	7	46.7	---	---	3	20.0	---	---	15
Sheboygan County	408	45.5	13	1.4	20	2.2	171	19.1	29	3.2	24	2.7	232	25.9	897
State of Wisconsin	1	6.7	---	---	---	---	---	---	---	---	1	6.7	13	86.7	15
Total per Species Group	6,931	22.9	838	2.8	5,145	17.0	10,404	34.4	796	2.6	1,812	6.0	4,344	14.4	30,270

Table 3: DBH class and percentage by municipality

Municipality	Diameter at Breast Height (DBH)						Total per Municipality
	0-6"	%	6-12"	%	> 12"	%	
City of Plymouth (Park Trees, 2009)	140	16.9	244	29.4	445	53.7	829
City of Plymouth (Street Trees, 2003)	929	52.0	210	11.8	648	36.3	1,787
City of Sheboygan	3,930	17.3	6,447	28.3	12,382	54.4	22,759
City of Sheboygan Falls	120	15.8	161	21.2	477	62.9	758
Village of Adell	8	9.4	13	15.3	64	75.3	85
Village of Cascade	7	10.4	24	35.8	36	53.7	67
Village of Cedar Grove	66	35.7	56	30.3	63	34.1	185
Village of Elkhart Lake	131	55.5	56	23.7	49	20.8	236
Village of Glenbeulah	8	4.0	76	38.2	115	57.8	199
Village of Howards Grove	28	10.1	150	54.0	100	36.0	278
Village of Kohler	289	17.7	446	27.3	897	55.0	1,632
Village of Oostburg	91	50.3	22	12.2	68	37.6	181
Village of Random Lake	46	28.9	43	27.0	70	44.0	159
Village of Waldo	3	5.1	19	32.2	37	62.7	59
Town of Lima	3	7.5	29	72.5	8	20.0	40
Town of Scott	2	3.4	2	3.4	55	93.2	59
Town of Sheboygan	12	40.0	11	36.7	7	23.3	30
Town of Sherman	1	6.7	5	33.3	9	60.0	15
Sheboygan County	169	18.8	302	33.7	724	80.7	897
State of Wisconsin	3	20.0	6	40.0	6	40.0	15
Total per Diameter Group	5,986	19.8	8,322	27.5	16,260	53.7	30,270

Table 4: Condition class by municipality

Municipality	Condition								Total per Municipality
	Good	%	Fair	%	Poor	%	Dead	%	
City of Plymouth (Park Trees, 2009)	829	100.0							829
City of Plymouth (Street Trees, 2003)	No Data		No Data		No Data		No Data		1,787
City of Sheboygan	20,140	88.5	2,127	9.3	436	1.9	56	0.2	22,759
City of Sheboygan Falls	758	100.0							758
Village of Adell	85	100.0							85
Village of Cascade	67	100.0							67
Village of Cedar Grove	185	100.0							185
Village of Elkhart Lake	236	100.0							236
Village of Glenbeulah	199	100.0							199
Village of Howards Grove	278	100.0							278
Village of Kohler	1,577	96.6	48	2.9	7	0.4			1,632
Village of Oostburg	181	100.0							181
Village of Random Lake	159	100.0							159
Village of Waldo	59	100.0							59
Town of Lima	40	100.0							40
Town of Scott	59	100.0							59
Town of Sheboygan	30	100.0							30
Town of Sherman	15	100.0							15
Sheboygan County	897	100.0							897
State of Wisconsin	14	93.3	1	6.7					15
Total per Condition Group	25,808	85.3	2,176	7.2	443	1.5	56	0.2	30,270

Table 5: Number of ash trees by diameter class and municipality

Municipality	Ash Diameter at Breast Height (DBH)						Total per Municipality
	0-6"	%	6-12"	%	> 12"	%	
City of Plymouth (Park Trees, 2009)	25	13.2	90	47.4	75	39.5	190
City of Plymouth (Street Trees, 2003)	190	51.2	61	16.4	120	32.3	371
City of Sheboygan	804	15.6	1,488	28.9	2,862	55.5	5,154
City of Sheboygan Falls	13	7.3	27	15.1	139	77.7	179
Village of Adell	---	---	8	47.1	9	52.9	17
Village of Cascade	6	22.2	7	25.9	14	51.9	27
Village of Cedar Grove	1	7.1	7	50.0	6	42.9	14
Village of Elkhart Lake	11	32.4	15	44.1	8	23.5	34
Village of Glenbeulah	---	---	10	90.9	1	9.1	11
Village of Howards Grove	6	5.4	62	55.4	44	39.3	112
Village of Kohler	5	1.8	62	22.0	215	76.2	282
Village of Oostburg	3	18.8	2	12.5	11	68.8	16
Village of Random Lake	24	42.1	19	33.3	14	24.6	57
Village of Waldo	2	13.3	9	60.0	4	26.7	15
Town of Lima	---	---	6	85.7	1	14.3	7
Town of Scott	1	12.5	---	---	7	87.5	8
Town of Sheboygan	9	39.1	9	39.1	5	21.7	23
Town of Sherman	---	---	2	40.0	3	60.0	5
Sheboygan County	95	23.3	153	37.5	160	39.2	408
State of Wisconsin	1	100.0	---	---	---	---	1
Total per Diameter Group	1,196	17.3	2,037	29.4	3,698	53.4	6,931

Table 6: Number of ash trees by condition class and municipality

Municipality	Ash Condition								Total per Municipality
	Good	%	Fair	%	Poor	%	Dead	%	
City of Plymouth (Park Trees, 2009)	190	100.0							190
City of Plymouth (Street Trees, 2003)	No Data		No Data		No Data		No Data		371
City of Sheboygan	4,632	89.9	425	8.2	94	1.8	3	0.1	5,154
City of Sheboygan Falls	179	100.0							179
Village of Adell	17	100.0							17
Village of Cascade	27	100.0							27
Village of Cedar Grove	14	100.0							14
Village of Elkhart Lake	34	100.0							34
Village of Glenbeulah	11	100.0							11
Village of Howards Grove	112	100.0							112
Village of Kohler	266	94.3	14	5.0	2	0.7			282
Village of Oostburg	16	100.0							16
Village of Random Lake	57	100.0							57
Village of Waldo	15	100.0							15
Town of Lima	7	100.0							7
Town of Scott	8	100.0							8
Town of Sheboygan	23	100.0							23
Town of Sherman	5	100.0							5
Sheboygan County	408	100.0							408
State of Wisconsin	1	100.0							1
Total per Condition Group	6,022	86.9	439	6.3	96	1.4	3	0.04	6,931

Table 7, 8, and 9: City of Plymouth tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 7

Tree Type	Number	%
Ash	561	21.4
Honeylocust	62	2.4
Linden	220	8.4
Maple	918	35.1
Oak	31	1.2
Ornamental	33	1.3
Other	791	30.2
Tree Total	2,616	100

Table 8

Diameter (DBH)	Number	%
0-6"	1,069	40.9
6-12"	454	17.4
> 12"	1,093	41.8
Tree Total	2,616	100

Table 9

Ash Diameter (DBH)	Number	%
0 - 6"	215	38.3
6-12"	151	26.9
> 12"	195	34.8
Ash Total	561	100

Table 10, 11, and 12: City of Sheboygan tree inventory data summary by tree type, DBH, and condition

Table 10

Tree Type	Number	%
Ash	5,154	22.6
Honeylocust	605	2.7
Linden	4,550	20.0
Maple	8,254	36.3
Oak	620	2.7
Ornamental	1,435	6.3
Other	2,141	9.4
Tree Total	22,759	100

Table 11

Diameter (DBH)	Number	%
0-6"	3,930	17.3
6-12"	6,447	28.3
> 12"	12,382	54.4
Tree Total	22,759	100

Table 12

Condition	Number	%
Good	20,140	88.5
Fair	2,127	9.3
Poor	436	1.9
Dead	56	0.2
Tree Total	22,759	100

Table 13 and 14: City of Sheboygan ash tree only inventory data summary by DBH and condition

Table 13

Ash Diameter (DBH)	Number	%
0 - 6"	804	15.6
6-12"	1488	28.9
> 12"	2862	55.5
Ash Total	5154	100

Table 14

Ash Condition	Number	%
Good	4,632	89.9
Fair	425	8.2
Poor	94	1.8
Dead	3	0.1
Ash Total	5,154	100

Table 15, 16, and 17: City of Sheboygan Falls tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 15

Tree Type	Number	%
Ash	179	23.6
Honeylocust	27	3.6
Linden	23	3.0
Maple	304	40.1
Oak	5	0.7
Ornamental	42	5.5
Other	178	23.5
Tree Total	758	100

Table 16

Diameter (DBH)	Number	%
0-6"	120	15.8
6-12"	161	21.2
> 12"	477	62.9
Tree Total	758	100

Table 17

Ash Diameter (DBH)	Number	%
0 - 6"	13	7.3
6-12"	27	15.1
> 12"	139	77.7
Ash Total	179	100

Table 18, 19, and 20: Village of Adell tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 18

Tree Type	Number	%
Ash	17	20.0
Honeylocust	---	---
Linden	5	5.9
Maple	52	61.2
Oak	---	---
Ornamental	---	---
Other	11	12.9
Tree Total	85	100

Table 19

Diameter (DBH)	Number	%
0-6"	8	9.4
6-12"	13	15.3
> 12"	64	75.3
Tree Total	85	100

Table 20

Ash Diameter (DBH)	Number	%
0 - 6"	---	---
6-12"	8	47.1
> 12"	9	52.9
Ash Total	17	100

Table 21, 22, and 23: Village of Cascade tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 21

Tree Type	Number	%
Ash	27	40.3
Honeylocust	---	---
Linden	3	4.5
Maple	10	14.9
Oak	1	1.5
Ornamental	3	4.5
Other	23	34.3
Tree Total	67	100

Table 22

Diameter (DBH)	Number	%
0-6"	24	35.8
6-12"	36	53.7
> 12"	7	10.4
Tree Total	67	100

Table 23

Ash Diameter (DBH)	Number	%
0 - 6"	6	---
6-12"	7	25.9
> 12"	14	51.9
Ash Total	27	100

Table 24, 25, and 26: Village of Cedar Grove tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 24

Tree Type	Number	%
Ash	14	7.6
Honeylocust	1	0.5
Linden	6	3.2
Maple	115	62.2
Oak	---	---
Ornamental	3	1.6
Other	46	24.9
Tree Total	185	100

Table 25

Diameter (DBH)	Number	%
0-6"	66	35.7
6-12"	56	30.3
> 12"	63	34.1
Tree Total	185	100

Table 26

Ash Diameter (DBH)	Number	%
0 - 6"	1	7.1
6-12"	7	50.0
> 12"	6	42.9
Ash Total	14	100

Table 27, 28, and 29: Village of Elkhart Lake tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 27

Tree Type	Number	%
Ash	34	14.4
Honeylocust	1	0.4
Linden	24	10.2
Maple	68	28.8
Oak	1	0.4
Ornamental	19	8.1
Other	89	37.7
Tree Total	236	100

Table 28

Diameter (DBH)	Number	%
0-6"	131	55.5
6-12"	56	23.7
> 12"	49	20.8
Tree Total	236	100

Table 29

Ash Diameter (DBH)	Number	%
0 - 6"	11	32.4
6-12"	15	44.1
> 12"	8	23.5
Ash Total	34	100

Table 30, 31, and 32: Village of Glenbeulah tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 30

Tree Type	Number	%
Ash	11	5.5
Honeylocust	2	1.0
Linden	1	0.5
Maple	57	28.6
Oak	4	2.0
Ornamental	---	---
Other	124	62.3
Tree Total	199	100

Table 31

Diameter (DBH)	Number	%
0-6"	8	4.0
6-12"	76	38.2
> 12"	115	57.8
Tree Total	199	100

Table 32

Ash Diameter (DBH)	Number	%
0 - 6"	---	---
6-12"	10	90.9
> 12"	1	9.1
Ash Total	11	100

Table 33, 34, and 35: Village of Howards Grove tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 33

Tree Type	Number	%
Ash	112	40.3
Honeylocust	22	7.9
Linden	11	4.0
Maple	41	14.7
Oak	3	1.1
Ornamental	2	0.7
Other	87	31.3
Tree Total	278	100

Table 34

Diameter (DBH)	Number	%
0-6"	28	10.1
6-12"	150	54.0
> 12"	100	36.0
Tree Total	278	100

Table 35

Ash Diameter (DBH)	Number	%
0 - 6"	6	5.4
6-12"	62	55.4
> 12"	44	39.3
Ash Total	112	100

Table 36, 37, and 38: Village of Kohler tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 36

Tree Type	Number	%
Ash	282	17.3
Honeylocust	99	6.1
Linden	262	16.1
Maple	246	15.1
Oak	101	6.2
Ornamental	155	9.5
Other	487	29.8
Tree Total	1,632	100

Table 37

Diameter (DBH)	Number	%
0-6"	289	17.7
6-12"	446	27.3
> 12"	897	55.0
Tree Total	1,632	100

Table 38

Ash Diameter (DBH)	Number	%
0 - 6"	5	1.8
6-12"	62	22.0
> 12"	215	76.2
Ash Total	282	100

Table 39, 40, and 41: Village of Oostburg tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 39

Tree Type	Number	%
Ash	16	8.8
Honeylocust	4	2.2
Linden	3	1.7
Maple	60	33.1
Oak	---	---
Ornamental	82	45.3
Other	16	8.8
Tree Total	181	100

Table 40

Diameter (DBH)	Number	%
0-6"	91	50.3
6-12"	22	12.2
> 12"	68	37.6
Tree Total	181	100

Table 41

Ash Diameter (DBH)	Number	%
0 - 6"	3	18.8
6-12"	2	12.5
> 12"	11	68.8
Ash Total	16	100

Table 42, 43, and 44: Village of Random Lake tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 42

Tree Type	Number	%
Ash	57	35.8
Honeylocust	1	0.6
Linden	11	6.9
Maple	40	25.2
Oak	1	0.6
Ornamental	7	4.4
Other	42	26.4
Tree Total	159	100

Table 43

Diameter (DBH)	Number	%
0-6"	46	28.9
6-12"	43	27.0
> 12"	70	44.0
Tree Total	159	100

Table 44

Ash Diameter (DBH)	Number	%
0 - 6"	24	42.1
6-12"	19	33.3
> 12"	14	24.6
Ash Total	57	100

Table 45, 46, and 47: Village of Waldo tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 45

Tree Type	Number	%
Ash	15	25.4
Honeylocust	---	---
Linden	---	---
Maple	2	3.4
Oak	---	---
Ornamental	1	1.7
Other	41	69.5
Tree Total	59	100

Table 46

Diameter (DBH)	Number	%
0-6"	3	5.1
6-12"	19	32.2
> 12"	37	62.7
Tree Total	59	100

Table 47

Ash Diameter (DBH)	Number	%
0 - 6"	2	13.3
6-12"	9	60.0
> 12"	4	26.7
Ash Total	15	100

Table 48, 49, and 50: Town of Lima tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 48

Tree Type	Number	%
Ash	7	17.5
Honeylocust	---	---
Linden	1	2.5
Maple	18	45.0
Oak	---	---
Ornamental	1	2.5
Other	13	32.5
Tree Total	40	100

Table 49

Diameter (DBH)	Number	%
0-6"	3	7.5
6-12"	29	72.5
> 12"	8	20.0
Tree Total	40	100

Table 50

Ash Diameter (DBH)	Number	%
0 - 6"	---	---
6-12"	6	85.7
> 12"	1	14.3
Ash Total	7	100

Table 51, 52, and 53: Town of Scott tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 51

Tree Type	Number	%
Ash	8	13.6
Honeylocust	1	1.7
Linden	5	8.5
Maple	39	66.1
Oak	---	---
Ornamental	---	---
Other	6	10.2
Tree Total	59	100

Table 52

Diameter (DBH)	Number	%
0-6"	2	3.4
6-12"	2	3.4
> 12"	55	93.2
Tree Total	59	100

Table 53

Ash Diameter (DBH)	Number	%
0 - 6"	1	12.5
6-12"	---	---
> 12"	7	87.5
Ash Total	8	100

Table 54, 55, and 56: Town of Sheboygan tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 54

Tree Type	Number	%
Ash	23	76.7
Honeylocust	---	---
Linden	---	---
Maple	2	6.7
Oak	---	---
Ornamental	1	3.3
Other	4	13.3
Tree Total	30	100

Table 55

Diameter (DBH)	Number	%
0-6"	12	40.0
6-12"	11	36.7
> 12"	7	23.3
Tree Total	30	100

Table 56

Ash Diameter (DBH)	Number	%
0 - 6"	9	39.1
6-12"	9	39.1
> 12"	5	21.7
Ash Total	23	100

Table 57, 58, and 59: Town of Sherman tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 57

Tree Type	Number	%
Ash	5	33.3
Honeylocust	---	---
Linden	---	---
Maple	7	46.7
Oak	---	---
Ornamental	3	20.0
Other	---	---
Tree Total	15	100

Table 58

Diameter (DBH)	Number	%
0-6"	1	6.7
6-12"	5	33.3
> 12"	9	60.0
Tree Total	15	100

Table 59

Ash Diameter (DBH)	Number	%
0 - 6"	---	---
6-12"	2	40.0
> 12"	3	60.0
Ash Total	5	100

Table 60, 61, and 62: Sheboygan County tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 60

Tree Type	Number	%
Ash	408	45.5
Honeylocust	13	1.4
Linden	20	2.2
Maple	171	19.1
Oak	29	3.2
Ornamental	24	2.7
Other	232	25.9
Tree Total	897	100

Table 61

Diameter (DBH)	Number	%
0-6"	169	18.8
6-12"	302	33.7
> 12"	724	80.7
Tree Total	897	100

Table 62

Ash Diameter (DBH)	Number	%
0 - 6"	95	23.3
6-12"	153	37.5
> 12"	160	39.2
Ash Total	408	100

Table 63, 64, and 65: State of Wisconsin tree inventory data summary by tree type, DBH, and ash trees by DBH

Table 63

Tree Type	Number	%
Ash	1	6.7
Honeylocust	---	---
Linden	---	---
Maple	---	---
Oak	---	---
Ornamental	1	6.7
Other	13	86.7
Tree Total	15	100

Table 64

Diameter (DBH)	Number	%
0-6"	3	20.0
6-12"	6	40.0
> 12"	6	40.0
Tree Total	15	100

Table 65

Ash Diameter (DBH)	Number	%
0 - 6"	1	100.0
6-12"	---	---
> 12"	---	---
Ash Total	1	100

USDA Forest Service, Forest Inventory and Analysis (FIA) Data for Sheboygan County

Forest Inventory and Analysis (FIA) collects, analyzes, reports, and distributes data about the Nation's forests: how much forest exists, who owns it, what condition it's in, where it's located, and how it's changed. FIA is managed by the Research and Development organization within the USDA Forest Service in cooperation with State and Private Forestry and National Forest Systems. FIA has been in operation under various names (Forest Survey, Forest Inventory and Analysis) for some 70 years. It covers forests on all forest lands within the US. For more information on this program refer to http://fia.fs.fed.us/.

The data for Sheboygan County came from FIA's Forest Inventory Data On-line (FIDO). The data is derived from permanent sample plots and was generated by a Forest Resource Analyst with WDNR. Table 66 shows the number of ash trees by diameter class in 2007 for Sheboygan County.

Table 66: Ash trees within Sheboygan County by diameter class for 2007

Tree Diameter Classifications	Tree Species			Total
	White ash (541)	Black ash (543)	Green ash (544)	
1.0-2.9 in (1)	1,620,284	**2,007,667**	**387,383**	4,015,334
3.0-4.9 in (2)	**352,257**	1,268,027	**1,091,898**	2,712,182
5.0-6.9 in (3)	**311,562**	**537,210**	1,091,838	1,940,610
7.0-8.9 in (4)	269,144	**135,712**	694,920	1,099,777
9-10.9 in (5)	**48,057**	**33,918**	398,638	480,613
11-12.9 in (6)	**16,959**	**81,975**	**104,614**	**203,548**
13-14.9 in (7)	--	--	113,074	113,074
15-16.9 in (8)	--	--	**31,098**	**31,098**
17-18.9 in (9)	--	--	**14,139**	**14,139**
19-20.9 in (10)	**31,098**	--	**0**	**31,098**
21-28.9 in (11)	--	--	**33,918**	**33,918**
29+ in (12)	--	--	--	--
Totals:	**2,649,362**	**4,064,509**	**3,961,519**	**10,675,391**

* All estimates have a percent sampling error (pse) greater than 25% and less than or equal to 50%, unless estimate is bold than pse is greater than 50%

Other Inventories

In the past, other communities within Sheboygan County have conducted their own tree inventories. They are listed below in Table 67. For more information on these inventories please contact the respected community.

Table 67: Tree inventories by community

Municipality	Year Conducted	Areas Inventoried
City of Plymouth	2003	Street trees
Village of Elkhart Lake	2000	Parks, Parkway trees
	2005	Picture survey
Village of Kohler	2005	Street trees

Associated Costs and Benefits

Trees are important to Sheboygan County. They help conserve and reduce energy use, reduce local carbon dioxide levels, improve air quality, and mitigate stormwater runoff. Additionally, trees provide a wealth of psychological, social, and economic benefits related primarily to their beauty and calming effect. Environmentally, trees make good sense, working ceaselessly to provide benefits back to the community.

To help quantify these benefits and to place a dollar value on the annual environmental benefits, i-Tree software can be used. i-Tree provides urban forestry analysis and benefits assessment tools. It was developed by the USDA Forest Service and numerous cooperators, i-Tree is in the public domain and freely accessible. The Forest Service, Davey Tree Expert Company, National Arbor Day Foundation, Society of Municipal Arborists, International Society of Arboriculture, and Casey Trees have entered into a cooperative partnership to further develop, disseminate and provide technical support for the suite.

For Sheboygan County, Davey Tree Expert Company conducted a quick analysis using i-Tree and the 2009 Sheboygan County tree inventory data. The estimates from i-Tree provide first-order approximations of tree value. i-Tree only generally accounts for the benefits produced by the trees, an accounting that is based on the best available science, with an accepted degree of uncertainty that can nonetheless provide a platform from which real management decisions can be made.

Following are the calculated **annual benefits for only the ash trees** (approximately 6,500) inventoried in Sheboygan County public areas.

Ash trees save Sheboygan County communities $310,265 each year in energy costs with an average annual savings of $47 per tree.

The trees are able to do this in three principal ways:[10]

- Shading reduces the amount of heat absorbed and stored by built surfaces.
- Evapotranspiration (ET) converts liquid water to water vapor and cools the air by using solar energy that would otherwise result in heating of the air.
- Windspeed reduction reduces the infiltration of outside air into interior spaces and reduces conductive heat loss, especially where conductivity is relatively high (e.g., windows).

[10] Midwest Community Tree Guide: Benefits, Costs and Strategic Planting, E. Gregory McPherson et. al., United States Department of Agriculture, Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-199

Ash trees sequester a net total of 3,236 tons of CO2 each year for an annual value of $48,551 or $7.47 per tree.

The trees can reduce atmospheric CO2 in two ways:[11]

- Trees directly sequester CO2 in their stems and leaves while they grow.
- Trees near buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with power production.

Ash trees provide $56,426 annually or $8.68 per tree in air quality benefits.

The trees provide four main air quality benefits:[12]

- They absorb gaseous pollutants (e.g., ozone, nitrogen oxides, and sulfur dioxide) through leaf surfaces.
- They intercept particulate matter (e.g., dust, ash, pollen, smoke).
- They release oxygen through photosynthesis.
- They transpire water and shade surfaces, which lowers air temperatures, thereby reducing ozone levels.

Ash trees intercept 16,338,919 gallons of rainfall for an annual savings of $442,815 ($68.10 per tree).

The trees can reduce runoff in several ways:[13]

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows.
- Roots increase the rate at which rainfall infiltrates soil and the capacity of soil to store water, thereby reducing overland flow.
- Tree canopies reduce soil erosion by diminishing the impact of raindrops on barren surfaces.
- Transpiration through tree leaves reduces soil moisture, increasing the soil's capacity to store rainfall.

The total annual aesthetic value of ash trees in Sheboygan County is $474,537 or $72.98 per tree.

It is difficult to place a dollar value on the benefit trees provide to the overall well-being of County residents. Trees provide beauty in the urban landscape, privacy to homeowners, improved human health, a sense of comfort and place, and refuge for urban wildlife. Trees promote better business by stimulating frequent shopping, longer shopping trips, and a willingness to pay more for goods and parking by the residents in the urban environment. The value of some of these benefits may be captured in the property values of the land on which trees stand.[14]

Annual benefits total $1.33 million and average $205 per tree.

[11], [12], [13] Midwest Community Tree Guide: Benefits, Costs and Strategic Planting, E. Gregory McPherson et. al., United States Department of Agriculture, Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-199

[14] City of Pittsburgh, Pennsylvania Municipal Forest Resource Analysis, April 2008.

Support Resources

Staffing, Training, and Budgets

When considering the control and management of EAB, communities will need to assess if they have adequate numbers of staff and they will need to ensure they are properly trained to conduct the work needed. Information shared by communities through a survey show that 14 of the 28 communities have a Public Works Department, Town Board, or other employee responsible for overseeing the care of public trees. The level of responsibility differs by community, from communities removing only dead and hazardous trees along roadways, to conducting general maintenance of trees, to planting of new trees, to a combination of all. There are three additional communities who have no responsible party for tree care, but contract with the County Highway Department to remove dead and hazardous trees along the roadways. Four communities have no responsible party for tree care. And there was no data for 7 communities.

Out of the 28 communities, eight have a specific budget in place for the care of public trees. And one has a budget for implementing EAB activities.

Out the communities that conduct some level of tree care, only one has certified arborist(s) on staff. Four other communities conduct minimal training, consisting of safety and basic tree care and maintenance. All others provide no level of training. In addition, when conducting tree care only one community follows the American National Standards Institute (ANSI) standards for tree care. Communities have expressed a desire for training pertaining to tree identification, maintenance, and felling; proper pruning techniques; identification of tree related issues; and continuing education for arborist certification.

Equipment

In addition to communities needing proper staff, they will also need the proper equipment to conduct work in-house. This can include equipment for preventative treatment of trees, tree removals, tree maintenance, and wood utilization. In many instances the lack of equipment and resources will result in municipalities using contract labor or limit the productive use of wood waste. Below in Table 68 is a listing of equipment by municipality that could potentially be used for tree care, removal, maintenance and/or utilization. The table does not list all equipment within the municipality and lists were not available for all municipalities in the county. For a complete list of equipment for each municipality please contact the individual municipality.

Table 68: Equipment listing by municipality

Sheboygan County					
15	Pickup trucks	2	Water tankers	43	Haul trucks - 10 yards+
8	Front-end loaders	5	Tractors w/loaders	10	Trailers
42	Chainsaws	2	Tractor backhoes	1	Stump cutter
2	Brush chippers PTO tractor mounted	3	Brush chippers engine driven	12	Various size trucks, platform, and dump
15	5-yard trucks	2	Track loaders	1	Bucket truck
3	Skid steer loaders				
City of Plymouth					
1	Brush chipper	2	Leaf loaders	1	Tractor loader
2	Rubber wheel front end loaders	6	Various size pickup trucks	6	5-yard pickup trucks/plows
2	Chainsaws				
City of Sheboygan					
43	Various size pickup trucks	28	Various size dump trucks	6	1 and 2-ton utility trucks
1	Versa lift	4	Bucket trucks	1	Tree spade
3	Dump trailers	11	Various tractors	4	Mules
4	Front end loaders	5	Bobcats	8	Chainsaws
4	Chippers	3	Stumpgrinders	2	Power pruners
1	Log splitter	2	Backhoes		
City of Sheboygan Falls					
3	Pickup trucks	5	Dump trucks	2	Backhoes
2	Rubber wheel loaders	1	Skid steer loader	4	Chainsaws
1	1-Ton dump truck	1	Leaf loader		
Village of Howards Grove					
1	20" chipper	3	5-yard dump trucks	2	Pickup trucks
1	Extendable pruning saw	2	Chainsaws	1	Bucket trucks
1	Loader backhoe	1	Utility tractor and trailer	1	Tractor w/side flail mower

Ordinances

Out of the 28 municipalities in Sheboygan County, six have a tree ordinance. Those that have an ordinance are the Cities of Plymouth and Sheboygan; and the Villages of Elkhart Lake, Howards Grove, Kohler, and Random Lake. No towns in the county have a tree ordinance.

All of the ordinances take into account specifics that should be considered for the control and management of EAB, except for having provisions about firewood movement or storage. They all establish authority for a city forester or other representative to perform the duties and exercise the powers imposed by the ordinance. However, only a few specifically establish municipal authority. All of them also establish authority for the control of planting, removal, maintenance, and protection of trees on public property and to guard against the spread of disease, insects and pests on all trees and shrubs on public and private areas. They all have authority to abate public nuisances and a few of the ordinances specifically name Dutch elm disease as a public nuisance. Although EAB will fall under the public nuisance definition in all the ordinances, none of the ordinances name EAB as such.

There are a few other noteworthy items about the ordinances. Some of the ordinances still list ash trees as a recommended species for planting. The City of Sheboygan has a licensing ordinance where “no person for compensation shall plant, prune, trim, spray or remove any tree or shrub in the city without first obtaining a license from the city.” The Village of Elkhart Lake also has a similar licensing ordinance for any person working on

street or park trees. Both ordinances require proof of insurance and payment of fee to obtain a license. And the Village of Kohler and Random Lake specifically places duties upon private land owners abutting on public streets or public places to "remove and refrain from planting any tree, plant or shrub designated by the Department of Agriculture of the State of Wisconsin and published in its regulations to be a host or carrier of a dangerous plant disease or insect pest."

For more information on ordinances refer to the *Section III - EAB Community Response Plan Elements.*

Current Debris/Wood Handling and Disposal Methods

According to information shared by communities through a survey, communities in Sheboygan County currently manage their wood waste in the following manners:

Table 69: Current debris/wood disposal methods in Sheboygan County

Method	Number
Cities and Villages	
Chipping	4
Mix of Chipping and Firewood	2
Firewood	1
Burning	1
Contract hauling	2
Towns:	
Chipping	2
Burning	2
Taken to transfer station	1
Individuals responsible of own	6
No response or data	10

From the survey responses it was found that the most urbanized municipalities of the county have systems in place to either chip waste or cut it into firewood, with a couple of municipalities hiring a contractor to haul their waste. The more rural municipalities with systems in place currently use a combination of chipping, firewood, and burning. Most of the rural municipalities having no system in place to deal with waste and their residents are left to handle their own waste.

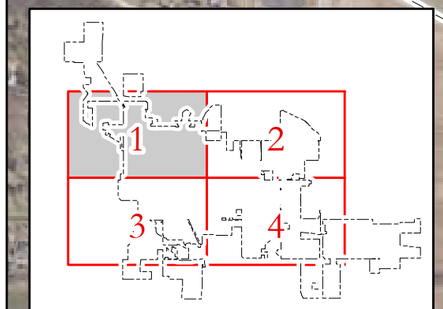
When municipalities were asked how they were going to handle wood waste generated by EAB, most had no plan in place or expressed that they were going to use the same methods of wood utilization already in place. Only one community expressed a need to explore new options for disposal and wood generation. If the wood waste became too much for a municipality to handle on their own, most expressed that they would be open to partnering with other communities, while four communities preferred to deal with the wood waste on their own. If an additional location to a municipalities current wood disposal site was needed for handling wood waste (marshalling yard) most municipalities (15) either didn't have a location that could be used or was unsure. Seven municipalities had tentative locations for a marshalling yard.

Emerald Ash Borer Activities

Information shared by communities through a survey show that the Village of Kohler is the only community with an EAB plan in place and a budget for implementation. However, there are a couple of other municipalities within the county who are presently taking preemptive measures to manage the effects of EAB on their communities. For specifics on management efforts taking place refer to Table 70.

Table 70: EAB Management efforts within Sheboygan County

Municipality	Management Efforts
City of Plymouth	Replacing $2,500 worth of ash trees with other species per year. (Equals appoximately 25 trees). Prepared City Council presentation on EAB.
Village of Elkhart Lake	Placed EAB information from WDNR in library for residents.
Village of Howards Grove	Dead, diseased, and hazardous trees are removed immediately. Trees are replaced as available from the Village tree lot. EAB will be a subject at the Village yearly informational meeting.
Village of Kohler	Conducting chemical injections of large trees and surface treatments of small trees. Plan to remove dead ash trees and replace with other species. Publishing EAB related material in Kohler newspaper.



2009 Inventory
829 Trees inventoried -
190 Ash trees located
2003 Inventory
1787 Trees Inventoried -
371 Ash Trees
Tree Symbols with Black
Trunks are from the
2003 Inventory

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

RAMP
COUNTY ROAD C
STATE HIGHWAY 23
SUPERIOR AVE
STATE HIGHWAY 67
RIVER HEIGHTS DR
AIRPARK RD
WILSON ST
HARVEY DR
KRUMREY ST
RUSTIC RD
SUNSET DR
STATE HIGHWAY 67 NORTH
RUSTIC ST
COUNTY ROAD O
SUHRKE RD
BRIAN ST
WOODLAND ST
CHAPLIN CT
KARASAN CT
City Park
MEADOW LN
RIVERVIEW DR
FAIRVIEW DR
DAVENPORT RD
GROVE ST
RIVERSIDE CIR
LOEBE DR
PARKVIEW DR
LAACK ST
VICTOR CT
EDNA ST
EEDNA ST
TORKE TERR
SCHWARTZ ST
FOREST AVE
MARSHNER ST
N MILWAUKEE ST
Nutt Ski Hill
WESTERN AVE
FACTORY ST
MIDDLE ST
SMITH ST
NORTH ST
BRAUN ST
FREMONT ST
PARK ST
PLYMOUTH ST
ELIZABETH ST
STAFFORD ST
ALFRED ST
HOME AVE
FRANKLIN ST
Roosevelt-Nutt Park
DIVISION ST
W MAIN ST
E MAIN ST
KIM CT
N PARK PL
FONDULAC AVE
PLEASANT ST
SPRING ST
CAROLINE ST
W MILL ST
E MILL ST
MILL ST
Utility

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Plymouth Tree Inventory 1- Final

Map 1 - 2009 EAB Park & 2003 Street Tree Inventory - City of Plymouth - Sheet 1

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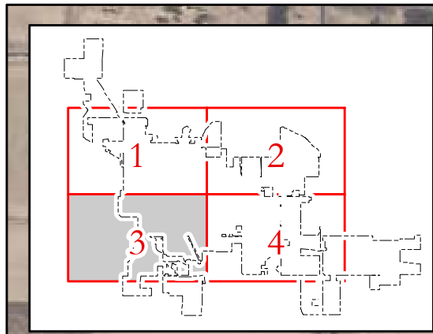
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Plymouth Tree Inventory 2- Final

Map 2 - 2009 EAB Park & 2003 Street Tree Inventory - City of Plymouth - Sheet 2



2009 Inventory
829 Trees inventoried -
190 Ash trees located
2003 Inventory
1787 Trees Inventoried -
371 Ash Trees
Tree Symbols with Black
Trunks are from the
2003 Inventory

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

COUNTY ROAD Z
SUMMIT ST
S PARK PL
MEADOW RIDGE LN
TRAIL RIDGE LN
TUMBLER RIDGE WAY
LANES END DR
COUNTRY AIRE RD
WHISPERING LN
KYLE CT
Utility Park
Stayer-Junior Park
Henry H. Huson Park
H. M. Meyer's Nature Park
Rotary Park
THAYER ST
FREDERICK ST
DALEVIEW DR
WILLOWBROOK DR
APPLETON ST
DEPOT RD
HILL CT
MEAD AVE
COLLINS ST
EASTERN AVE
REED ST
HIGH ST
EGAN ST
KARIN CIR
MCCOLM ST
BYRON ST
SOUTH ST
CLARK ST
W EASTMAN ST
EASTMAN ST
COLD STORAGE ST
W RIVERBEND DR
E PROSPECT AVE
W CLIFFORD ST
E CLIFFORD ST
APPLETON ST
E RIVERBEND DR
VALLEY RD
S MILWAUKEE ST
ANN DR
JENNIE DR
BETH CIR
SOUTH RIVER BLVD
BEECH CT
OAK RIDGE DR
SOUTH HILLS DR
SOUTH HILLS CT
ASH CIR
BEECH DR
MAPLE DR
HILL & DALE RD
BILGOS CT
EVERGREEN RD
SHORT CUT RD
COUNTY ROAD PP

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Plymouth Tree Inventory 3- Final

Map 3 - 2009 EAB Park & 2003 Street Tree Inventory - City of Plymouth - Sheet 3

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Plymouth Tree Inventory 4- Final

Map 4 - 2009 EAB Park & 2003 Street Tree Inventory - City of Plymouth - Sheet 4

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 1- Final

Map 5 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 1

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 2- Final

Map 6 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 2

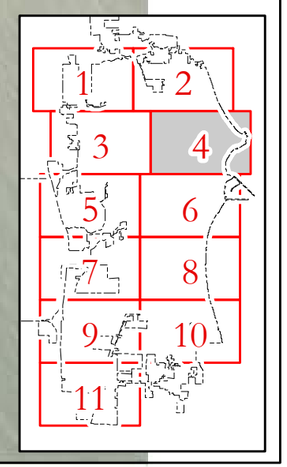
Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 3- Final

Map 7 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 3

22759 Trees inventoried -
5154 Ash trees located

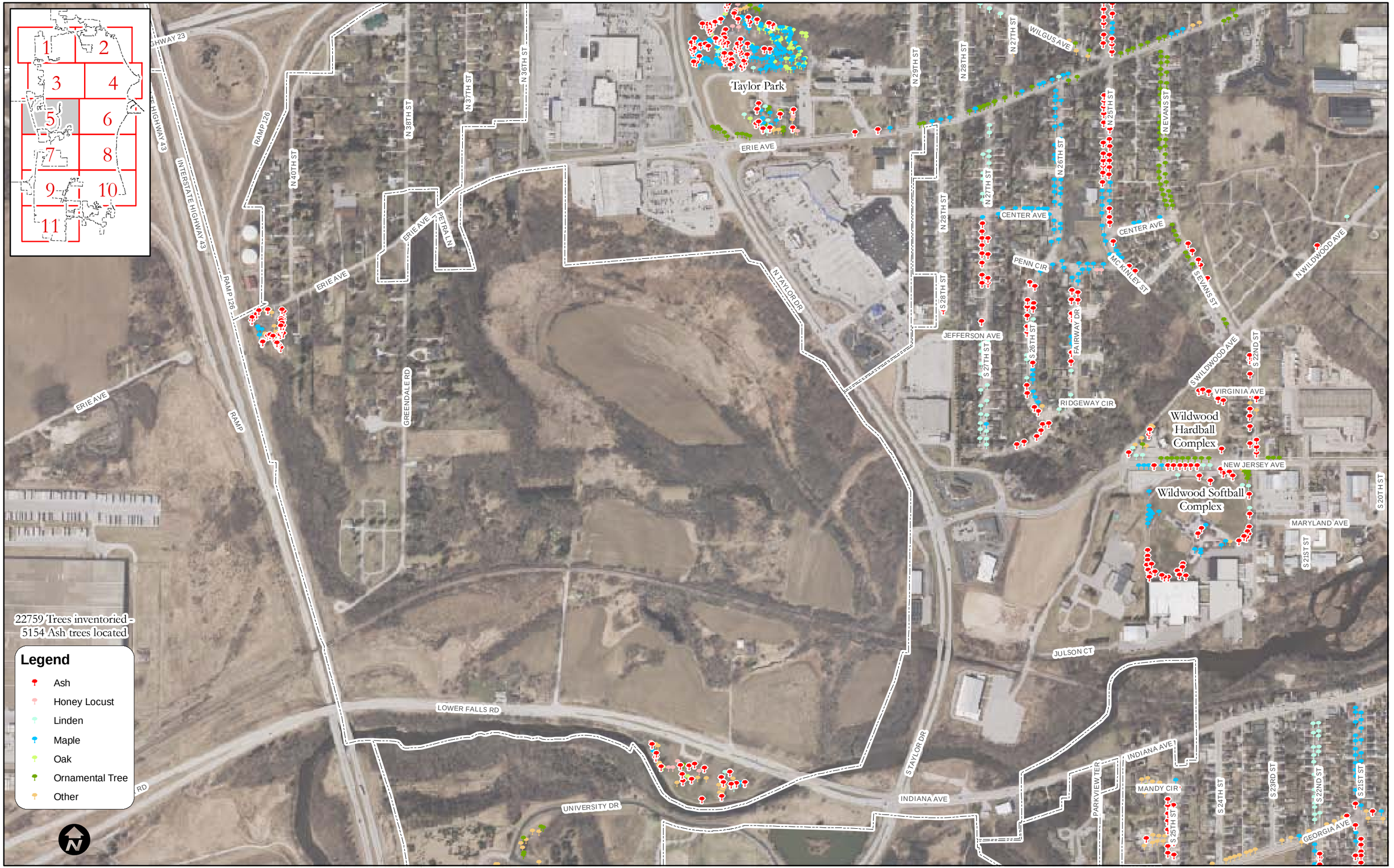
Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 4- Final

Map 8 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 4



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 5- Final

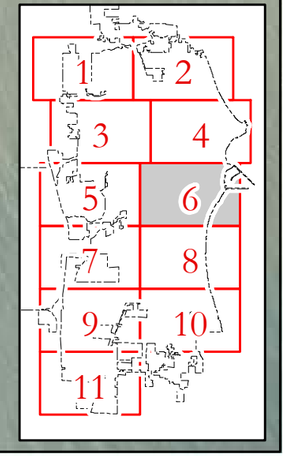
Map 9 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 5

22759 Trees inventoried -
5154 Ash trees located

Legend

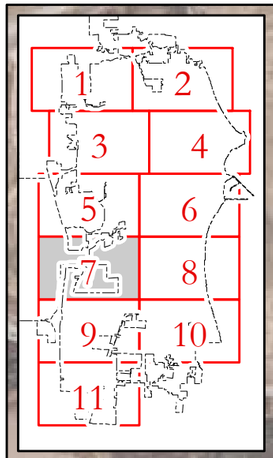
- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

Kiwanis Park
Sheridan Park
Moose Park
Deland Lakefront Park
Rotary Riverview Park



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 6- Final

Map 10 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 6



22759 Trees inventoried -
5154 Ash trees located

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 7- Final

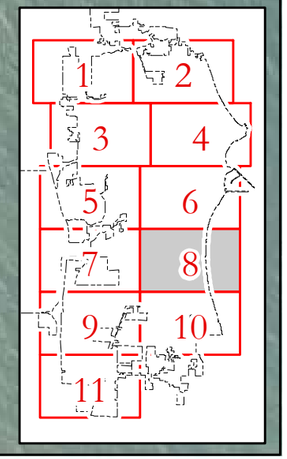
Map 11 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 7

22759 Trees inventoried -
5154 Ash trees located

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

CLARA AVE
DAVID AVE
NORMA CT
MARVIN CT
S 20TH ST
S 19TH ST
S 14TH ST
SPRUCE CT
Franklin Park
BROADWAY
SAUK TRAIL RD
GRAMS CT
S 17TH ST
ELM AVE
COLORADO CT
S 15TH ST
S 13TH ST
SWIFT AVE
HIGH AVE
S 10TH ST
S 9TH ST
SPRING AVE
S 7TH ST
General Charles King Park
ARIZONA AVE
NEVADA CT
S 12TH ST
S 11TH ST
DILLINGHAM AVE
UNION AVE
OAKLAND AVE
SAUK TRAIL RD
S BUSINESS DR
PLYMOUTH LN
ASHLAND AVE
S 16TH ST
LELAND AVE
MEAD AVE
S 8TH ST
CUSTER AVE
Roosevelt Park
WEDEMEYER ST
HUMBOLT AVE
HENRY ST
S 11TH PL
JACKSON AVE
LAKESHORE DR
POLK CT
WHITCOMB AVE
WILSON AVE
S 21ST ST



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 8- Final

Map 12 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 8

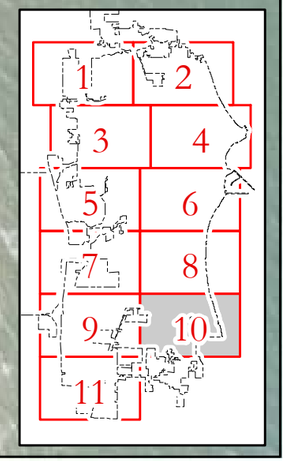
Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 9- Final

Map 13 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 9

22759 Trees inventoried -
5154 Ash trees located

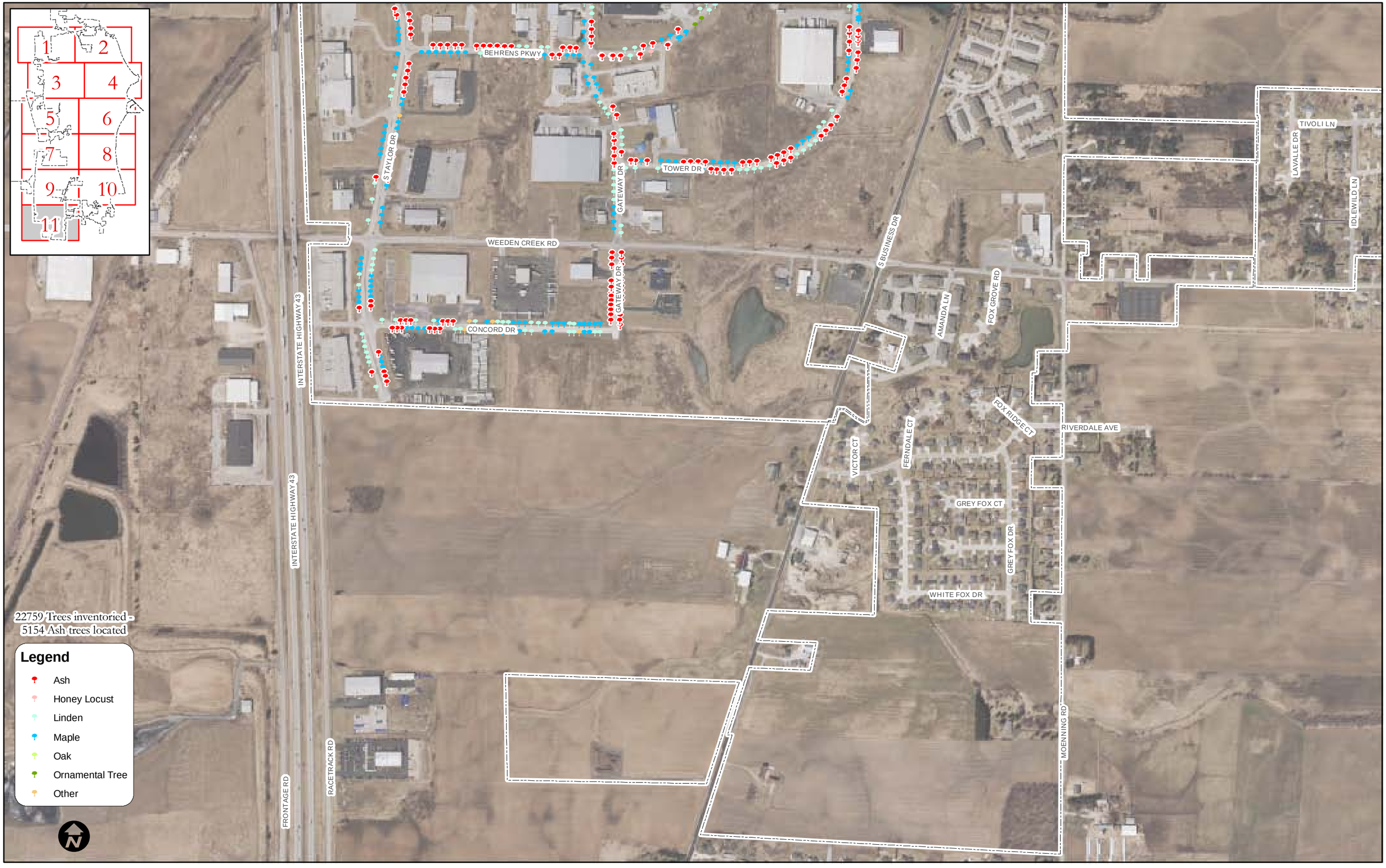
Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 10- Final

Map 14 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 10



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Tree Inventory 11- Final

Map 15 - 2009 EAB Street & Park Tree Inventory - City of Sheboygan - Sheet 11

758 Trees Inventoried -
179 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Sheboygan Falls Tree Inventory

Map 16 - 2009 EAB Park & Street Tree Inventory - City of Sheboygan Falls

85 Trees Inventoried -
17 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

COUNTY ROAD BB
TOWER AVE
GRANDVIEW CIR
BROOKVIEW AVE
HIGHLAND ST
COUNTY ROAD I
PARK ST
STATE HIGHWAY 57
FREEDOM LN
WISCONSIN ST
MILL ST
STATE AVE
MAINE AVE
Village Park
SHERMAN AVE
ADELL AVE
SEIFERT ST
CENTER AVE
NEUGENT ST
OSIUS ST
MILWAUKEE ST
1ST AVE
COUNTY ROAD A SOUTH
EDGEWOOD AVE
COUNTY ROAD I
STATE HIGHWAY 57
COUNTY ROAD A SOUTH

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Adell Tree Inventory

Map 17 - 2009 EAB Park & Street Tree Inventory - Village of Adell

67 Trees Inventoried -
27 Ash Trees

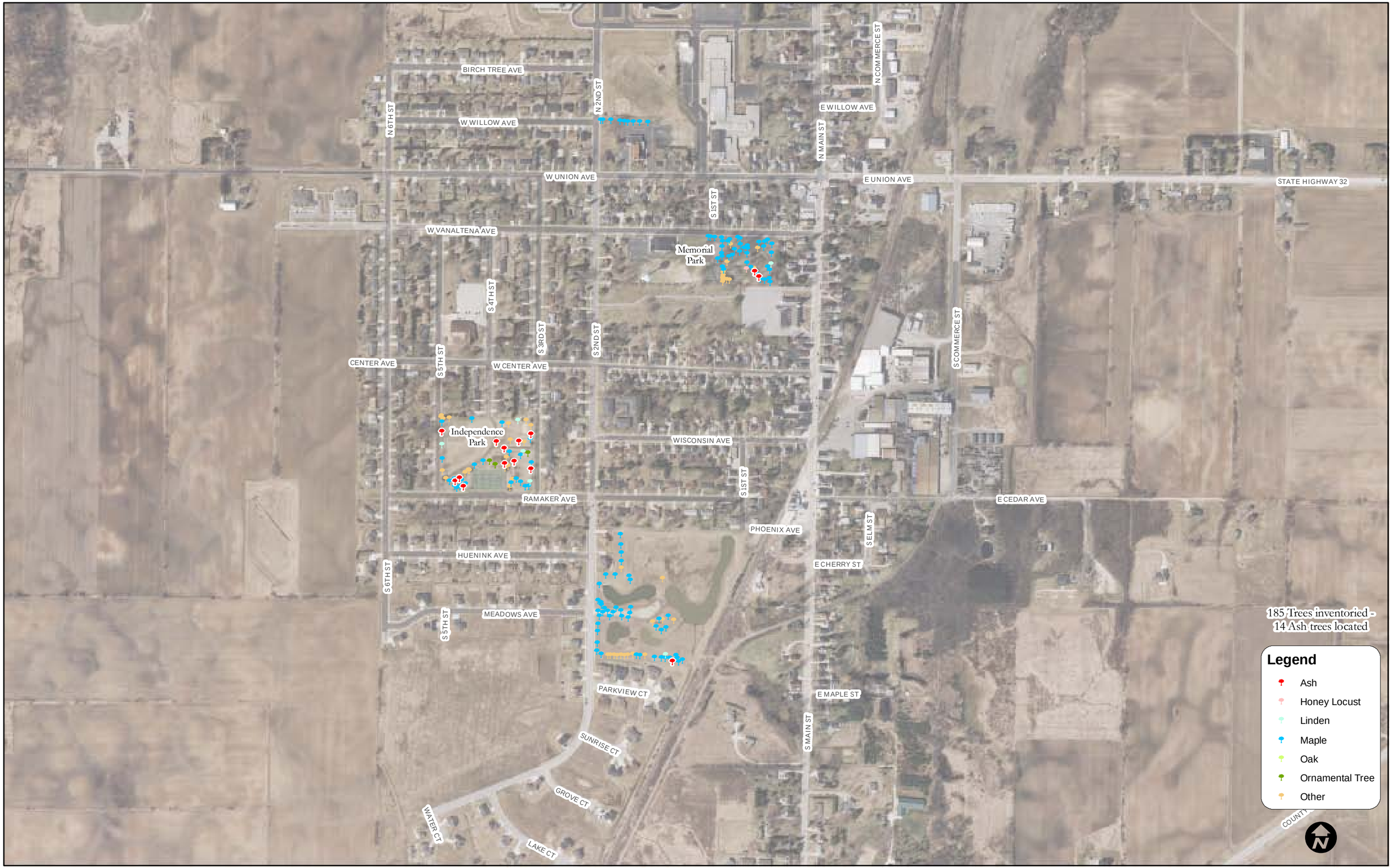
Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

NORTH AVE
BOBOLINK LN
CARDINAL CT
DOVE LN
CLARK ST
STATE HIGHWAY 28
ROCK RD
Cascade Millpond
WEST WATER ST
LAKE ST
JOHNSON DR
LAKE CT
FRANCIS AVE
EAST WATER ST
MIL WAUKEE AVE
WISCONSIN ST
FRANCIS AVE
MADISON AVE
1ST ST
Cascade Memorial Park
BATES RD
STATE HIGHWAY 28
ELLEN VIEW RD
LAKE ELLEN PUBLIC ACCESS
COUNTY ROAD F

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Cascade Tree Inventory

Map 18 - 2009 EAB Park & Street Tree Inventory - Village of Cascade



Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Cedar Grove Tree Inventory - Final

Map 19 - 2009 EAB Street & Park Tree Inventory - Village of Cedar Grove

236 Trees Inventoried -
34 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

June Vollrath Park

Village Park

Village Bathing Beach

Fireman's Park

COUNTY ROAD J

COUNTY ROAD JP

COUNTY ROAD A NORTH

KETTLEVIEW CT

WOODVIEW CT

CRESTWOOD DR

N LINCOLN ST

PARK LN

SNAKE RD

PLATEAU DR

E MAPLE ST

N EAST ST

N LAKE ST

N WEST ST

GOTTFRIED ST

PINE ST

CEDAR LN

MORAINE DR

GARFIELD AVE

N WASHINGTON ST

W RHINE ST

E RHINE ST

SQUARE ST

OSTHOFF AVE

CHICAGO ST

S WASHINGTON ST

S WEST ST

S LAKE ST

S EAST ST

ELM ST

INDUSTRIAL DR

S LINCOLN ST

SOHN DR

PAULINA PL

OTTO WAY

AERO DR

DEER RUN LN

POINT ELKHART DR

N TURTLE BAY RD

S TURTLE BAY RD

IMIGS RD

SHADY LN

POETS COVE

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Elkhart Lake Tree Inventory

Map 20 - 2009 EAB Park & Street Tree Inventory - Village of Elkhart Lake

199 Trees Inventoried -
11 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

PARKVIEW CIR
COUNTY ROAD A & P
COUNTY ROAD C
Dr. John Hanson Memorial Park
HIDDEN MEADOW DR
HIGHLAND DR
AKIN ST
KETTLE RIDGE CIR
N SWIFT ST
W BENSON ST
E BENSON ST
N OTIS ST
W BARRETT ST
E BARRETT ST
GLEN RD
W MAIN ST
E MAIN ST
S OTIS ST
S GARDEN ST
RAILROAD AVE
YOUNG ST
Glenbeulah Park
SLADE ST
S SWIFT ST
CLARK ST
E APPLETON ST
CEMETERY RD
COUNTY ROAD P
COUNTY ROAD A WEST
COUNTY ROAD S

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Glenbeulah Tree Inventory

Map 21 - 2009 EAB Park & Street Tree Inventory - Village of Glenbeulah

278 Trees Inventoried -
112 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

STATE HIGHWAY 32
TRUMAN CIR
VANBUREN RD
TYLER RD
ROOSEVELT AVE
ROOSEVELT RD
KENNEDY CT
KENNEDY AVE
N LINCOLN DR
GLENN AVE
N WISCONSIN DR
Memorial Park
JEFFERSON CIR
CONRAD CT
N RIVER PKWY
MADISON AVE
ARMSTRONG AVE
BROOKDALE RD
COUNTY ROAD A NORTH
COLLEGE AVE
ROWE RD
LEE AVE
S MACARTHUR ST
S GRANT ST
S WISCONSIN DR
MILL ST
SHERMAN ST
S PERSHING ST
S LINCOLN DR
NORENE RD
AUDUBON RD
STATE HIGHWAY 42
EISENHOWER CT
ETHAN ALLEN DR

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Howards Grove Tree Inventory North

Map 22 - 2009 EAB Park & Street Tree Inventory - Village of Howards Grove - North Part

278 Trees Inventoried -
112 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

ETHAN ALLEN DR
CARVER AVE
W BELL AVE
WHITTIER AVE
LONGFELLOW AVE
EMERSON AVE
ALCOTT AVE
ORIOLE LN
MARTIN LN
GOLDFINCH LN
CARDINAL LN
ELK LN
WREN LN
PINE RIDGE AVE
MILLERSVILLE AVE
GARTON RD
MAYFLOWER LN
PARK CT
Riverside Park
BITTERSWEET LN
MAPLETREE CT
BEECHTREE RD
ARBOR LN
SANDSTONE LN
HEDGESTONE LN
FIELDSTONE LN
STONEBRIDGE DR
S LINCOLN DR
S WISCONSIN DR
S WASHINGTON DR
HAWTHORNE DR
FROST RD
AUDUBON RD
WARBLER RD
MORNING DOVE DR
ROBIN RD
BLUEBIRD RD
BADGER RD
BIRDLAND RD
DEERFIELD DR
BRISTLECONE ST
WOODCREST ST
APPLETREE RD
MAPLETREE RD
FOREST HILLS DR
STATE HIGHWAY 42

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Howards Grove Tree Inventory South

Map 23 - 2009 EAB Park & Street Tree Inventory - Village of Howards Grove - South Part

1632 Trees Inventoried -
282 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

SUNSET RD
SUNSET RD
COUNTY ROAD Y
N 47TH ST
N 45TH ST
SARA CT
N 49TH ST
PAGE CT
RAMP
RAMP
RAMP 126
RAMP 126
RAMP 126
STATE HIGHWAY 23
STATE HIGHWAY 23
RAMP
RAMP
STATE HIGHWAY 23
WOODLAND RD
CREEKS CROSS RD
WILLOW LN
TREEHOUSE PKWY
TREEHOUSE LN
WOODLAKE RD
HIGHLAND DR
HIGHLAND DR
WILLOW CREEK DR
WOODLAKE CT
SIR HOWARD CIR
WOODLAKE RD
SIR HOWARD CT
BRIARWOOD CT
WILLOW CREEK DR
ERIE AVE
RANGELINE RD
PHILLIP DR

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Kohler Tree Inventory - North

Map 24 - 2009 EAB Park & Street Tree Inventory - Village of Kohler - North Part

1632 Trees Inventoried -
282 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

FOREST RD
PHILLIP CT
WOODLAKE RD
ORCHARD RD
HIGHLAND DR
WOODLAND RD
RANGELINE RD
UPPER RD
CHURCH ST
SCHOOL LN
MIDDLE WAY
HILL ST
GRAFTON CT
GARDEN LN
LILAC LN
SCHOOL ST
AUDUBON RD
Ravine Park
EAST PARK LN
WEST PARK LN
MARKET ST
LOWER RD
SOUTH RD
COUNTY ROAD A
LINDEN RD
GREENFIELD DR
PINE CIR
PINE TREE RD
GREEN TREE RD
SUMMIT RD
GREEN PL
RIDGE CT
VALLEY RD
RIDGE CT
RIDGEWAY
ROOSEVELT RD
WASHINGTON WALK
CENTER LN
PARKWAY
ASPEN RD
BAYBERRY LN
MULBERRY LN
ASPEN CT
ASPEN LN
Lost Woods Park
Roosevelt Park
MAIDEN LN
WEST RIVERSIDE DR

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Kohler Tree Inventory - South

Map 25 - 2009 EAB Park & Street Tree Inventory - Village of Kohler - South Part

181 Trees Inventoried -
16 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

MINNESOTA AVE
PINE DR
DUTCH LN
N 13TH ST
WISCONSIN AVE
Veterans Memorial Park
N 12TH ST
PARK AVE
PARK PL
N 14TH ST
N 11TH ST
MEADOW LN
WILLOW LN
Stuart J Mentink Memorial Park
N 10TH ST
N 9TH ST
N 8TH ST
OHIO AVE
N 6TH ST
ANTHONY CIR
N 7TH ST
INDIANA AVE
WASHINGTON CIR
ILLINOIS AVE
PARK AVE
NEW YORK AVE
N 7TH ST
CENTER AVE
MINDERHAUD RD
HARTMANN RD
SAUK TRAIL RD
TOWN LINE RD
MINNESOTA AVE
N SAUK TRAIL RD
N 4TH ST
N BUSINESS PARK DR
WOODLAND CT
EAST FIELD DR
S 1ST ST
S 2ND ST
S 3RD ST
S 4TH PL
S 14TH ST
S 12TH ST
SUPERIOR AVE
S 9TH ST
SUPERIOR AVE
S 7TH ST
MICHIGAN AVE
WEST FIELD CT
S 11TH ST
ZUIDER LN
S 11TH ST
S 10TH ST
S 8TH ST
S 6TH ST
ERIE AVE
S SAUK TRAIL RD
S BUSINESS PARK DR
ENTERPRISE CT
MICHIGAN AVE
S 12TH ST
HURON AVE
HURON AVE
ONTARIO AVE
MAPLE AVE
ASPEN AVE
ASPEN AVE

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Oostburg Tree Inventory

Map 26 - 2009 EAB Park & Street Tree Inventory - Village of Oostburg

159 Trees Inventoried -
57 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

STATE HIGHWAY 144
WOLF RD
ALLEN RD
SHORT ST
JESSIE LN
WEST LAKE DR
LAKE DR
POINT RD
MAPLE CT
RANDOM LAKE RD
N SPRING ST
KRIER LN
NORTH ST
6TH ST
WESTERN AVE
ALLEN ST
5TH ST
FRANZEN ST
HOFF ST
EAST SHORE DR
GRAND AVE
Kircher Baseball Park
4TH ST
S SPRING ST
SPRING CT
LAKESIDE ST
3RD ST
CARROLL ST
BUTLER ST
EVERGREEN DR
KING OAK CT
2ND ST
COUNTY ROAD II
1ST ST
BENTERT ST
LAKE ST
RUSSELL DR
Lakeview Park
MUELLER LN
LAKE BREEZE LN
WIND SAIL CT
HICKORY DR
CIMMERON DR
PARKVIEW DR
RANDOM LAKE RD
CREEK RD
ORTH DR
COUNTY ROAD K

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Random Lake Tree Inventory

Map 27 - 2009 EAB Park & Street Tree Inventory - Village of Random Lake

59 Trees Inventoried -
15 Ash Trees

Legend

- Ash
- Honey Locust
- Linden
- Maple
- Oak
- Ornamental Tree
- Other

PHEASANT RUN
DEER TRAIL RD
BLUEBERRY LN
STATE HIGHWAY 57
STATE HIGHWAY 28
E HIGH ST
N MILL ST
W FOURTH ST
N DEPOT ST
N HARMON ST
N LYNDON ST
W THIRD ST
N LAWSON ST
W SECOND ST
Waldo Millpond Park
E SECOND ST
STATE HIGHWAY 28
W FIRST ST
E FIRST ST
COUNTY ROAD V
SCHOOL ST
DAN ST
S MILL ST
MULBERRY DR
Waldo Village Park
SCHOOL ST
RUSS ST
EAST AVE
BLACKBERRY DR
STATE HIGHWAY 57

Created by the Sheboygan County Planning Department , May 2010
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Waldo Tree Inventory

Map 28 - 2009 EAB Park & Street Tree Inventory - Village of Waldo

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\Township Tree Inventory

Map 29 - 2009 EAB Park & Street Tree Inventory - Town Owned Properties

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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\ShebCo OPRT Tree Inventory

Map 30 - 2009 EAB Park & Street Tree Inventory - Sheboygan County Old Plank Road Trail

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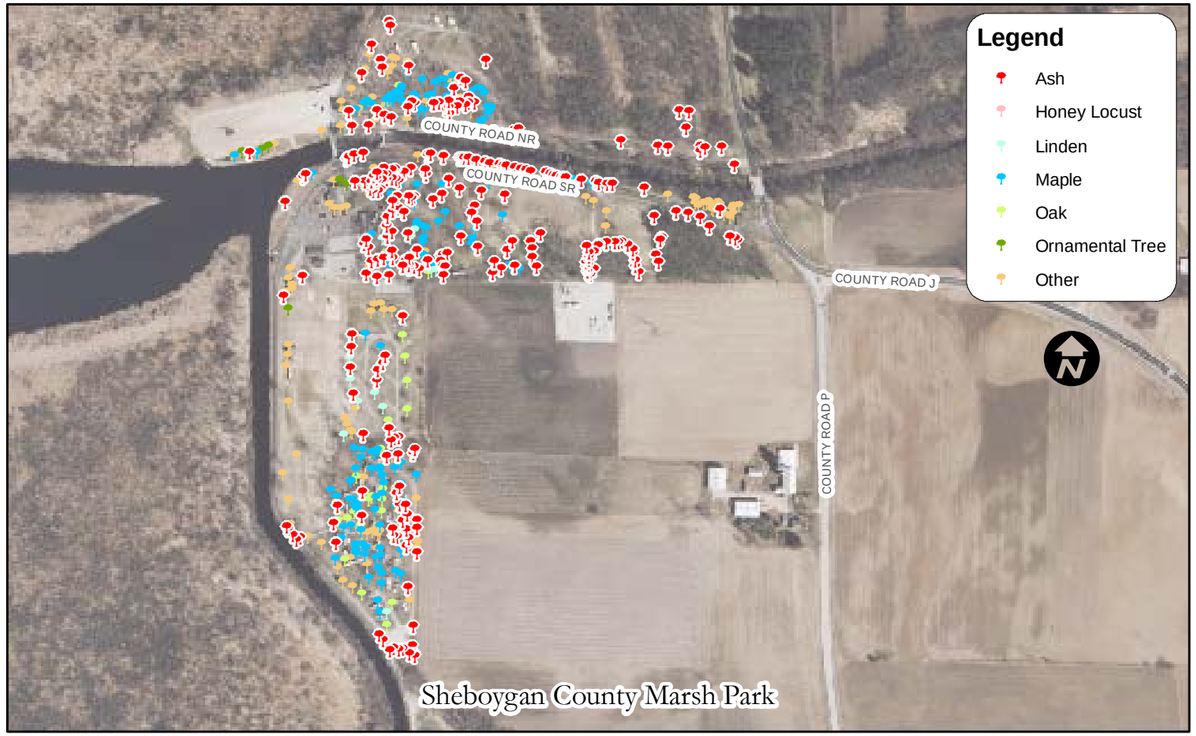
G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\ShebCo Boat Landings Tree Inventory

Map 31 - 2009 EAB Park & Street Tree Inventory - Sheboygan County Boat Landings



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G:\Departments\Planning\Mapdocs\2009 Tree Inventory data\EAB Plan Maps\ShebCo Boat Landings & Other Tree Inventory

Map 32 - 2009 EAB Park & Street Tree Inventory - Sheboygan County Boat Landings & Other Areas

V. EAB Preparation, Detection, and Control

Being a relatively new invasive species in North America, EAB has given the scientific community little time to study it. To date, there have been no scientific discoveries for eliminating EAB infestations. In addition, there has been no break through on how to cost effectively control its spread or keep its population in check. However, research is on going and has made great strides in developing tools and methodologies that will help mitigate the impact on local communities. Based on these new discoveries, general guidelines for emerald ash borer detection and control in both rural and urban situations have been developed.

This section provides a summary of the most up to date management efforts that municipalities can conduct to help with detection and control of EAB. This section is not intended to be an exhaustive review of all literature, but to serve as a guide and resource. Keep in mind as research continues, guidelines could be modified and the following information would be subject to change.

Tree Inventories[15]

The first and most important step in managing your community's urban forest resource and preparing for EAB is to conduct a tree inventory. A tree inventory is the process of counting, characterizing, and recording information about the public and sometimes private trees that make up the urban forest or the trees within a stand for woodlots. It is a useful tool that documents important information related to the total number of trees, their condition, location, and species composition.

The goal of any community tree inventory is to provide information essential for management in a timely fashion, at a reasonable cost. But, how do you determine what type of inventory is best for your community? The type of inventory that will fit your community best depends on community size, size of the tree population, the technology level of your community, budget, staff availability, and how the information will be used. Therefore, the first step in any inventory is to identify objectives. Objectives will help your community to determine how much information needs to be collected. It is a waste of time and money to collect information you don't need. On the other hand, if the objectives include specific management actions then more detailed information may need to be taken. The most common type of data collected in tree inventories are: location, land use, species, size, condition, site information, and maintenance needs. For help in determining what the best type of tree inventory is for your community, WDNR put together a series of articles to help communities. They can be found in the *Emerald Ash Borer Toolkit for Wisconsin Communities* by WDNR. In addition, the information below gives a short explanation of the major categories of tree inventories.

Street Tree Inventory

Street tree inventories document and help with management of trees along roads and within the public right-of–way. They are conducted using a variety of on-the-ground sampling methods ranging from a relatively quick windshield survey to the more detailed walking survey using notepads to personal digital assistants (PDA's) to geographic information systems (GIS). Documentation of street trees is useful for identifying the species, location,

[15] Wisconsin Department of Natural Resources, Emerald Ash Borer Toolkit, http://dnr.wi.gov/forestry/uf/eab/

and condition of trees the community government is responsible for maintaining. This information can then be used to identify areas of susceptibility (high ash component), low species diversity (species and/or age), and future planting opportunities. In addition, community forest management plans can be developed from the inventory to provide direction for urban forestry initiatives.

Park and Open Space Inventory

Park and open space inventories document the publicly owned trees away from streets and right-of-ways. These trees comprise a smaller part of the entire community tree population, but may be the most important part of the urban forest to many residents. They make up the more natural areas of communities and are usually a place of refuge or recreation for residents.

Some trees in parks and open spaces typically do not need to be inventoried as often or as thoroughly as street trees because they are in areas of lower pedestrian traffic. Because of this, these trees pose a lower liability risk and do not need to be documented as intensely. It is still a good idea to keep tabs on the resource in the interest of overall species diversity and forest management practices.

However, within parks there are other trees that should be more closely monitored. These would be trees within manicured areas which experience higher use (i.e. along trails, picnic tables, playground equipment, mowed areas, etc). These areas are designed to be inviting and keeping tabs on the health and condition of trees in this area is in the community's best interest. A documented risk assessment program can help to identify trees prone to failure and preemptively deal with them. Additionally, in the case of an accident, being able to produce a risk assessment and work history log indicates the community's active role in maintaining safe trees.

Woodlot Inventory

For woodlots, it is often impractical to inventory every tree. Therefore, information on woodlots is obtained through a field inventory called a timber cruise. When conducting a timber cruise the woodlot is divided into stands containing different timber types, much like the different fields on a farm. Individual stands may contain various sizes of trees, including new plantations. They may also vary by species composition or management techniques. Most stands are easily distinguished from others. Some woodlots are uniform throughout and may be managed as one stand. Once the stands are delineated, sample plots are located in each stand, then all the trees in the plots are identified and measured. The plots are then used to estimate the total number of trees in the woodlot. For more information on how to conduct a woodlot survey refer to the *Emerald Ash Borer Toolkit for Wisconsin Communities* by WDNR.

Monitoring and Detection

One of the first lines of defenses against EAB is to enact a program to monitor and detect for the pest. It has been estimated in many instances where EAB was found, that EAB was usually present in the community for a number of years before it was detected. If a new EAB infestation can be detected while it is still limited in scale, it may be more controllable. In addition, identifying infestations early will give communities more time to implement a management strategy before their ash trees are in a late stage of decline and become hazardous, ultimately saving communities money.

Monitoring for EAB involves knowing the signs and symptoms of EAB (refer to *Section II - EAB* of this plan), and the use of surveys and inspections. When conducting surveys and inspections, using the most current tree inventory results from your community can be helpful in designating high-risk areas and appropriate areas in your community for an EAB survey.

Inventory information will show areas of high ash tree density, and tree health or conditions. Both of which can help delineate high-risk areas. Ash trees that are stressed or unhealthy tend to attract EAB better than others. If a given area meets both criteria---a high density of ash and stressed ash trees---this is a good place to start surveying for EAB.

In addition to locating high-risk areas based on inventory information, consider locations in the community where EAB has a greater probability of being introduced, such as:[16]

- Businesses that import firewood from non-local sources. Know where your firewood comes from.
- Local campgrounds or festival grounds, where overnight camping and potential firewood use occur.
- Developments or subdivisions built within the last 12 years. EAB was identified in 2002, but has probably been in the country since the 1990's. Ash nursery stock planted in these developments could have been infested with EAB long before any quarantine was in place.
- Industries that utilize raw ash products, such as mills and furniture manufacturers.
- Industries and businesses that import goods shipped on solid wood packaging materials from Asia.

After identifying high-risk areas and locations for possible EAB introduction, develop a survey schedule and begin by conducting inspections in these areas. There are several different methods of surveying for EAB, each having its own advantages and disadvantages. A brief description of each survey method is discussed below.[17]

Visual Survey

Visual surveys include looking for outwardly visible signs and symptoms of EAB on ash trees by a person on the ground. A visual survey can be conducted either by systematically covering an area or by selecting individual trees from an inventory. The advantage of visual surveys is that a large area, using few resources, can be covered in a short amount of time. The main disadvantage is that by the time visual symptoms of EAB are present, it usually means the infestation has been in the area for several years. An example of a visual survey data form can be found in Appendix F.

Canopy Survey

Canopy surveys are used when a closer look at the tree's canopy is warranted. Usually the tree has exhibited signs and symptoms through a visual survey that calls for a closer look. Once in the tree's canopy, small windows of the canopy's trunk and branches can be peeled back using a drawknife to look for EAB larvae. The advantage of a canopy survey is that a close up inspection can occur where EAB symptoms show up first. The disadvantages

[16] Wisconsin Department of Natural Resources, Emerald Ash Borer Toolkit, http://dnr.wi.gov/forestry/uf/eab/
[17] Survey methods: Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

include the costs of using professional tree climbers and/or the use of a bucket truck along with the time it takes to perform individual tree inspections.

Detection Trees

EAB Detection Tree
Source: WDNR

Detection trees are created by artificially wounding an ash tree to purposely stress it, which has been shown to attract EAB. The most effective way to wound a tree for this purpose is girdling (remove a band of bark around the trunk) the tree. Detection trees are currently the most effective tool available for proactively surveying for EAB. The disadvantage of this method is the ash tree used is destroyed. WDNR and DATCP have been using this method since 2004 to look for EAB infestations across the state.

Destructive Sampling

Destructive Sampling includes the removal and/or peeling of an ash tree to look for EAB larvae and larval galleries. Ash trees that are sampled can be of any size, but trees between 4"-12" DBH are the most efficient to peel. The advantage of this method is the discovery of early EAB infestations. A disadvantage is the sampled ash tree is destroyed. Currently, WDNR and DATCP are conducting this method along with Detection Trees to help delimitate the areas of current infestations.

Purple Traps

Purple Trap
Source: Wisconsin EAB Information Source Website

Purple panel traps were used as a survey tool in Wisconsin for the first time in 2007. The survey was initiated by the DATCP, USDA-APHIS and WDNR. To date, researchers still consider the use of detection trees to be the best method for detecting low-density emerald ash borer infestations. However, there are situations in which purple traps may be favored over detection trees in order to prevent the loss of an ash tree. Such situations include surveying in areas where the tree may be considered a prize urban or campground shade tree or when surveying where the ash resource is limited, but risk still exists (e.g. firewood piles, mills and nurseries).

The traps are made of a purple corrugated plastic board that is coated with non-toxic glue. Research shows that EAB is visually attracted to purple and to increase the attractiveness of the trap to the beetles, it is baited with a lure (Manuka oil). The traps are 24" in length, triangular in shape, and open in the center. It is recommended to hang the traps on an open grown or edge ash tree at a height of 33-40 feet above ground.

Detection

Due to there being numerous EAB look-a-likes, if EAB is found while conducting surveying efforts, the specimen will need to be verified by officials at USDA-APHIS and/or WI DATCP. Once there has been official confirmation of EAB in Sheboygan County, appropriate managers and core staff will be notified early in the response. In addition, providing timely,

accurate and consistent communication to others will be important in enhancing credibility and community support of your plan and actions. For details of the proper notification and communication procedures along with regulations that will go into effect when EAB is confirmed refer to *Section VII – EAB Confirmation, Authority and Responsibility* of this plan.

Control

A major section of your community's EAB Plan will be how your community intends on managing its ash trees. Management options vary and there is no one all-inclusive method. Your community will need to weigh the options carefully and select the combination of methods that works best for them. Some of the factors that could influence management decisions and questions that should be asked are listed below:[18]

- Environmental impact – What are the environmental impacts of the control method considered? And how would those impacts be different if no action or a different method was considered?
- Land Ownership – Who owns the affected land and how does that influence access to the site?
- Land use and classification – What is the predominant land use in the affected and surrounding area? Natural area? Residential neighborhood? Downtown district? And is the method being considered consistent with the land use goals for the affected area?
- Cost of implementation – How much does the selected control method cost?
- Availability of resources to carry out control method – Is there sufficient financial and human resources to carry out the control method selected? Is the necessary equipment available? Does additional funding need to be obtained or allocated?
- Sociological impact – What are the potential social, cultural, and/or psychological impacts of the control method?
- Size of infestation – How large is the infestation and how long has it been there?
- Traditional ecological knowledge – Do indigenous people live in the area and will their resources or traditions be affected?

The following subsections provide information on methods of preventing the introduction of EAB, controlling it when it gets here and minimizing the impact of the insect on your community's trees.

Prevention

To date, EAB has not been found in Sheboygan County and prevention entails striving to keep EAB from arriving. Two strategies for prevention are education and preemptive removals, both of which are described below.

Education

One of the most effective methods of control for EAB is educational outreach. EAB is believed to move slowly through the landscape on its own, staying within ½ mile of their emergence point with some mated females flying several miles. However, accidental movement of nursery stock, logs, and firewood by humans greatly accelerates its

[18] Wisconsin Emerald Ash Borer Response Plan, Updated: July, 2008 and Dane County Emerald Ash Borer and Wood Utilization Strategic Management Plan, May 15, 2009.

movement. Most individuals and industries who are made aware of the risks of moving this type of materials will usually voluntarily alter their practices to reduce the risk of moving EAB. Therefore, education of how EAB can be moved long distances through these materials is critical to slowing its movement.

Preemptive Removals

Once EAB arrives in your community, the burden of dealing with hundreds or thousands of ash trees can be overwhelming. It can place strain on your community budget, personnel, and resources. By preemptively removing ash trees before the arrival of EAB in your community, it can minimize the strains placed on your community and provide flexibility in tree removal budgets. In addition, they can potentially diminish the movement of EAB across the landscape by making it difficult for dispersing beetles to find host trees.

The scale of preemptive removals can vary from removing all ash trees in a short amount of time (i.e. 10% removal each year for 10 years) to only removing ash trees in poor health. It could also include only removing and replacing young trees (i.e. all ash trees less than 5" caliper or less than 3 years old). All of the options will make removals more manageable when EAB arrives. Another consideration is to work with your local utility company to remove or phase ash trees out of the utility easements.

Communities will have to decide if this method is right for them. Listed below are some of the pros and cons of preemptive removals.[19]

Pros:

- Opportunity to spread removal costs over longer time frame.
- Reduces problem of dealing with many dead and/or hazardous ash trees at one time.
- Opportunity to start the replanting/recovery process right away.
- Greater flexibility in organizing removal and routine work schedules.
- Ability to utilize ash wood for products or use it as a local source of firewood.

Cons:

- Immediate impacts to tree canopy and aesthetics.
- Removing healthy ash may create negative feeling in the community.
- Does not take into account that research may find an effective control of EAB.

Reactive Management

This subsection contains current management strategies for when EAB arrives in your community. When controlling EAB through any of these methods, it will be important to continue surveys to know the extent of the infestation and education for the public to understand the method chosen.

Biological Control

Biological control is the use of natural enemies such as insect parasites, predators, and pathogens to kill various stages of pests. Research on EAB biological control began in 2002

[19] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

leading to the discovery of three species of wasps from China: *Spathius agrili*, *Oobius agrili*, and *Tetrastichus planipennisi*. These natural enemies are tiny stingless wasps that seek and kill EAB eggs and larvae. In their native ranges these wasps have been found to parasitize between 50 to 90% of EAB larvae. In 2007, USDA-APHIS and the State of Michigan approved the small-scale inoculative release of these wasps to evaluate establishment, monitor spread rates, and determine the effects on EAB population dynamics and ash survival.[20] Thus far it does appear that these parasitoids can survive Michigan winters and research continues at these sites to monitor long-term parasitoid establishment and impacts on EAB populations. Another parasitoid is a native wasp that showed up during the trials, *Atanycolus capertus*. Currently it is showing promise, with parasitism approaching 20% on one site. The main challenge for using these wasps in biological control is the mass-rearing of the insects to use.[21]

Woodpeckers, in particular Downy and Hairy Woodpeckers, are commonly observed feeding on EAB larvae and pupae within infested trees. Although extremely valuable for detecting EAB, the effects on controlling the population are small.

Additionally, because biological control agents cannot reduce EAB population densities to zero, they are not considered alternatives that will completely control and manage EAB on their own. Therefore, future management of EAB will depend on an integrated pest management program that includes the use of parasitoids as biological control agents.

Insecticide Control[22]

Since EAB has arrived in Wisconsin there have been many questions to the effectiveness of insecticides in protecting ash trees and if it is an appropriate management option. If you elect to treat your ash trees, there are several insecticide options available and research has shown that treatments can be effective. However, keep in mind that controlling insects that feed under the bark with insecticides has always been difficult and success is not guaranteed. This is especially true with EAB because our native North American ash trees have little natural resistance to this pest.

In some university trials, insecticide treatments were effective, while other trials failed with the same treatments. Also, some studies conducted over multiple years revealed that EAB infestations continued to increase in the same tree despite ongoing treatment programs. Research in recent years has led to a better understanding how EAB can be managed successfully with insecticides. The current state of this understanding is detailed in a bulletin by North Central IPM Center, Appendix G.

When considering an insecticide option, some of the highlights are:

- Insecticides are not effective in eradicating EAB infestations, but can effectively protect ash trees from EAB. They are best used as a preventative.
- The best control can be achieved when insecticide treatments are started before the tree is infested or in the earliest stages of infestation before visible symptoms are present.
- Rule of thumb for starting treatment is if EAB is found within your county or within 10-15 miles.

[20] Biological Control of Emerald Ash Borer (Agrilus planipennis), USDA-APHIS, http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/eab-biocontrol.pdf
[21] Emerald Ash Borer University, Pesticides and Biocontrol to Manage EAB Webinar
[22] Insecticide Options for Protecting Ash Trees From Emerald Ash Borer, North Central IPM Center, June 2009 and Emerald Ash Borer: Insecticide Options for Protecting Ash Trees and Their Effectiveness, R. Chris Williamson

- Some formulations can be purchased and applied by homeowners, others must only be applied by professional applicators.
- Emamectin benzoate is the only product tested to date that controls EAB for more than one year with a single application. It also provided a higher level of control than other products in side-by-side studies.
- Since insecticide treatments must be repeated each year, it may be more cost-effective to remove and replace the ash tree with an alternative tree to increase species diversity.
- Research and experience suggest that effectiveness of insecticides has been less consistent on larger trees. Research has not been conducted on trees larger than 25-inch DBH. When treating very large trees under high pest pressure, it may be necessary to consider combining two treatment strategies.
- Homeowners wishing to protect trees larger than 15-inch DBH should consider having their trees professionally treated.
- Treatment programs must comply with any label restrictions on the amount of insecticide that can be applied per acre in a given year.

It is important to note that research on insecticide management of EAB remains a work in progress. Scientists from universities, government agencies and companies continue to conduct intensive studies to understand how and when insecticide treatments will be most effective.

Eradication

Eradication is the attempt to completely eliminate EAB from a local area by removing all infested trees and all potential host trees. In the recent past, this was a widely recommended form of control and containment of EAB. However, many eradication efforts have failed. This is believed to have happened because it is very difficult to adequately determine the extent of the infestations. Therefore, eradication is now only a favored option for the occasional outlier infestation that is at a very small scale, has traceable origins, and is less than two years old.

Reactive Removals

Reactive removal is the process of waiting to remove ash trees that are already infested with EAB or dead. Some communities will decide to take the path of preemptively removing a portion or all of their ash trees. However, some will be reluctant to do this not realizing the magnitude of the situation till it is too late, or because they were not financially capable of doing so. Communities will have to decide if this method is right for them. Listed below are some of the pros and cons of reactive removals. [23]

Pros:

- Delayed impacts to tree canopy and aesthetics.
- No negative public perception or removing healthy trees.
- Delayed budgetary impacts until EAB hits.
- Further EAB research may offer effective control, minimizing need for removals.

[23] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

Cons:

- If no action is taken to control EAB infestations, studies have shown that the rate of spread will be much faster.
- Budget impacts can be severe once EAB is in community.
- Replanting funds may be available due to extreme removal costs.

Woodlot Management Options

Woodlots and parks, whether private or community owned, play an important role in a community's forest ecosystem and should be considered when preparing for EAB. If there are community owned forested areas, it is recommended that there should be a management plan in place that addresses the long-term management options. Within the plan there should be details looking at the impacts EAB will have on the goals and uses of that area. Whether private or community owned, management recommendations from WDNR forest health specialists can help when considering the options for these areas. Recommendations can be found in the WDNR document "Emerald Ash Borer and Forest Management", Appendix H.

Diversification

The impacts of EAB on a community are directly dependent on the number, size and location of ash. The more ash a community has, the higher the infestation and the faster the insect will spread. In addition, the larger the trees are, the greater the cost for removal and the greater the loss of environmental services.

Providing for species and age diversity in your urban forest are two significant ways to reduce the impact of a destructive pest such as EAB. Recent pilot studies show that ash trees comprise around 12% of the all tree species within the boundaries of Wisconsin's communities. Ash is also the second most common street tree in Wisconsin communities (behind Norway maple), making up to as much as 30% of the street trees in a community. Through the most recent tree inventory conducted by Sheboygan County ash trees comprise anywhere from 5% in Glenbeulah to 40% in Cascade and Howards Grove, with the average being 23%.

When considering the diversity in your community an old rule of thumb is no more than 5% of one species, 10 % of one genus and 20% of one family. If you were to adhere to this, in the case of EAB, the loss of trees would still be pretty drastic at one fifth of your entire forest. Optimally, you'd like to have the greatest diversity of species you can manage.

In addition to species composition, the size of trees in your community needs to be considered. EAB has been shown to attack all ash trees regardless of size. However size will play a part in the sustainability of the whole forest and the cost of management. If all your trees are large, removal costs will be more. In the same instance if all the trees in community are the same size/age, they could potentially start to fall apart at the same time and eventually you will be faced with the same catastrophic tree loss even without EAB.

Communities need to start planning now for a more diverse urban forest. This includes having a replacement plan (for more information refer to *Section V – Preparation, Detection, and Control* of this document) for when ash trees in your community have to be removed to an overall goal of species and size diversity within your community's forest. Finding a wider variety of species will be potentially harder and more expensive, but it is worth it. For a list of alternative species see Appendix I.

VI. Wood Utilization[24]

EAB has the potential to generate a significant amount of wood debris in any one community. Most likely this will be a gradual increase initially, but later increasing rapidly as EAB populations increase. It will also depend on the number of ash trees in your community, how many were treated before hand with insecticides, and the management approach taken for tree removals (i.e. preemptive vs. reactive removals). The big question every community will face is: What do you do with the wood debris? When facing this question items that will need to be considered are: how can the wood debris be utilized and/or disposed of, are there local businesses that can use the wood debris, and where will the wood debris be stored (marshalling yards).

The following subsections will help in answering these questions. In addition, a survey was conducted of Sheboygan County communities to determine how they currently handle wood debris, if they have a potential location for a marshalling yard, and if they would be interested in partnering with other communities. This information could be helpful when setting up recommendations for wood utilization and/or marshalling yards. To see the results of the survey, refer to *Section IV – Assessments* of this document.

Utilization/Disposal Methods

The most common use of ash trees is mulch and firewood. Ash can also be milled on site into lumber using a portable sawmill, transported to a mill, or transported to a marshalling yard within a quarantined area. Other products include railroad ties, paneling, flooring, moldings, pallets and baseball bats. Ash can also be used for many other products that we see everyday and take for granted like picnic tables in a park, bleacher seating, tree and survey stakes, sideboards for trucks and handles for tools like hammers and rakes.

By finding creative ways to use wood generated from ash tree removals, communities can often lessen the economic impact of EAB while strengthening local wood product industries. This can be accomplished through partnering with neighboring communities, with local sawmills, and/or local businesses. Whatever option is pursued, local residents generally respond positively to wood reuse programs knowing that their community trees are not going to waste.

When putting together wood utilization recommendations/policies the following items should be considered:

- Decide whether your community has specific needs for wood products, i.e. mulch, lumber or other products.
- Contact local stakeholders to determine available resources, limitations, partners, and timelines. Some stakeholders to be considered are WDNR staff, local foresters/arborists, wood industry representatives, and recycling centers.
- Develop a list of potential wood processors/industries and their interest. Begin discussion with how they might partner with your community.
- Identify and create collection yards.
- Be aware of regulatory conditions when dealing with EAB generated waste.
- Create educational programs related to using EAB affected trees.

[24] Emerald Ash Borer Community Preparedness Plan, Michigan Department of Natural Resources and Michigan Department of Agriculture, 11/19/2008.

Local Users

When determining alternative uses for ash trees it is a good idea to know who the local users are in your area, what type of raw material they need, and what type of product they produce. The WNDR has a listing of companies using round wood, *Wisconsin Primary Wood Using Directory*. This includes sawmills, veneer plants, particle board plants, log cabins, pulp mills, and chip plants. The directory lists the products they produce and the raw material that they need. Another list, Wisconsin *Secondary Wood Using Directory,* is of companies that use products produced by the primary wood using industry to make a product. This includes furniture, parts, pallets, moldings, kitchen cabinets, etc. The directory lists the products they produce and the raw material needed. Both directories can by found at http://www.woodindustry.forest.wisc.edu/. In addition, there is a listing of *Wisconsin Wood Residue Brokers*, firms that buy sawdust, bark and shaving and market it to other manufactures. The list can be downloaded from the University of Wisconsin Extension web site, http://forest.wisc.edu/extension/publications/103.pdf. Refer to Tables 71 to 73 for a listing of primary and secondary wood users and wood residue brokers in Sheboygan County.

Besides the companies that process wood and wood products, there are portable sawmill operators who could possibly come to a municipality and cut lumber for use. The problem is that there is no listing of these operators as most do not provide this service as their primary source of income, however the local DNR forester in your area may be aware of these operators.

Table 71: Primary wood users in Sheboygan County

Company Name	Address	Phone	Tree Species Processed	Products Sold
A &M Trees	7230 Sauk Trail Rd Sheboygan WI 53081	920 452-1967	---	Mulch
Geneva Log Homes, Inc. / Greatwood Log Homes, Inc / Wilderness Log Homes, Inc.	N5821 County Road S Plymouth, WI 53073	920-893-8416	Pine, W. Cedar, W. Red Cedar	Log Homes
James Schulz	W6347 CTR SS Random Lake, WI 53075	920-994-4626	Ash, Basswood, Cedar, Hard Maple, Red Oak, Soft Maple, Red Oak	Green Lumber, Sawdust
Orville Knoener	W3496 STH 32 Elkhart Lake, WI 53020	920-565-2654	Ash, Cedar, Hard Maple, Red Oak, Soft Maple, White Oak, White Pine	Ad Lumber, Firewood, Green Lumber, Sawdust
Pine Ridge Log Homes	W6529 Valley Lane Plymouth, WI 53073	920-892-4104	Red Pine, White Pine, White Cedar	Log Homes
Pioneer Restorations	W9230 Tower Drive Adell, WI 53001	262-626-8364	---	Log Homes
Serenity Farm & Landscape	2803 Old Park Rd Sheboygan, WI 53081	920-457-0314	---	Firewood

Source: Wisconsin Primary and Secondary Wood Using Industry Database, http://www.woodindustry.forest.wisc.edu/.

Table 72: Secondary wood users in Sheboygan County

Company Name	Address	Phone	Tree Species Purchases	Materials Purchased	Products Sold
A J S & Associates	200 Industrial Dr Random Lake, WI 53075	920-994-4300	Hard Maple, Soft Maple, Sap Gum, Tupelo	Plywood, Lumber	Handles, Beer Tap
Arts Display Inc	721 Riverfront Dr Sheboygan, WI 53081	920-452-2061	Basswood, Cherry, Hard Maple, Red Oak, Walnut	Pre-finished Stock	Picture Frames
Bemis Mfg Co	300 Mill St Sheboygan Falls, WI 53085	920-467-4621	Ash, Birch, Hickory, Pecan, Hard Maple, Soft Maple	Sawdust, Shavings, Wood Waste, Solid Wood	Toilet Seats
Derus Patterns Inc	339 Forest Ave Sheboygan Falls, WI 53085	920-467-2735	Honduras Mahogany, Hard Maple, Sugar Pine	Plywood	Wood Patterns
Ellingers Agatized Wood Inc	923 S 21st St Sheboygan, WI 53081	920-457-7746	Ponderosa Pine	Sawdust, Hardwood Shavings	Cutting Boards, Salad Bowls, Trays
General Contractory Inc	1946 N 15th St Sheboygan, WI 53081	920-458-5799	---	---	Cabinets
Greatwood Log Homes Inc	STH 57 Elkhart Lake, WI 53020	920-876-3378	---	---	Log Buildings
Lakeshore Display Co Inc	2031 Washington Ave Sheboygan, WI 53082	920-457-3695	Mahogany, Yellow Poplar	Fiberboard, Surfaced Kiln Dried Lumber	Displays, Advertising
Lakeshore Pallet Inc.	5504 County Highway V Sheboygan Falls, WI 53085	920-467-4404	Ash, Aspen, Basswood, Birch, Yellow Poplar, Cherry, Hard Maple, Soft Maple, Mixed Hardwoods, Red Oak	Hardwood Dimension, Softwood Dimension, Oriented Strand Board Plywood	Pallets, Skids, Panels Dimension
Leick Furniture Inc	2219 S 19th St Sheboygan, WI 53081	920-451-4060	Red Oak	Particleboard, Rough Green Lumber	Household Furniture
Millersville Box Co	931 Millersville Ave Howards Grove, WI 53083	920-565-3331	Aspen, Soft Maple, Mixed Hardwood	Cants	Pallets, Skids
Natural Habitat Structures	N4981 CTH S Plymouth, WI 53073	920-893-5308	Spruce, Western Pine	Plywood, Surfaced Kiln Dried Lumber	Mobile & Modular Homes
Nemschoff Chairs Inc	2218 Julson Ct Sheboygan, WI 53082	920-457-7726	Cherry, Hard Maple, Soft Maple, Red Oak, Walnut	Hardwood Dimension	Cabinets, Public Building Furniture, Other Furniture
Oak Shop	N5017 Big Bend Ln Sheboygan Falls, WI 53085	920-467-6187	Red Oak, White Oak	Rough Green Lumber	Household Furniture
Ongna Wood Products Inc*	W3535 Cth OO Sheboygan Falls, WI 53085	920-564-3123	Ash, Aspen, Hard Maple, Soft Maple, Red Oak, White Oak, SPF(Canadian)	Plywood, Lumber	Boxes, Crates, Pallets, Skids
Otter Creek Landscape & Wreath	N6625 STH 57 Plymouth, WI 53073	920-893-8700	Ponderosa Pine	Particleboard, Plywood, Lumber	Wreaths
Richardson Brothers Co	635 CTH PP Sheboygan Falls, WI 53085	920-467-4631	Cherry, Hard Maple, Red Oak	Hardwood Dimension	Boat Interiors
Scholten Pattern Works Inc	3321 Paine Ave Sheboygan, WI 53081	920-457-5651	Mahogany, Sugar Pine	Oriented Strand Board, Plywood, Surfaced Kiln Dried Lumber	Wood Patterns
Schu Industries Inc	616 North St Random Lake, WI 53075	920-994-9528	Birch, Cherry, Hard Maple, Soft Maple, Red Oak	Fiberboard, Plywood, Laminates, Rough & Surface Kiln Dried Lumber	Public Building Furniture
Sheboygan County Woodworking	W3106 STH 32 Elkhart Lake, WI 53020	920-565-3099	Hard Maple, Soft Maple, Red Oak, Ponderosa Pine	Particleboard, Fiberboard, Hardboard, Surfaced Kiln Dried Lumber	Advertising Displays
Sheboygan Madewell Chair Co	512 N 15th St Sheboygan, WI 53081	920-457-7878	Birch, Cherry, Hard Maple, Red Oak	Rough Kiln Dried Lumber	Houshold, Office, and Public Building Furniture
Sheboygan Substrates	2924 S 31st St Sheboygan, WI 53082	920-452-1503	---	---	Molded Woodfiber Components
Sohres Building Systems	1019 Erie Sheboygan, WI 53081	920-458-0409		Particleboard, Fiberboard, Hardboard, Plywood, Surfaced Kiln Dried Lumber	Cabinets
T Weber & Companions	W8406 S CTH A Adell, WI 53001	920-994-9451	---	---	Models/Crafts
The Grove Charcoal Co	PO Box 386 Cedar Grove, WI 53013	920-668-8080	Mixed Hardwoods	Rough Air and Kiln Dried Lumber	---

Table 72: Secondary wood users in Sheboygan County cont.

Company Name	Address	Phone	Tree Species Purchases	Materials Purchased	Products Sold
West Shore Industries	5300 STH 42 N Sheboygan, WI 53083	920-565-4715	Cherry, Hard Maple, Soft Maple, Red Oak, White Oak	Particleboard	Counter Tops, Tables
Wilderness Log Homes, Inc.	N5821 CTH S Plymouth, WI 53073	920-893-8416	Eastern White Pine	Cants, Softwood Dimension, Oriented Strand Board, Plywood, Green Lumber	Log Homes
Wind Mill Woodworking Inc	200 Balsam Rd Sheboygan Falls, WI 53085	920-467-2402	MDF	Fiberboard	Partitions, Fixtures, Paneling
Wisc Woodcraft LLC	1234 Kentucky Ave Sheboygan, WI 53082	920-458-1068	Birch, Hard Maple, Soft Maple, Red Oak, E. White Pine, S. Yellow Pine, Redwood, SPF(Canadian), W. Pine, Yellow Poplar	Particleboard, Fiberboard, Hardboard, Oriented Strand Board, Plywood, Veneer, Rough and Surface Kiln Dried Lumber	Cabinets, Other Millwork, Partitions, Fixtures, Displays, Point of Purchase
Wisconsin Box Co	1025 North Ave Cleveland, WI 53015	920-693-2260	---	Plywood	Crates

* Have obtained a DATCP Compliance Agreement.
Source: Wisconsin Primary and Secondary Wood Using Industry Database, http://www.woodindustry.forest.wisc.edu/.

Table 73: Wood residue brokers in Sheboygan County

Company Name	Address	Phone	Products	Broker
Millersville Box Co.	931 Millersville Ave. Sheboygan, WI 53083	920-565-3331	Shavings	Byproduct of own operation
Teunissen Shavings	W3488 Hwy RR Cedar Grove, WI 53013	920-668-6734	Sawdust, Shavings, Particleboard	X

Source: "Wisconsin Wood Residue Brokers", Scott Bowe and Terry Mace, University of Wisconsin-Extension, Forestry Facts No. 103, February 2010.

Marshalling Yards[25]

Sheboygan County was placed under quarantine when EAB was found in nearby Newburg, WI. A quarantine will limit the movement of firewood, ash nursery stock or ash logs or timber out of the quarantine. For more information on quarantines and regulations that will be put in place, refer to *Section VII - EAB Confirmation, Authority and Responsibility.*

In order to deal with the increase in wood debris and the restrictions on its movement, a marshalling yard may need to be established. A marshalling yard is a disposal site whose purpose is to help prevent ash wood which could potentially house EAB from being transported out of a quarantined area. Marshalling yards are set up with utilization in mind and are used to merchandise or dispose of wood materials which may or may not be infested. They can be used as staging sites for wood processing, such as chipping, grinding, debarking and sawing, and related marketing activities. The yards also serve as temporary or emergency storage sites when trees are removed. In addition, they allow municipalities, tree service companies, utilities and individuals to drop off cut ash material for processing and disposal in a manner to prevent artificial spread. Marshalling yards or wood recycling centers may also accept various species, not just ash, and can make wood disposal more efficient and economical.

When determining where to put a marshalling yard the following should be considered:

- The site can be located on public or private property within the quarantined area.

[25] Wisconsin Department of Natural Resources, Emerald Ash Borer Toolkit, http://dnr.wi.gov/forestry/uf/eab/

- The site can be contracted or provided by a municipality.
- Size requirements depend on potential wood volume, proximity of other yards, and merchandising activities that will take place. i.e. If there are other disposal sites nearby and the site will only be used for chipping operations, a smaller site (3 to 5 acres) is likely to be enough. However, if there are no other disposal sites in the area, a large volume of local wood and there are multiple utilization objectives, a larger site (~10 acres) would better accommodate processing and storage.
- The property should be fenced to prevent items other than wood from being disposed at the site as well as to protect the public from accessing potentially dangerous equipment.

VII. EAB Confirmation, Authority, and Responsibility

The discovery of EAB in Sheboygan County will require a cooperative effort between local, state, and federal departments and agencies. When EAB is found in the county all three entities will play a role in the prevention and regulation of its movement.

Any suspected EAB find can be reported in a couple of ways: notify DATCP through their toll-free hotline, 1-800-462-2803 or notify the local authority for your area (see section below). Any suspected infestation will have to be confirmed by the USDA-APHIS laboratory or by a specialist at DATCP. When EAB is confirmed in the county USDA-APHIS and DATCP will first notify any affected individuals, such as local officials and key stakeholders, prior to the public release of information. Second, they will place the county under quarantine. A quarantine is a system of rules administered by the USDA-APHIS and DATCP. The rules are intended to help prevent the spread of EAB by slowing its movement, tracking ash trees from their origin to their final destination, and by using compliance agreements.

In addition, when an EAB find is confirmed in Sheboygan County, one of two response strategies will be implemented. If it is a large infestation covering a wide geographic area, the Incident Command System (ICS) Response Organization, as outlined in the *Wisconsin Emerald Ash Borer Response Plan*, will be activated to manage the infestation. The ICS structure establishes a common set of objectives and strategies, allowing for a team effort between all agencies. The ICS Response Organization will implement the state response plan, gather and assess data, and conduct investigations. If it is a smaller infestation limited in its geographic extent, then small interagency response teams will be created. Here WDNR and DATCP representatives will work with the local authorities in managing the response.

EAB Regulations for Quarantined Areas

In order to prevent further spread of EAB through artificial (human assisted) means, the following materials are regulated in quarantined areas:

- Ash trees, limbs, branches, and roots
- Ash logs, slabs, or untreated ash lumber with bark attached
- Cut firewood of all non-coniferous species
- Ash chips and ash bark fragments larger than one inch in two dimensions
- Mixed wood residue that may contain ash
- Any wood items which could harbor living EAB eggs, larvae, or adults and thus transmit an infestation.

For practical purposes, the minimum level of a quarantine will be at the county level. However, additional surrounding counties may have to be quarantined in order for regulated articles to be processed without a significant cost increase to municipalities. This is the case for Sheboygan County. Although EAB has not been detected in the county, due to its close proximity to Ozaukee County, Sheboygan County was also placed under quarantine. Quarantines are regulated at the federal and state levels. USDA-APHIS will primarily regulate interstate movement of regulated materials. DATCP will regulate intrastate movement of regulated materials. In addition, DNR Wardens have the authority to enforce and write tickets on the spot for the movement of regulated materials through NR40 (Wisconsin's Invasive Species Identification, Classification and Control Rule). While

movement of material anywhere within the quarantine is legal, caution should be placed on the movement of material across large expanses of the quarantine to limit any further spread of EAB.

Quarantines will primarily affect nurseries, firewood dealers, and mills. DATCP will work with affected industries and communities to minimize the impacts. Compliance agreements are the most common tool used to allow industries to conduct business and move affected material while protecting areas of the state not yet affected. Compliance agreements allow the movement of affected material from quarantined areas to unquarantined areas from October 1 to March 31 and require all material to be processed according to legal specifications by May 1. The dates are determined based on the life cycle of EAB. EAB is in its larval stage under the bark of the trees from approximately October 1 to May 1, thus when transporting material during this time spread is minimized. However, due to EAB typically emerging from the trees in its adult "flight" stage between May 1 and September 30, no material can be moved outside quarantine areas during this period and thus the need to have all material that was moved processed by May 1.

As of September 2009, Ongna Wood Products, Inc. in Sheboygan Falls is the only wood products company in the county with a DATCP compliance agreement. In addition, there is one certified firewood dealer in the county, Timberblaze LLC in Plymouth. For a complete list of dealers refer to DATCP website, http://www.datcp.state.wi.us. Listed below is a summary of EAB regulations by industry[26]. For a more extensive look at both federal and state summaries please refer to Appendix J.

Nurseries

Ash nursery stock is prohibited from being distributed outside of the EAB quarantine area.

Mills & Loggers

Ash logs cannot be moved out of the quarantine area during the adult flight period (roughly April 1 through September 30) unless fumigated or debarked. From October 1 through March 31, ash logs may be allowed to be moved to an approved mill outside of the quarantine area for processing by March 31. Bark and wood waste must be processed by March 31. These processes must be approved by state or federal agriculture agencies. Contact officials for further information.

Firewood Producers & Users

All hardwood firewood is prohibited from distribution outside the EAB quarantine area unless it has been heat treated, fumigated or debarked (plus removal of ½ inch of wood). These processes must be approved by state or federal agriculture agencies. Firewood not for commercial sale (homeowner use) may be moved within the quarantine area but users should avoid moving firewood any distance from the area the wood originated from to reduce further spread of EAB.

Green Lumber Manufacturers

Ash lumber will need to be processed in an approved manner, such as complete removal of bark (plus ½ inch of wood), kiln drying by approved standards, or fumigation prior to

[26] Easy Guide for Emerald Ash Borer Regulations, DATCP and USDA-APHIS.

distribution out of the quarantine area. All processes will need approval by state or federal agencies. Contact officials for further information.

Pallet Producers

Ash lumber (generated from ash from the quarantine area) used to make pallets will need to be processed in a manner approved by state or federal agencies. Contact officials for further information.

Wood Waste

Wood waste from pruning, storm damage, or removals should not be moved from the point of action in order to reduce the spread of EAB. Waste wood produced for mulch should not have chips larger than 1" x 1" in two dimensions. Locations for wood waste drop-off may be established in the near future. Contact officials for more information.

Local Authority

Sheboygan County contacts for urban forestry issues can be found in Table 74 and 75.

Table 74: Sheboygan County municipal contacts

Municipality	Contact Position and Name		Phone	Email
City:				
Plymouth	Director of Public Works	Bill Immich	920-893-1271	wimmich@plymouthgov.com
Sheboygan	Deputy Director of Public Works	David Biebel	920-459-3366	dbiebel@ci.sheboygan.wi.us
Sheboygan Falls	Director of Public Works	Mike Mersberger	920-467-7901	dpwmikem@charterinternet.com
Village:				
Adell	Director of Public Works	Jeff Kreutzinger	920-946-5363	jhk804@wi.twcbc.com
Cascade	Clerk	Sherry Gallagher	920-528-8642	cascade@wi.rr.com
Cedar Grove	Superintendent of Public Works	Paul Dekker	920-668-6523	---
Elkhart Lake	Clerk	Jeanette Moioffer	920-876-2122	jmoioffer@verizon.net
Glenbeulah	Clerk/Treasurer	Michele Bertram	920-526-3701	glenbeulah@wi.rr.com
Howards Grove	Public Works Supervisor	James Schuette	920-565-3051	villagehgdpw@tds.net
Kohler	Superintendent of Public Works	Bruce Neerhof	920-459-3881	bneerhof@kohlervillage.org
Oostburg	Director of Public Works	Roger Oonk	920-564-3844	roger.oonk@oostburg.org
Random Lake	Director of Public Works	Daniel Klotz	920-980-0598	dklotz@randomlake.org
Waldo	Clerk	Catherine Parrish	920-528-7534	Waldo-clerk@excel.net
Town:				
Greenbush	Town Board Chairman	Mike Limberg	920-526-3536	---
Herman	Clerk	George Marthenze	920-565-2934	TownHerman@tds.net
Holland	Clerk	Sharon Claerbaut	920-668-6696	clerk@townofholland.com
Lima	Clerk/Treasurer	Teresa Stengal	920-467-6037	townlima@dishmail.net
Lyndon	Public Works Foreman	Al Steiner	920-838-3249	---
Mitchell	Clerk	Mari Born	920-528-7776	townofmitchell@aol.com
Mosel	Clerk/Treasurer	Rachel Rehbein	920-565-3700	townofmosel@wi.rr.com
Plymouth	Clerk/Treasurer	Laura Raeder	920-893-5713	lraeder@excel.net
Rhine	Clerk/Treasurer	Bonnie Stoelting	920-876-3413	bstoelting@townrhine.com
Russell	Clerk	Lawrence Kempf	920-894-2370	kempf_vl@tm.net
Scott	Clerk/Treasurer	Billi Jo Richter	920-994-4470	townascott@aol.com
Sheboygan	Clerk	Cathy Conrad	920-451-2320	cathy@townofsheboygan.org
Sheboygan Falls	Clerk/Treasurer	Jeanette Meyer	920-467-1922	townshebfalls@yahoo.com
Sherman	Clerk/Treasurer	Rhonda Klatt	920-994-9421	townofsherman@yahoo.com
Wilson	Clerk	Cheryl Rostollan	920-208-2390	clerk@townwilson.com

Other Contacts

Table 75: Sheboygan County and State agency contacts

Agency/Department	Contact Position and Name		Phone	Email
Sheboygan County:				
Land & Water Conservation Dept.	Department Manager	Patrick Miles	920-459-1372	milespem@co.sheboygan.wi.us
Planning Dept.			920-459-3060	planning@co.sheboygan.wi.us
Emergency Management Dept.	Department Director	Steven Steinhardt	920-459-3360	steinscs@co.sheboygan.wi.us
U.W. Extension	Agriculture Agent	Mike Ballweg	920-459-5900	michael.ballweg@ces.uwex.edu
Wisconsin Department of Natural Resources:				
Urban and Community Forestry	S.E. Regional Urban Forestry Coordinator	Kim Sebastain	414-263-8602	Kim.Sebastian@Wisconsin.gov
Division of Forestry	Sheboygan Co. Forester	Tim Beyer	920-892-8756	tim.beyer@wisconsin.gov
Wisconsin Department of Agriculture, Trade, & Consumer Protection:				
Emerald Ash Borer Hotline			1-800-462-2803	eab@datcp.state.wi.us
	Regulatory Supervisor	Bob Dahl	608-224-4573	Robert.dahl@wisconsin.gov

VIII. Communication and Education

EAB Outreach for Municipalities

Public awareness is vital to slowing the spread of EAB, therefore it is never too early to begin the education and outreach process. Education and outreach plays a key role in communicating the effects of EAB on a community's urban forest and increasing public awareness, understanding, and support for an EAB plan and program. Increasing public awareness of your community's EAB plan will also enhance the effectiveness of detection survey efforts, help to prevent adverse public reaction to control efforts, and promote compliance with regulations. Due to the importance of public awareness, communities are encouraged to take steps to educate themselves and their citizenry about EAB. This section provides a general overview of different public outreach efforts that communities can conduct for EAB education. When determining what method is best for your community consider who your target audience is; what are the most commonly asked questions by employees, public officials, and citizens; and identify the key message(s) for all EAB plan initiatives (i.e. don't move firewood, examine your trees, know state and federal regulations).

Meetings and presentations

In many cases, UW-Extension-Sheboygan County, DATCP, and WDNR, personnel can attend local meetings, give a presentation, and answer your questions about EAB. In addition, those in charge of implementing a community's EAB plan could prepare a PowerPoint presentation on EAB and local efforts that could easily be presented to local boards and committees. No matter what method is chosen, make sure all interested parties and citizens are informed about the meeting.

Family events

Organize family friendly events that include EAB education. This could be held in conjunction with Arbor Day activities or other community events.

Displays, brochures, and cards

Set up EAB informational displays and materials in a municipal office, library, at the county fair, or other controlled environment. DATCP and WDNR have various materials produced that can be loaned or distributed to interested citizens. Or partner with volunteers to man booths at key locations during targeted times. For example, during EAB Awareness Week set booths up at campgrounds, rest stops, and high traffic shopping areas.

Doorhangers

When EAB has been found in your community, or when EAB control activities are being conducted an area, doorhangers are a method for educating the citizens in the area.

News releases and publications

Include articles in a local municipal newsletter or the local newspaper. There are many pre-written articles available from county departments, UW-Extension, and WDNR.

Utility mailings

Work with the local utility companies/departments (i.e. water, electric) to include an informational brochure in the local utility mailings.

Websites

If your community has a website, have a page dedicated to EAB education and activities. This could be as simple as having a link to the WDNR or Wisconsin's EAB Information Source websites. Refer to Appendix M for a listing of EAB resources

EAB Planning for Homeowners[27]

With the find of EAB so close to Sheboygan County in neighboring Ozaukee County, the health of ash trees within your neighborhood, woodlot, or yard could be in danger. As a homeowner you may have heard of EAB, but are left wondering how EAB is going to affect my trees and what do I do? As a homeowner you can take steps to reduce the threat and spread of EAB by following the simple guidelines below. Doing so will contribute to healthy urban and rural forests in your community, surrounding counties, and throughout the state.

- Keep ash that is infested with EAB in place – do not move it off your property.
- Keep hardwood firewood local – do not move your own from your property and if you are buying it, buy from a local or certified firewood dealer near where you will use it.
- Protect high value ash trees with products that are labeled for controlling EAB. Refer to *Section V - EAB Preparation, Detection, and Control* for information on chemical control of EAB or Appendix G
- Replace infested ash with other tree species. Refer to *Section V - EAB Preparation, Detection, and Control* or Appendix I for information on alternative species to ash.

In addition to the guidelines above, there is other information that could be helpful in understanding and controlling EAB.

Know how to identify ash trees and the signs of EAB

Ash trees can easily be confused with other species. In addition, ash trees are susceptible to many insects and diseases that can mimic the same signs of EAB. For information on how EAB, ash tree identification, and the signs and symptoms of EAB refer to *Section II – EAB* or Appendix B.

Stay aware of where EAB has been found

Information on the location of EAB changes quickly. For the most recent updates, visit www.emeraldashborer.wi.gov (statewide) or http://www.uwex.edu/ces/cty/sheboygan/ (local) or contact your Sheboygan County UW-Extension office.

Know the laws regarding EAB

The emerald ash borer is regulated by the Wisconsin Department of Natural Resources (DNR) through Chapter NR 40, Wis. Adm. Code and by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) in Chapter ATCP 21, Wis. Adm. Code. It is illegal to move any life stages of EAB under NR 40. DATCP, however, allows certain exemptions for businesses authorized through a compliance agreement. For more information about EAB regulations, quarantines, and compliance agreements refer to *Section VII - EAB Confirmation, Authority and Responsibility* or Appendix J.

[27] The Wisconsin Emerald Ash Borer Program, An EAB Guide For Homeowners.

Understand management options for EAB

Research has shown that EAB infested trees may show no symptoms until they have been infested for more than two to three years. Three general management options are to treat trees with an insecticide, remove and replace your ash trees, and or do nothing. For more information on these subjects refer to *Section V - EAB Preparation, Detection, and Control*.

Know the option for disposing of your infested ash wood

In order to minimize the spread of EAB it is important to keep ash infested wood at your home and use it for firewood or mulch on site. Or work with a certified arborist to properly dispose of infested material. Other options are listed in Appendix K

For a handout summarizing the items in this section refer to Appendix L.

IX. Funding[28]

The costs associated with EAB will primarily be the responsibility of individual municipalities. However, with proactive planning these costs can be reduced and distributed over multiple budget years. While there is currently some Federal and State assistance available with initial surveys and assessments when EAB is found in your local area, there is currently no funding available for recommended response options to an EAB find and/or implementation of local EAB Plans. It is unlikely that Federal and State funding assistance will become available in the future for EAB management, therefore Wisconsin is currently urging municipalities and residents to independently explore various potential funding options. Funding assistance for municipalities may be available through several sources listed below:

Wisconsin DNR Urban Forestry Grants: At current funding levels, these grants are not available to provide funding for control efforts. They may provide funding for urban forest management and EAB readiness. This may include tree inventories, EAB response plans, reforestation efforts, writing of tree ordinances and contract specifications, and public awareness programs and materials. For more information, visit: http://dnr.wi.gov/forestry/UF/grants/.

Community Development Block Grants: Some communities in other states are using this type of funding to help pay for EAB response and control measures.

Transportation funds: Some communities in infested states are using funds designated for their roads to help pay for EAB costs in their right-of-ways. Some are using federal Transportation Enhancement funds for replanting. Information on Wisconsin's TE program is available at: http://www.dot.wisconsin.gov/localgov/aid/te.htm

Utility companies: Utility companies in Wisconsin may provide assistance with removing trees that are in conflict with power lines and replacing them with smaller trees. Some have programs to subsidize planting trees for energy conservation. Contacts for major local utility companies in Sheboygan County are:

We Energies - Call Center, 1-800-242-9137

Plymouth Utility - Customer service, 920-893-1471

Sheboygan Falls Utility - Customer service, 920-467-7900

Alliant Energy, Customer service - 1-800-862-6222, ask for Greg Pulver

American Transmission Company (ATC) - 262-506-6884, ask for Chris Dailey

Revenue from wood waste: In areas where EAB is killing a lot of trees, communities have developed relationships with private businesses to turn removed ash trees into lumber, furniture, mulch, fuel pellets and other products. For more information on wood utilization refer to *Section III – EAB Community Response Plan Elements*

Community foundations and TreeBanks: Some communities have charitable foundations set up to fund a variety of community activities, including specific funds for tree related activities. TreeBank is a program that helps communities set up and market local "branches" to receive donations and provide funding for community tree planting, education and stewardship. For more information refer to: http://www.itreebank.org/

[28] Wisconsin Department of Natural Resources, Emerald Ash Borer Toolkit, http://dnr.wi.gov/forestry/uf/eab/.

Reallocating funds: Most communities are going to be faced with shifting funds from one part of a municipal budget to the departments responsible for public-owned trees to deal with EAB when it arrives. As part of your community's EAB readiness plan, it will need to be considered where these resources could best come from with the least impact on existing services. Increasing the amount of funding allocated to urban forestry activities will allow your community to prepare for EAB before it arrives, help enable long-term development of diverse urban forests, and help ensure your community is prepared to handle future storm and infestation events.

Taxes: While likely to be an unpopular solution, some communities have chosen to raise taxes in order to fund EAB management efforts.

Seek additional support: Enlist aid from elected state and federal officials for EAB funding.

Other possible sources:

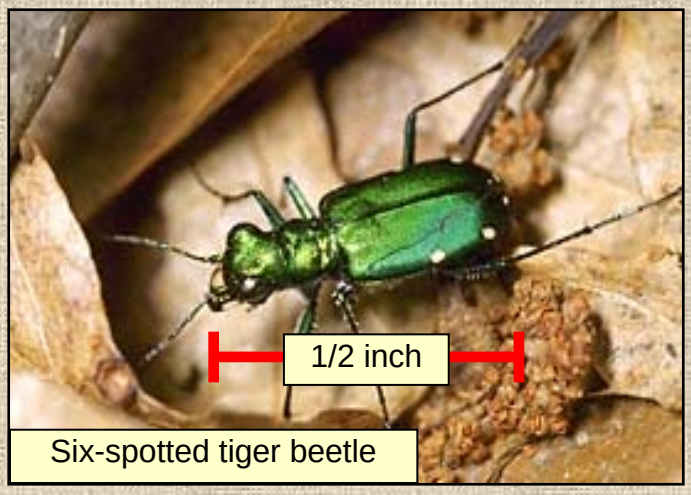
- Grants Information Collection - UW Madison, http://grants.library.wisc.edu
- Wisconsin Dept. of Commerce, http://www.commerce.state.wi.us/
- National Urban and Community Forestry Advisory Council, http://www.treelink.org/nucfac/
- USDA grant and Partnership Programs, http://www.wssa.net/WSSA/Grants/USDA_Grants_Workbook_2007.pdf
- WDNR Forestry Publications Site, http://dnr.wi.gov/forestry/relatedsites.htm

Appendices

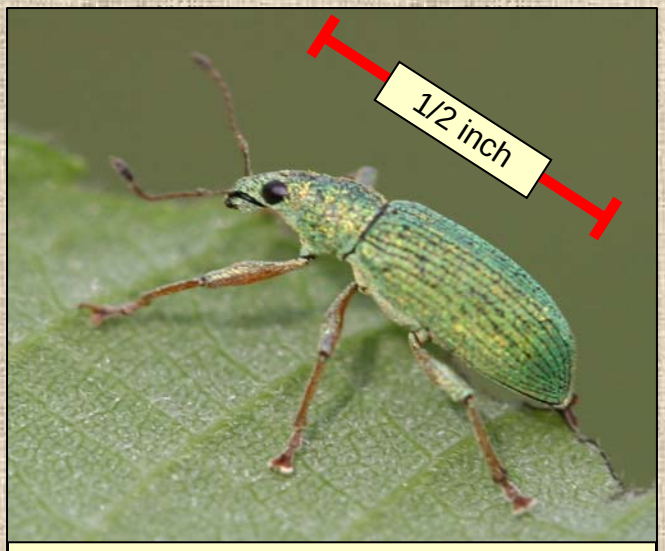
Appendix A

EAB Look a Likes
And Native Ash Tree Pests

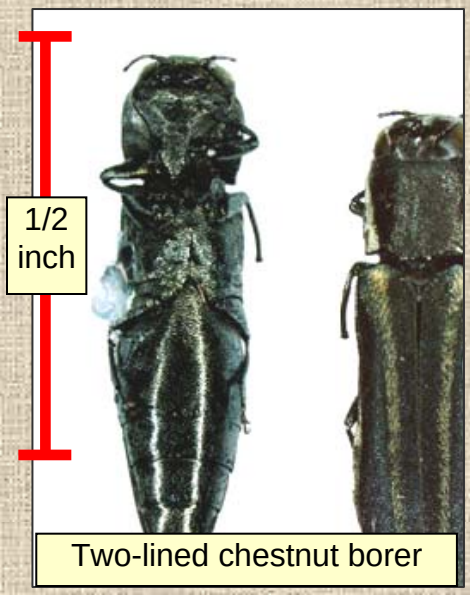
Emerald Ash Borer and Its Common Wisconsin Look-alikes



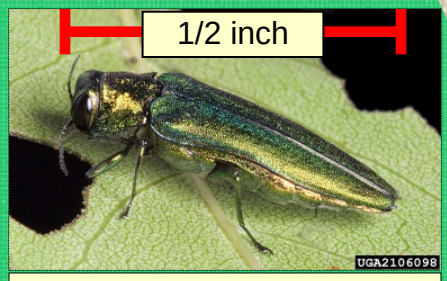
Six-spotted tiger beetle



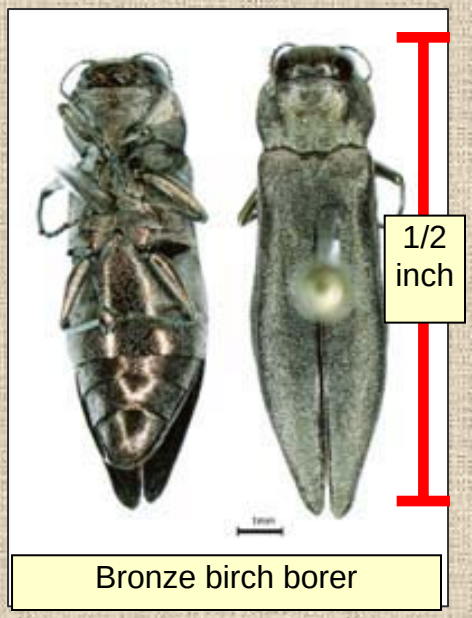
Pale green weevil



Two-lined chestnut borer

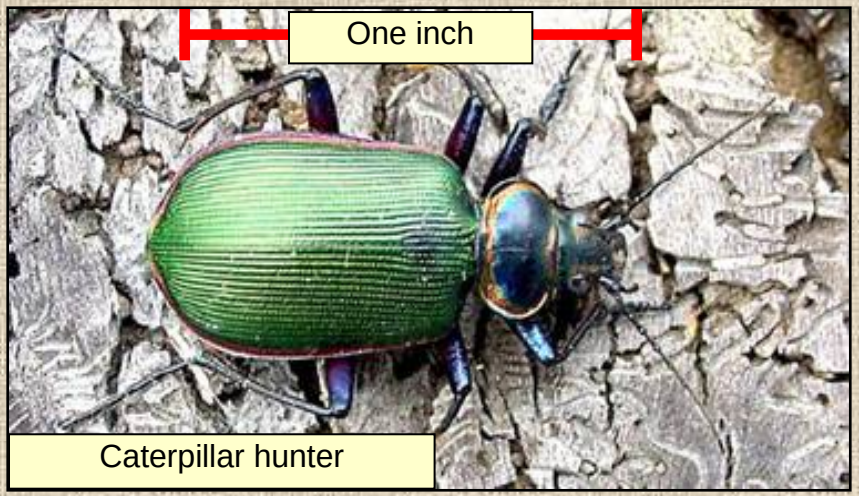


Adult emerald ash borer



Bronze birch borer

Japanese beetle



Caterpillar hunter

WISCONSIN DEPT. OF NATURAL RESOURCES

1-800-462-2803

emeraldashborer.wi.gov

Extension Bulletin E-2939 New, February 2005

Native Borers and Emerald Ash Borer Look-alikes

Native Ash Borers

D.G. Nielsen, Ohio State University/OARDC

J. Solomon, USDA Forest Service www.forestryimages.com

D. Herms, Ohio State University/OARDC

D. Herms, Ohio State University/OARDC

D. Herms, Ohio State University/OARDC

D. Herms, Ohio State University/OARDC

Native ash borers are North American insects that tunnel under the bark of ash trees, sometimes causing enough damage to seriously weaken trees.

These two borers attack healthy ash trees:

Banded ash clearwing, *Podosesia aureocincta*; adult (Fig. A), larva (Fig. B).

Ash/lilac borer, *Podosesia syringae*; adult (Fig. C).

- Wasp-mimicking moths that feed on xylem of ash trees.
- Larvae are round with legs and expel frass from tree (Fig. D).
- Round exit hole (1/4 inch); pupal case exposed in exit hole upon emergence (Fig. E).

These three borers attack stressed or dying ash trees:

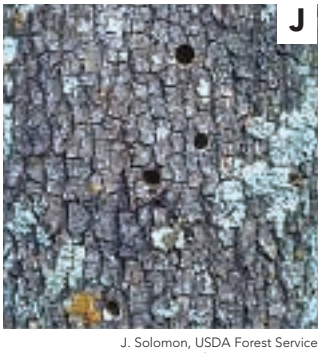
Redheaded ash borer, *Neoclytus acuminatus*; adult (Fig. F), larva (Fig. G).

Banded ash borer, *Neoclytus caprea*; adult (Fig. H).

- Longhorned beetles (roundheaded borers) that attack stressed ash trees, but also colonize elm, hickory, oak, linden and others.
- Larvae tunnel deep into xylem (Fig. I) and adults emerge from round-oval exit holes measuring 1/4 inch (Fig. J).

J. Solomon, USDA Forest Service
www.forestryimages.com

Csoka, Hungary For Res Inst.,
www.forestryimages.com



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Emerald Ash Borer

MICHIGAN STATE UNIVERSITY EXTENSION

Native Borers (continued)

Eastern ash bark beetle, *Hylesinus aculeatus*; adult (Fig. K).

- Cylindrical bark beetle that forms galleries beneath the bark of ash trees (Fig. L).
- Infested trees peppered with tiny, round exit holes measuring approximately 1/16 inch (Fig. M).


K

J. Solomon, USDA Forest Service
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L

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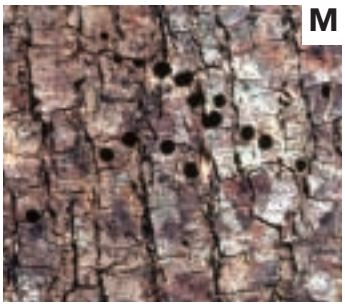
M

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Emerald Ash Borer Look-alikes

The following insects are common to Michigan and could possibly be confused with emerald ash borer.


N

Michigan State University


O

University of Arkansas


P

Michigan State University

- **Six-spotted tiger beetle**, *Cicindela sexguttata*; adult measures 1/2 inch long (Fig. N).
- **Caterpillar hunter**, *Calosoma scrutator*; adult measures 1 inch long (Fig. O).
- **Japanese beetle**, *Popillia japonica*; adult measures slightly less than 1/2 inch long (Fig. P).
- **Bronze birch borer**, *Agrilus anxius*; adult measures approximately 1/2 inch long (Fig. Q).
- **Two-lined chestnut borer**, *Agrilus bilineatus*; adult measures approximately 1/2 inch long (Fig. R).
- Several other uncommon metallic wood-boring beetles.


Q

J. Zablotny, USDA APHIS PPQ


R

J. Zablotny, USDA APHIS PPQ

New - 2:05 - 5M - KMF/LB

Appendix B

Ash Tree Identification

Extension Bulletin E-2942 New, May 2005

Ash Tree Identification

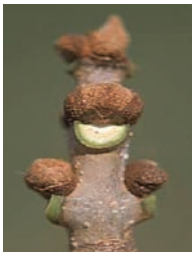
Ash species attacked by emerald ash borer include green (*Fraxinus pennsylvanica*), white (*F. americana*), black (*F. nigra*), and blue (*F. quadrangulata*), as well as horticultural cultivars of these species. Green and white ash are the most commonly found ash species in the Midwest with blue ash being rare.

While other woody plants, such as mountainash and pricklyash, have "ash" in their name, they are not true ash, or *Fraxinus* species. Only true ash are susceptible to attack by emerald ash borer.

To properly identify ash trees, use the following criteria:

Branch and Bud Arrangement

Branches and buds are directly across from each other and not staggered. When looking for opposite branching in trees, please consider that buds or limbs may die; hence not every single branch will have an opposite mate.



Diane Brown-Rytlewski

Leaves

Leaves are compound and composed of 5-11 leaflets. Leaflet margins may be smooth or toothed. The only other oppositely branched tree with compound leaves is boxelder (*Acer negundo*), which almost always has three to five leaflets. White ash (on left) and green ash (on right)

*Paul Wray, Iowa State University

Bark

On mature trees (left), the bark is tight with a distinct pattern of diamond-shaped ridges. On young trees (right), bark is relatively smooth.

*Paul Wray, Iowa State University

Seeds

When present on trees, seeds are dry, oar-shaped samaras. They usually occur in clusters and typically hang on the tree until late fall, early winter.

MICHIGAN STATE UNIVERSITY EXTENSION

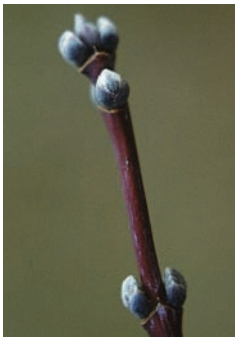
Emerald Ash Borer

Tree Species Resembling Ash

Boxelder *(Acer negundo)*

Exhibits opposite branching and compound leaves. However, has 3 to 5 leaflets (instead of 5 to 11) and the samaras are always in pairs instead of single like the ash.

*Paul Wray, Iowa State University



*Bill Cook, Michigan State University

European Mountainash *(Sorbus aucuparia)*

Leaves are compound with alternate (staggered) branching. Tree bears clusters of creamy white flowers in May. Fruits are fleshy, red-orange berries.

Diane Brown-Rytlewski

*Boris Hrasovec, University of Zagreb

Shagbark Hickory *(Carya ovata)*

Leaves are compound with 5 to 7 leaflets, but the plant has an alternate branching habit. Fruit are hard-shelled nuts in a green husk.

*Paul Wray, Iowa State University

*Paul Wray, Iowa State University

Elm *(Ulmus species)*

Branching is alternate and the leaves are simple with an unequal leaf base.

*Paul Wray, Iowa State University

*Paul Wray, Iowa State University

*Paul Wray, Iowa State University

Black Walnut *(Juglans nigra)*

Leaves are compound with 9 to 15 leaflets, but the plant has an alternate branching habit. Fruit is a large dark brown nut inside a green husk.

*Paul Wray, Iowa State University

Authors: Kimberly Rebek and Mary Wilson

*www.forestryimages.org

New - 5:05 - 6,250 - KMF/LB

Appendix C

Elements of a Tree Removal Contract
and Bid Language

SAMPLE TREE REMOVAL CONTRACT BID LANGUAGE & ELEMENTS

Submission of Bids

All bids shall be submitted in sealed envelopes and shall include the following information on the face of the envelope:

Bidder's Name & Address
Bid Number and Item

Failure to do so may result in a premature opening of, or failure to open, such proposal. All bids must be hand delivered or mailed to: (Community's Address)
Bidders are responsible for submitting proposals before stated closing time. Delays in the mail will not be considered. Any proposal received after the stated deadline will be rejected.

Bidder shall submit a unit price for each item listed.

Consideration of Proposals

The Community hereby reserves the right, in its sole discretion, to reject any/or all bids, to award the bid in its entirety, in part, or not at all, as it may deem to be in the best interest of *The Community.*

General Specifications

- **Contract Term**
  The term of this contract will be from XXXXXX through XXXXXX
- **Notification of Ownership**
  The Contractor shall make the following notifications in writing:
  - When the Contractor becomes aware that a change in its ownership or officers has occurred, or is certain to occur, and that could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify *The Community* within 30 days.
  - The Contractor shall also notify *The Community* within 30 days whenever changes to asset valuations or any other cost changes have occurred, or are certain to occur, as a result of a change in ownership or officers.
- **Contractor Responsibilities**
  The contractor will be required to assume responsibility for all contractual activities, whether or not that contractor performs them. Further, *The Community* will consider the contractor to be the sole point of contact with regard to contractual matters, including payment of any and all charges resulting from the anticipated contract. If any part of the work is to be sub-contracted, this contract must include a list of sub-contractors, including firm name, address, contact person, and a complete description of work to be sub-contracted. *The Community* reserves the right to approve sub-contractors and to require the contractor to replace sub-contractors found to be unacceptable. The contractor is totally responsible for adherence by the sub-contractor to all provisions of this contract.
- **General Indemnification**
  To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the State, its departments, divisions, agencies, sections, commissions, officers, employees and agents, from and against all losses, liabilities, penalties, fines, damages and claims (including taxes), and all related costs and expenses (including reasonable attorneys' fees and disbursements, costs of investigation, litigation, settlement, judgments, interest and penalties), arising from or in connection with any of the following:
  - Any claim, demand, action, citation or legal proceeding against *The Community*, its employees and agents arising out of or resulting from (1) the product provided or (2) performance of the work, duties, responsibilities, actions or omissions of the Contractor or any of its sub-Contractors under this Contract.

- Any claim, demand, action, citation or legal proceeding against *The Community*, its employees and agents arising out of or resulting from a breach by the Contractor of any representation or warranty made by the Contractor in this Contract;
- Any claim, demand, action, citation or legal proceeding against *The Community*, its employees and agents arising out of or related to occurrences that the Contractor is required to insure against as provided for in this Contract;
- Any claim, demand, action, citation or legal proceeding against *The Community*, its employees and agents arising out of or resulting from the death or bodily injury of any person, or the damage, loss or destruction of any real or tangible personal property, in connection with the performance of services by the Contractor, by any of its sub-Contractors, by anyone directly or indirectly employed by any of them, or by anyone for whose acts by any of them may be liable; provided, however, that this indemnification obligation shall not apply to the extent, if any, that such death, bodily injury or property damage is caused solely by the negligence or reckless or intentional wrongful conduct of *The Community*;
- Any claim, demand, action, citation or legal proceeding against *The Community*, its employees and agents which results from an act or omission of the Contractor or any of its sub-Contractors in its or their capacity as an employer of a person.

- **Liability Insurance**
  - The Contractor is required to provide proof of the minimum levels of insurance coverage as indicated below. The purpose of this coverage shall be to protect *The Community* from claims which may arise out of or result from the Contractor's performance of services under the terms of this Contract, whether such services are performed by the Contractor, or by any sub-Contractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable.
  - The Contractor waives all rights against *The Community*, its departments, divisions, agencies, offices, commissions, officers, employees and agents for recovery of damages to the extent these damages are covered by the insurance policies the Contractor is required to maintain pursuant to this Contract.
  - All insurance coverage provided relative to this Contract/Purchase Order is PRIMARY and NON-CONTRIBUTING to any comparable liability insurance (including self-insurances) carried by *The Community*.
  - The insurance shall be written for not less than any minimum coverage specified in this Contract or required by law, whichever is greater.
  - The insurers selected by Contractor shall have an A.M. Best rating of A or better, or as otherwise approved in writing by *The Community*, or if such ratings are no longer available, with a comparable rating from a recognized insurance rating agency.
  - Before both parties sign this Contract or before the purchase order is issued by *The Community,* the Contractor must furnish to *The Community* certificate(s) of insurance verifying insurance coverage ("Certificates"). The Certificate must be on the standard "accord" form or equivalent. **THE CONTRACT OR PURCHASE ORDER NO. MUST BE SHOWN ON THE CERTIFICATE OF INSURANCE TO ASSURE CORRECT FILING.** All Certificate(s) are to be prepared and submitted by the Insurance Provider. All Certificate(s) shall contain a provision indicating that coverage afforded under the policies WILL NOT BE CANCELLED, MATERIALLY CHANGED, OR NOT RENEWED without THIRTY (30) days prior written notice, except for ten (10) days for non-payment of premium, having been given to *The Community*. The notice must include the Contract or Purchase Order number affected and be mailed to: (COMMUNITY CONTACT INFO). Failure to provide evidence of coverage may, at *The Community's* sole discretion, result in this Contract's termination.
  - The Contractor is required to pay for and provide the type and amount of insurance listed below:

    Commercial General Liability with the following minimum coverage:

$2,000,000	General Aggregate Limit other than Products/Completed Operations
$2,000,000	Products/Completed Operations Aggregate Limit
$1,000,000	Personal & Advertising Injury Limit
$1,000,000	Each Occurrence Limit
$500,000	Fire Damage Limit (any one fire)

    The Contractor must list *The Community,* its departments, divisions, agencies, offices, commissions, officers, employees and agents as ADDITIONAL INSUREDS on the Commercial

General Liability certificate. The Contractor also agrees to provide evidence that insurance policies contain a waiver of subrogation by the insurance company.

Vehicle Liability Insurance

If a motor vehicle is used to provide services or products under this Contract, the Contractor must have vehicle liability insurance on any auto including owned, hired and non-owned vehicles used in Contractor's business for bodily injury and property damage as required by law.

- The Contractor must list ***The Community***, its departments, divisions, agencies, offices, commissions, officers, employees and agents as ADDITIONAL INSUREDS on the vehicle liability certificate. The Contractor also agrees to provide evidence that insurance policies contain a waiver of subrogation by the insurance company.
- Workers' compensation coverage must be provided in accordance with applicable laws governing the employees' and employers' work activities in the state of the Contractor's domicile. If a self-insurer provides the applicable coverage, proof must be provided of approved self-insured authority by the jurisdiction of domicile. For employees working outside of the state of qualification, Contractor must provide appropriate certificates of insurance proving mandated coverage levels for the jurisdictions where the employees' activities occur.
  - Any certificates of insurance received must also provide a list of states where the coverage is applicable.
  - The Contractor also agrees to provide evidence that insurance policies contain a waiver of subrogation by the insurance company. This provision shall not be applicable where prohibited or limited by the laws of the jurisdiction in which the work is to be performed.
- Employers liability insurance with the following minimum limits:
  - $100,000 each accident
  - $100,000 each employee by disease
  - $500,000 aggregate disease
- Sub-Contractors

  Except where ***The Community*** has approved in writing a Contractor sub-Contract with other insurance provisions, Contractor shall require all of its Sub-Contractors under this Contract to purchase and maintain the insurance coverage as described in this Section for the Contractor in connection with the performance of work by those Sub-Contractors. Alternatively, Contractor may include any Sub-Contractors under Contractor's insurance on the coverage required in this Section. Sub-Contractor(s) shall fully comply with the insurance coverage required in this Section. Failure of Sub-Contractor(s) to comply with insurance requirements does not limit Contractor's liability or responsibility.
- Certificates of Insurance and Other Requirements
  - Contractor shall furnish to ***The Community*** certificate(s) of insurance verifying insurance coverage or providing satisfactory evidence of self-insurance as required in this Section (the "Certificates"). Before this Contract is signed, and not less than 20 days before the insurance expiration date every year thereafter, the Contractor shall provide evidence that ***The Community*** and its agents, officers and employees are listed as additional insured, but only to the extent of liabilities assumed by Contractor as set forth in Indemnification Section of this Contract, under each commercial general liability and commercial automobile liability policy.

  - Contractor shall maintain all required insurance coverage throughout the term of the Contract and any extensions thereto and, in the case of claims-made through the Commercial General Liability policies, shall secure tail coverage for at least three (3) years following the expiration or termination for any reason of this Contract. The minimum limits of coverage specified above are not intended, and shall not be construed, to limit any liability or indemnity of Contractor under this Contract to any indemnified party or other persons. Contractor shall be responsible for all deductibles with regard to such insurance. If Contractor fails to pay any premium for required insurance as specified in this Contract, or if any insurer cancels or significantly reduces any required insurance as specified in this Contract without ***The Community's*** written consent, at ***The Community's*** election (but without any obligation to do so) after ***The Community*** has given Contractor at least thirty (30) days written notice, ***The Community*** may pay such premium or procure similar insurance coverage from another company or companies; and at ***The Community's*** election, ***The Community*** may deduct the

entire cost (or part thereof) from any payment due Contractor, or Contractor shall pay the entire cost (or any part thereof) upon demand by *The Community*.

- **Contractor Warranties**
  The Contract will contain customary representations and warranties by the Contractor, including, without limitation, the following:
  - The Contractor will perform all services in accordance with high professional standards in the industry;
  - The Contractor will use adequate numbers of qualified individuals with suitable training, education, experience and skill to perform the services;
  - The Contractor will use its best efforts to use efficiently any resources or services necessary to provide the services listed in this contract;
  - The Contractor will use its best efforts to perform the services in the most cost effective manner consistent with the required level of quality and performance;
  - The Contractor will perform the services in a manner that does not infringe the proprietary rights of any third party;
  - The Contractor will perform the services in a manner that complies with all applicable laws and regulations;
  - The Contractor has duly authorized the execution, delivery and performance of this Contract;
  - The Contractor is capable in all respects of fulfilling and shall fulfill all of its obligations under this Contract.
  - The Contract signatory has the power and authority, including any necessary corporate authorizations, necessary to enter this Contract, on behalf of Contractor.
  - The Contractor is qualified and registered to transact business in all locations where required.

- **Breach of Contract**
  Failure to comply with articles, sections, or subsections of this agreement, or making any false statement in this agreement, will be considered a material breach of this agreement giving *The Community* authority to invoke any and all remedies available to it under this agreement.

  The Community may cancel this Contract without further liability or penalty for any reasons deemed appropriate by *The Community*.

- **Tree Removal Specifications**
  Description of Work - General
  The contractor shall perform the following work for each tree removal. All of the following is to be included in the unit price per tree removal as applicable:
  - Remove all ash trees designated by *The Community* (typically in the form of an inventory)
  - Grind stumps to 10” below soil surface. Remove stump chips, fill with quality topsoil, and apply appropriate premium grade grass seed.
  - For woodlot trees, remaining stumps must not exceed four (4) in height from ground on all sides.
  - Pick up and chip all fallen branches in areas of tree, yard and surrounding areas.
  - Remove and dispose of all generated debris.
  - Clean, sweep and restore to the condition existing prior to the removal operations all areas of paving, lawns, walkways, sidewalks, fixtures, fences etc. that have been damaged, dirtied, altered or displaced by the tree removal work. All debris shall be removed from the site.
  - If the community desires to keep the generated wood and chips, the contractor should transport all tree(s) and chipped materials to a location as directed by the Community. Otherwise, the contractor may keep the tree material and provide a plan on how they will dispose of it.
  - Trees must be removed using acceptable industry practices for such removal. These practices are outlined by the American National Standards Institute (ANSI) for professional arborists in sections A-300 and Z-133. (See www.tcis.org for more information). Contractor should expect that it might be necessary to climb trees to perform the tree removal for this specification.
  - Driveways and alleys are not to be blocked with generated tree debris beyond the time to complete required work on that site and shall at no time remain over night.
  - The Contractor must relocate any fixtures or property (including but not limited to fences, furniture, gates, etc…) necessary to complete the work of this Contract. Any fixtures or property

removed or altered shall be returned to its original site, repaired to its original condition, or if it is unable to be repaired, then replaced with an item of at least equal quality.

- **Safety Precautions**
  - The contractor shall perform work taking precautions against injury to persons, damage to property and interference with vehicular traffic. The contractor shall take necessary precautions to ensure the safety of all persons engaged in the work of this contract.
  - The contractor is responsible for contacting MISS DIG to determine locations of utilities prior to beginning stump grinding activity at each location.
  - When performing tree removal adjacent to existing sewers, drains, water and gas lines, electric or telephone conduits or cables, poles which are to remain in operation, the contractor shall maintain such utility equipment and structures in place at their own expense and shall cooperate with utility companies, homeowners, or other parties owning or operating such utility equipment or structures.
  - The contractor shall be responsible for any and all signage or barricades necessary to ensure the safety of its workers, homeowners, community employees and the general public.
  - The contractor is responsible for following all pertinent local, state and federal Rules and Regulations throughout the period of this contract.

Appendix D

Planting New Trees

Step 4 – Remove twine, clip and fold back wire basket and trim burlap. If left on, this material can girdle the tree.

Note: If planting a containerized tree remove the entire pot.

Step 5 – Carefully remove soil from the top of the root ball to expose the root collar.

Check to see that the root collar is either level with or 1"to 2" above finished grade. Planting a tree too deep can kill it!

Step 6 – Back fill planting space with excavated soil. Water thoroughly to eliminate air pockets. Do not tamp!

Step 7 – Celebrate a job well done ... a properly planted tree!

For more information, contact the WDNR Forestry Program at 608/267-7494 or your local county UW- Extension office.

Step 1-7 photos taken by Bob Queen.

Caring For Your Tree

Watering - Water as needed throughout the season, about 1" per week. To avoid over-watering, remember to check the wetness of the soil under the mulch and adapt your watering to rainfall and soil conditions.

Mulching - Mulch improves soil structure and aeration, keeps roots cool and moist, controls weeds, and keeps lawnmowers and weed whips away from the trunk. To properly mulch, apply 2" to 4" of woody mulch (aged wood chips, shredded bark or something similar) over the root zone. Make sure to pull the mulch 3" to 6" away from the trunk to prevent bark rot and limit rodent feeding.

Staking – Most newly planted trees do not need to be staked. If staking is necessary, use wide webbing straps. Secure webbing to stakes with heavy gauge wire. Attach materials so that the tree is allowed to move in the wind.

Do not encircle the tree with wire threaded through a garden hose – this can girdle the tree. Remove stakes and ties within one year. The use of trunk wrap is not recommended.

Proper Pruning – Less is better, newly planted trees need all the leaves they can get. Remove only dead, broken, diseased or rubbing branches.

Text by Tracy Salisbury, Urban Forester, WDNR and Genny Fannucchi, Forest Resource Education and Awareness Specialist, WDNR. Design by Linda Pohlod, Graphic Artist, WDNR.

This publication is available in alternative format (large print, Braille, audio tape etc.) upon request. Please call 608/267-7494 for more information.

WISCONSIN DEPT. OF NATURAL RESOURCES

Division of Forestry

PUB-FR-184 2001

New Tree Planting

Bob Queen

"One who plants a tree, plants hope."

Selecting Your Tree

Things to consider before planting a tree.

Where to Plant

Where you plant a tree is very important. The first step is to look up. If there are overhead utilities plant a low growing tree or select a different planting site. Planting a tall growing tree where it doesn't have room to grow can lead to the unsightly and unhealthy practice of topping as shown above.

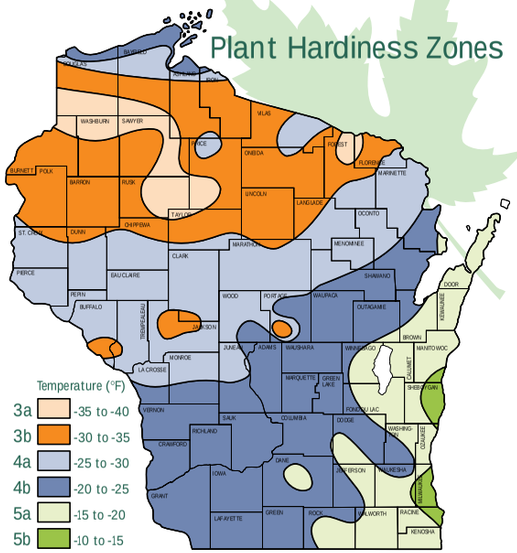
Right tree right place

The second step is to look down. Are there underground utilities, waterlines, or septic systems in the area? If so, select a different planting site.

The last step is to look around. Make sure you leave plenty of room for your tree to grow. That perfect spot right next to the house may not be so perfect when the tree reaches its mature size.

The Hardiness Zone

Trees are classified by *hardiness zone*. The hardiness zone is based on the lowest average winter temperature that a tree can tolerate. Wisconsin has six different zones ranging from 3a (coldest) to 5b (warmest). Know your hardiness zone and choose trees adapted to that zone.



Types of Nursery Stock

Bare Root – Just as the name implies, these trees do not have soil around the roots. Advantages: less expensive, lightweight, condition of the root system is easily seen and stock recovers quickly after planting. Disadvantages: limited availability, roots must be kept moist and stock must be planted while dormant.

Containerized – There are two types of containerized trees: 1) *potted*, a bare root tree placed in a pot with soil and 2) *container grown*, a tree that has grown in a pot for at least a year. Advantages: easy to handle and plant, and stock can be planted anytime during the growing season. Disadvantages: circling roots (if stock left in container too long) and condition of the root system is not readily visible.

Balled and Burlapped (B & B) – These trees are dug with a ball of soil around the roots. The ball is wrapped in burlap and tied with twine. The root ball may be within a wire basket. Advantages: stock is available throughout the growing season, is often larger and provides greater visual impact. Disadvantages: expensive, heavy, difficult to move and plant and often difficult to locate the root collar (see photo at right) and plant the tree at the proper depth.

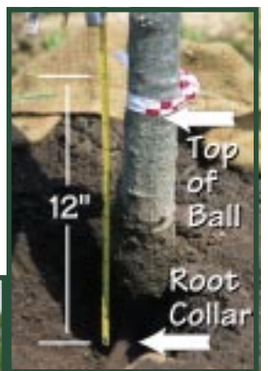
The root collar is the place where the trunk tissue meets the root tissue.

7 Steps in Planting Your Tree

IMPORTANT – Call Before You Dig!
Contact Diggers Hotline at
1-800-242-8511

Step 1 – Determine where the root collar is located within the root ball.

Step 2 – Dig a planting space two to three times wider than the root ball, but no deeper.



To determine proper planting depth, measure the distance from the bottom of the root ball to the root collar. To help the roots grow, widen the planting site by tilling or spading around the excavated area.

Step 3 – Before placing a tree in its planting space, remove all tags, ribbons, and trunk guard. Carefully roll the tree into its planting space. To avoid root damage, don't drag or lift the tree by the trunk. Gently guide the tree into the planting hole.

Appendix E

Determining Tree Removal
and Replacement Costs

Determining Tree Removal and Replacement Costs

What does it cost to remove a 12" dbh ash street tree? Based on average contract cost estimates, approximately $340 (tree removal = $270, stump removal=$70). Cost estimates were averaged and obtained from tree service companies in several areas around the state including Milwaukee, Madison, Green Bay and Eau Claire.

What does it cost to plant a 2" B&B (balled and burplapped) street tree, including labor and mulch? Cost estimates from several Wisconsin tree care firms average $375 per tree.

Does it cost more to remove and plant trees on private property than on public property? Yes, costs average about $100 more for removal, $20 more for stumping and $100 more for planting on private property due to accessibility and obstacles. Where stump removal is not possible, herbicide spray to prevent re-growth is approximately $10 a stump.

How much of a typical community forest is made up of ash? On average, almost 20 percent of Wisconsin's municipal street and park trees are ash species and varieties! (Figures are not available for privately owned ash trees.) Eighty percent of Wisconsin's public urban forest resource is NOT ash, and these trees also need care.

What will it cost to remove and replace ash street and park trees in a typical Wisconsin community? A typical Wisconsin community with a population of 7500 might have approximately 1500 street trees. Based on a 20 percent average ash component, 300 of those trees would be ash; tree and stump removal and replacement could exceed $200,000. A community with a population of 32,000 might have approximately 11,000 street trees. If 20 percent are ash, removal and replacement costs could exceed $1.5 million.

How can I determine specific costs for ash tree removal in my community? A municipal tree inventory is invaluable for estimating removal costs. Consult your inventory for the following information:

- total number of ash street and park trees (Subtract any to be removed by electric utility company)
- number of ash in each size class (e.g., 1–6", 7–12", etc.)
- removal costs for each size class (Larger trees—and those with hazards or barriers nearby—cost more to remove.)
- replanting (Costs vary by species, caliper, harvesting/packaging method; contracted labor or in-house; replacement rate.)

Removal costs further assume: 1) anticipated tree mortality within one to three years of EAB infestation, and 2) removal of trees with more than 50 percent crown dieback.

Note: All costs and values based on 2006 estimates.

Appendix F

Visual Survey Data Form

USDA Forest Service Emerald Ash Borer Visual Survey Data Form (June 2007)

State: _ _ **County:** _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _(where survey site is located) **Date:** _ _ _ _ _ _ _ _ _ _ _

Site Name: _ (ie. campground name, city street)

Site Location (record GPS coordinates for the general site):

Latitude: _ _. _ _ _ _ _ Decimal degrees dd.ddddd – NAD83 **Longitude: -** _ _. _ _ _ _ _ Decimal degrees dd.ddddd – NAD83

Site Ownership: **P**-Private; **M**-Municipal; **F**-Federal; **S**-State; **C**-County; **O**-Other; **U**-Unknown

Observer: _ _ _ _ _ _ _ _ _ _(First name) _ _ _ _ _ _ _ _ _ _ _ _ _(Last name) **Observer organization:** _ _ _ _ _ _ _ _ _ _ _ _ _ _ (who did the survey? Ex. ODNR

Land Use: A-Agricultural; **F**-Forest/woodlot; **RR**-Rural residential; **RC**-Rural commercial; **UR**-Urban residential; **UC**-Urban commercial; **O**-Other

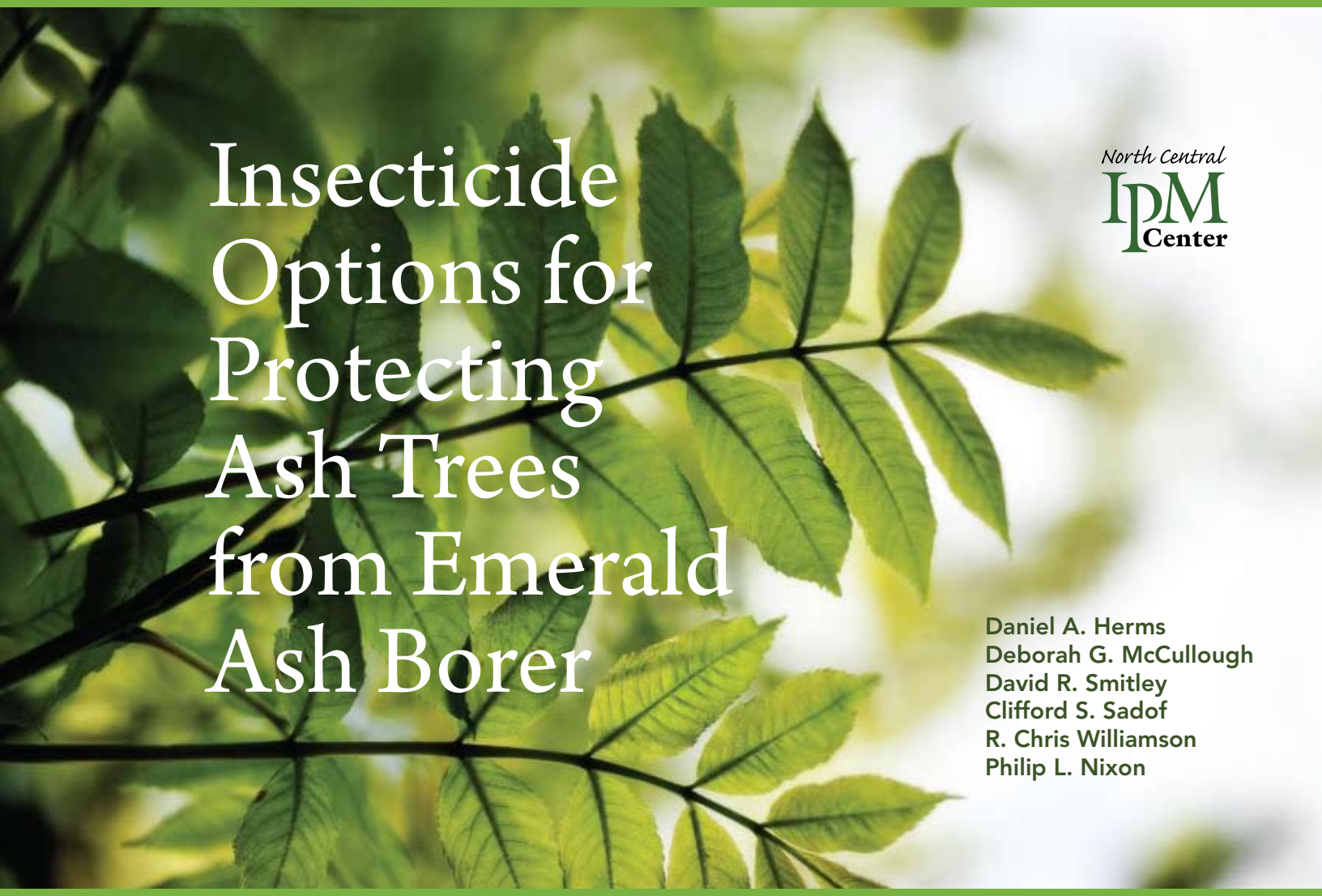
Site Description: FW-Firewood Dealer; **N**-Nursery; **WP**-Wood/log processing; **L**-Landfill; **RE**-Recreation; **S**-Street Tree; **YT**-Yard Tree; **O**-Other,

Tree	Ash Species	DBH	Health (circle all that apply)	EAB Signs	Sample submitted	Follow-up requested	Comments (What is the local ash density? Is firewood used or stored at this location?)
1	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
2	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
3	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
4	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
5	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
6	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
7	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
8	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
9	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
10	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
11	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	
12	W G B O U	1-5 6-10 11-15 >15	H C E D	N D S B W	N A L B	Y N	

Ash Species: W-White; G-Green; B-Black; O-Other; U-Undetermined	**EAB Signs:** N-None; D-D-shaped exit holes; S-Serpentine galleries; B-Bark splits, W-Woodpecker probing
Health: H-Healthy; C-Crown dieback; E-Epicormic sprouting; D-Dead	**Sample Submitted:** N-None; A-Adults; L-Larvae, B-Bark or wood

Appendix G

Chemical and Insecticide Options



Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

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Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

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Contents

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

Emerald ash borer (*Agrilus planipennis* Fairmaire), an invasive insect native to Asia, has killed tens of millions of ash trees in urban, rural and forested settings. This beetle was first discovered in 2002 in southeast Michigan and Windsor, Ontario. As of June 2009, emerald ash borer (EAB) infestations were known to be present in 12 states and two Canadian provinces. Many homeowners, arborists and tree care professionals want to protect valuable ash trees from EAB. Scientists have learned much about this insect and methods to protect ash trees since 2002. This bulletin is designed to answer frequently asked questions and provide the most current information on insecticide options for controlling EAB.

Answers to Frequently Asked Questions

What options do I have for treating my ash trees?

If you elect to treat your ash trees, there are several insecticide options available and research has shown that treatments can be effective. Keep in mind, however, that controlling insects that feed under the bark with insecticides has always been difficult. This is especially true with EAB because our native North American ash trees have little natural resistance to this pest. In university trials, some insecticide treatments were effective in some sites, but the same treatments failed in other sites. Furthermore, in some studies conducted over multiple years, EAB densities continued to increase in individual trees despite annual treatment. Some arborists have combined treatments to increase the odds of success (e.g., combining a cover spray with a systemic treatment).

Our understanding of how EAB can be managed successfully with insecticides has increased substantially in recent years. The current state of this understanding is detailed in the bulletin. It is important to note that research on management of EAB remains a work in progress. Scientists from universities, government agencies and companies continue to conduct intensive studies to understand how and when insecticide treatments will be most effective.

I know my tree is already infested with EAB. Will insecticides still be effective?

If a tree has lost more than 50 percent of its canopy, it is probably too late to save the tree. Studies have shown that it is best to begin using insecticides while ash trees are still relatively healthy. This is because most of the insecticides used for EAB control act systemically — the insecticide must be transported within the tree. In other words, a tree must be healthy enough to carry a systemic

insecticide up the trunk and into the branches and canopy. When EAB larvae feed, their galleries injure the phloem and xylem that make up the plant's circulatory system. This interferes with the ability of the tree to transport nutrients and water, as well as insecticides. As a tree becomes more and more infested, the injury becomes more severe. Large branches or even the trunk can be girdled by the larval galleries.

Studies have also shown that if the canopy of a tree is already declining when insecticide treatments are initiated, the condition of the tree may continue to deteriorate during the first year of treatment. In many cases, the tree canopy will begin to improve in the second year of treatment. This lag in the reversal of canopy decline probably reflects the time needed for the tree to repair its vascular system after the EAB infestation has been reduced.

My ash tree looks fine but my county is quarantined for EAB. Should I start treating my tree?

Scientists have learned that ash trees with low densities of EAB often have few or no external symptoms of infestation. Therefore, if your property is within a county that has been quarantined for EAB, your ash trees are probably at risk. Similarly, if your trees are outside a quarantined county but are still within 10-15 miles of a known EAB infestation, they may be at risk. If your ash trees are more than 15 miles beyond this range, it is probably too early to begin insecticide treatments. Treatment programs that begin too early are a waste of money. Remember, however, that new EAB infestations have been discovered every year since 2002 and existing EAB populations will build and spread over time. Stay up to date with current EAB quarantine maps and related information at www.emeraldashborer.info. You can use the links in this Web site to access specific information for individual states. When an EAB infestation is detected in a state or county for the first time, it will be added to these maps. Note, however, that once an area has been quarantined, EAB surveys generally stop, and further spread of EAB in that area will not be reflected on future maps.

I realize that I will have to protect my ash trees from EAB for several years. Is it worth it?

The economics of treating ash trees with insecticides for EAB protection are complicated. Factors that can be considered include the cost of the insecticide and expense of application, the size of the trees, the likelihood of success, and potential costs of removing and replacing the trees. Until recently, insecticide products had to be applied every year. A new product that is effective for two years or even longer (emamectin benzoate) has altered the economics of treating ash trees. As research progresses, costs and methods of treating trees will continue to change and it will be important to stay up to date on treatment options.

Benefits of treating trees can be more difficult to quantify than costs. Landscape trees typically increase property values, provide shade and cooling, and contribute to the quality of life in a neighborhood. Many people are sentimental about their trees. These intangible qualities are important and should be part of any decision to invest in an EAB management program.

It is also worth noting that the size of EAB populations in a specific area will change over time. Populations initially build very slowly, but later increase rapidly as more trees become infested. As EAB populations reach their peak, many trees will decline and die within one or two years. As untreated ash trees in the area succumb, however, the local EAB population will decrease substantially. Scientists do not yet have enough experience with EAB to know what will happen over time to trees that survive the initial wave of EAB. Ash seedlings and saplings are common in forests, woodlots, and right-of-ways, however, and it is unlikely that EAB will ever completely disappear from an area. That means that ash trees may always be at some risk of being attacked by EAB, but it seems reasonable to expect that treatment costs could eventually decrease as pest pressure declines after the EAB wave has passed.

Insecticide Options for Controlling EAB

Insecticides that can effectively control EAB fall into four categories: (1) systemic insecticides that are applied as soil injections or drenches; (2) systemic insecticides applied as trunk injections; (3) systemic insecticides applied as lower trunk sprays; and (4) protective cover sprays that are applied to the trunk, main branches, and (depending on the label) foliage.

Insecticide formulations and application methods that have been evaluated for control of EAB are listed in Table 1. Some are marketed for use by homeowners while others are intended for use only by professional applicators. The "active ingredient" refers to the compound in the product that is actually toxic to the insect.

Formulations included in Table 1 have been evaluated in multiple field trials conducted by the authors. Inclusion of a product in Table 1 does not imply that it is endorsed by the

Table 1. Insecticide options for professionals and homeowners for controlling EAB that have been tested in multiple university trials. Some products may not be labeled for use in all states. Some of the listed products failed to protect ash trees when they were applied at labeled rates. Inclusion of a product in this table does not imply that it is endorsed by the authors or has been consistently effective for EAB control. See text for details regarding effectiveness.

Insecticide Formulation	Active Ingredient	Application Method	Recommended Timing
Professional Use Products			
Merit® (75WP, 75WSP, 2F)	Imidacloprid	Soil injection or drench	Mid-fall and/or mid- to late spring
Xytect™ (2F, 75WSP)	Imidacloprid	Soil injection or drench	Mid-fall and/or mid- to late spring
IMA-jet®	Imidacloprid	Trunk injection	Early May to mid-June
Imicide®	Imidacloprid	Trunk injection	Early May to mid-June
TREE-äge™	Emamectin benzoate	Trunk injection	Early May to mid-June
Inject-A-Cide B®	Bidrin®	Trunk injection	Early May to mid-June
Safari™ (20 SG)	Dinotefuran	Systemic bark spray	Early May to mid-June
Astro®	Permethrin	Preventive bark and foliage cover sprays	2 applications at 4-week intervals; first spray should occur when black locust is blooming (early May in southern Ohio to early June in mid-Michigan)
Onyx™	Bifenthrin		
Tempo®	Cyfluthrin		
Sevin® SL	Carbaryl		
Homeowner Formulation			
Bayer Advanced™ Tree & Shrub Insect Control	Imidacloprid	Soil drench	Mid-fall or mid- to late spring

authors or has been consistently effective for EAB control. Please see the following sections for specific information about results from these trials. Results of some tests have also been posted on www.emeraldashborer.info.

Strategies for the most effective use of these insecticide products are described below. It is important to note that pesticide labels and registrations change constantly and vary from state to state. It is the legal responsibility of the pesticide applicator to read, understand and follow all current label directions for the specific pesticide product being used.

Using Insecticides to Control EAB

Soil-Applied Systemic Insecticides

Systemic insecticides applied to the soil are taken up by the roots and translocated throughout the tree. The most widely tested soil-applied systemic insecticide for control of EAB is imidacloprid, which is available under several brand names for use by professional applicators and homeowners (see Table 1). All imidacloprid formulations can be applied as a drench by mixing the product with water, then pouring the solution directly on the soil around the base of the trunk. Dinotefuran was recently labeled for use against EAB as a soil treatment (in addition to its use as a basal trunk spray discussed below). Studies to test its effectiveness as a soil treatment are currently underway in Michigan and Ohio.

Imidacloprid soil applications should be made when the soil is moist but not saturated. Application to water-logged soil can result in poor uptake if the insecticide becomes excessively diluted and can also result in puddles of insecticide that could wash away, potentially contaminating surface waters and storm sewers. Insecticide uptake will also be limited when soil is excessively dry. Irrigating the soil surrounding the base of the tree before the insecticide application can improve uptake.

The application rates for the homeowner product (Bayer Advanced™ Tree & Shrub Insect Control) and professional formulations of imidacloprid are very similar. Homeowners apply the same amount of active ingredient that professionals apply. However, there are certain restrictions on the use of homeowner formulations that do not apply to professional formulations. Homeowner formulations of imidacloprid can be applied only as a drench. It is not legal to inject these products into the soil, although some companies have marketed devices to homeowners specifically for this purpose. Homeowners are also restricted to making only one application per year. Several generic products containing imidacloprid are available to homeowners, but the formulations vary and the effectiveness of these products has not yet been evaluated in university tests.

Soil drenches offer the advantage of requiring no special equipment for application other than a bucket or watering can. However, imidacloprid can bind to surface layers of organic matter, such as mulch or leaf litter, which can reduce uptake by the tree. Before applying soil drenches, it is important to remove, rake or pull away any mulch or dead leaves so the insecticide solution is poured directly on the mineral soil.

Imidacloprid formulations labeled for use by professionals can be applied as a soil drench or as soil injections. Soil injections require specialized equipment, but offer the advantage of placing the insecticide under mulch or turf and directly into the root zone. This also can help to prevent runoff on sloped surfaces. Injections should be made just deep enough to place the insecticide beneath the soil surface (2-4 inches). Soil injections should be made within 18 inches of the trunk where the density of fine roots is highest. As you move away from the tree, large radial roots diverge like spokes on a wheel and studies have shown that uptake is higher when the product is applied at the base of the trunk. There are no studies that show that applying fertilizer with imidacloprid enhances uptake or effectiveness of the insecticide.

Optimal timing for imidacloprid soil injections and drenches is mid-April to mid-May, depending on your region. Allow four to six weeks for uptake and distribution of the insecticide within the tree. In southern Ohio, for example, you would apply the product by

mid-April; in southern Michigan, you should apply the product by early to mid-May. When treating larger trees (e.g., with trunks larger than 12 inches in diameter), treat on the earlier side of the recommended timing. Large trees will require more time for uptake and transportation of the insecticide than will small trees. Recent tests show that imidacloprid soil treatments can also be successful when applied in the fall.

Trunk-Injected Systemic Insecticides

Several systemic insecticide products can be injected directly into the trunk of the tree including formulations of imidacloprid and emamectin benzoate (see Table 1). An advantage of trunk injections is that they can be used on sites where soil treatments may not be practical or effective, including trees growing on excessively wet, compacted or restricted soil environments. However, trunk injections do wound the trunk, which may cause long-term damage, especially if treatments are applied annually.

Products applied as trunk injections are typically absorbed and transported within the tree more quickly than soil applications. Allow three to four weeks for most trunk-injected products to move through the tree. Optimal timing of trunk injections occurs after trees have leafed out in spring but before EAB eggs have hatched, or generally between mid-May and mid-June. Uptake of trunk-injected insecticides will be most efficient when trees are actively transpiring. Best results are usually obtained by injecting trees in the morning when soil is moist but not saturated. Uptake will be slowed by hot afternoon temperatures and dry soil conditions.

Noninvasive, Systemic Basal Trunk Sprays

Dinotefuran is labeled for application as a noninvasive, systemic bark spray for EAB control. It belongs to the same chemical class as imidacloprid (neonicotinoids) but is much more soluble. The formulated insecticide is sprayed on the lower five to six feet of the trunk using a common garden sprayer and low pressure. Research has shown that the insecticide penetrates the bark and moves systemically throughout the rest of the tree.

Healthy ash trees that have been protected with insecticides growing next to untreated ash trees killed by EAB.

Dinotefuran can be mixed with surfactants that may facilitate its movement into the tree, particularly on large trees with thick bark. However, in field trials, adding a surfactant did not consistently increase the amount of insecticide recovered from the leaves of treated trees.

The basal trunk spray offers the advantage of being quick and easy to apply and requires no special equipment other than a garden sprayer. This application technique does not wound the tree, and when applied correctly, the insecticide does not enter the soil.

Protective Cover Sprays

Insecticides can be sprayed on the trunk, branches and (depending on the label) foliage to kill adult EAB beetles as they feed on ash leaves, and newly hatched larvae as they chew through the bark. Thorough coverage is essential for best results. Products that have been evaluated as cover sprays for control of EAB include some specific formulations of permethrin, bifenthrin, cyfluthrin and carbaryl (see Table 1).

Protective cover sprays are designed to prevent EAB from entering the tree and will have no effect on larvae feeding under the bark. Cover sprays should be timed to occur when most adult beetles are feeding and beginning to lay eggs. Adult activity can be difficult to monitor because there are no

EAB adults must feed on foliage before they become reproductively mature.

effective pheromone traps for EAB. However, first emergence of EAB adults generally occurs between 450-550 degree days (starting date of January 1, base temperature of 50˚F), which corresponds closely with full bloom of black locust (*Robinia pseudoacacia*). For best results, consider two applications, one at 500 DD_{50} (as black locust approaches full bloom) and a second spray four weeks later.

How Effective Are Insecticides for Control of EAB?

Extensive testing of insecticides for control of EAB has been conducted by researchers at Michigan State University (MSU) and The Ohio State University (OSU). Results of some of the MSU trials are available at www.emeraldashborer.info.

Soil-Applied Systemic Insecticides

Efficacy of imidacloprid soil injections for controlling EAB has been inconsistent; in some trials EAB control was excellent, while others yielded poor results. Differences in application protocols and conditions of the trials have varied considerably, making it difficult to reach firm conclusions about sources of variation in efficacy. For example, an MSU study found that low-volume soil injections of imidacloprid applied to small trees averaging 4 inches in DBH (diameter of the trunk at breast height) using the Kioritz applicator (a hand-held device for making low-volume injections) provided good control at one site. However, control was poor at another site where the same application protocols were used to treat larger trees (13-inch DBH). Imidacloprid levels may have been too low in the larger trees to provide adequate control. Higher pest pressure at the second site also may have contributed to poor control in the large trees.

In the same trials, high-pressure soil injections of imidacloprid (applied in two concentric rings, with one at the base of the tree and the other halfway to the drip line of the canopy) provided excellent control at one site. At another site, however, soil injections applied using the same rate, timing and application method were completely ineffective, even though tree size and infestation pressure were very similar. It should be noted that recent studies have shown that imidacloprid soil injections made at the base of the trunk result in more effective uptake than applications made on grid or circular patterns under the canopy.

Imidacloprid soil drenches have also generated mixed results. In some studies conducted by MSU and OSU researchers, imidacloprid soil drenches have provided excellent control of EAB. However, in other studies, control has been inconsistent. Experience and research indicate that imidacloprid soil drenches are most effective on smaller trees and control of EAB on trees with a DBH that exceeds 15 inches is less consistent.

This inconsistency may be due to the fact that application rates for systemic insecticides are based on amount of product per inch of trunk diameter or circumference. As the DBH of a tree increases, the amount of vascular tissue, leaf area and biomass that must be protected by the insecticide increases exponentially. Consequently, for a particular application rate, the amount of insecticide applied as a function of tree size is proportionally decreased as trunk diameter increases. Hence, the DBH-based application rates that effectively protect relatively small trees can be too low to effectively protect large trees. Some systemic insecticide products address this issue by increasing the application rate for large trees.

In an OSU study with larger trees (15- to 22-inch DBH), Xytect™ (imidacloprid) soil drenches provided consistent control of EAB when applied experimentally at twice the rate that was allowed at that time. Recently, the Xytect™ label was modified to allow the use of this higher rate, which we now recommend when treating trees larger than 15-inch DBH. Merit® imidacloprid formulations, however, are not labeled for application at this high rate. Therefore, when treating trees greater than 15-inch DBH with Merit® soil treatments, two applications are recommended, either in the fall and again in the spring, or twice in the spring, about four weeks apart (for example in late April and again in late May). This is not an option for Bayer Advanced™ Tree and Shrub Insect Control and other

homeowner formulations of imidacloprid, which are limited by the label to one application per year. Homeowners wishing to protect trees larger than 15-inch DBH should consider having their trees professionally treated.

Treatment programs must comply with any limits specified on the label regarding the maximum amount of insecticide that can be applied per acre during a given year.

Trunk-Injected Systemic Insecticides

Emamectin benzoate • In several intensive studies conducted by MSU and OSU researchers, a single injection of emamectin benzoate in mid-May or early June provided excellent control of EAB for at least two years, even under high pest pressure. For example, in a highly-replicated study conducted on trees ranging in size from 5- to 20-inch DBH at three sites in Michigan, untreated trees had an average of 68 to 132 EAB larvae per m^2 of bark surface, which represents high pest pressure. In contrast, trees treated with emamectin benzoate had, on average, only 0.2 larvae per m^2, a reduction of > 99 percent. When additional trees were felled and debarked two years after the emamectin benzoate injection, there were still virtually no larvae in the treated trees, while adjacent, untreated trees at the same sites had hundreds of larvae.

In two OSU studies conducted in Toledo with street trees ranging in size from 15- to 25-inch DBH, a single application of emamectin benzoate also provided excellent control for two years. There was no sign of canopy decline in treated trees and very few emergence holes, while the canopies of adjacent, untreated trees exhibited severe decline and extremely high numbers of emergence holes.

One study suggests that a single injection of emamectin benzoate may even control EAB for three years. Additional studies to further evaluate the long-term effectiveness of emamectin benzoate are underway. To date, this is the only product that controls EAB for more than one year with a single application. In addition, in side-by-side comparisons with other systemic products (neonicotinoids), emamectin benzoate was more effective.

Imidacloprid • Trunk injections with imidacloprid products have provided varying degrees of EAB control in trials conducted at different sites in Ohio and Michigan. In an MSU study, larval density in trees treated with Imicide® injections were reduced by 60 percent to 96 percent, compared to untreated controls. There was no apparent relationship between efficacy and trunk diameter or infestation pressure. In another MSU trial, imidacloprid trunk injections made in late May were more effective than those made in mid-July, and IMA-jet® injections provided higher levels of control than did Imicide®, perhaps because the IMA-jet® label calls for a greater amount of active ingredient to be applied on large trees. In an OSU study in Toledo, IMA-jet® provided excellent control of EAB on 15- to 25-inch trees under high pest pressure when trees were injected annually. However, trees that were injected every other year were not consistently protected.

In a discouraging study conducted in Michigan, ash trees continued to decline from one year to the next despite being injected in both years with either Bidrin (Inject-A-Cide B®) or imidacloprid. The imidacloprid treatments consisted of two consecutive years of Imicide® (10% imidacloprid) applied using Mauget® micro-injection capsules, or an experimental 12% formulation of imidacloprid in the first year followed by Pointer™ (5% imidacloprid) in the second year with both applied using the Wedgle™ Direct-Inject™ System. All three treatment regimes suppressed EAB infestation levels in both years, with Imicide® generally providing best control under high pest pressure in both small (six-inch DBH) and larger (16-inch DBH) caliper trees. However, larval density increased in treated and untreated trees from one year to the next. Furthermore, canopy dieback increased by at least 67 percent in all treated trees (although this was substantially less than the amount of dieback observed in untreated trees). Even consecutive years of these treatments only slowed ash decline under severe pest pressure. In another MSU study, ACECAP® trunk implants (active ingredient is acephate) did not adequately protect large trees (greater than 15-inch DBH) under high pest pressure.

EAB larvae damage the vascular system of the tree as they feed, which interferes with movement of systemic insecticides in the tree.

Noninvasive Basal Trunk Sprays with Dinotefuran

Studies to date indicate that systemic basal trunk sprays with dinotefuran are about as effective as imidacloprid treatments. MSU and OSU studies have evaluated residues in leaves from trees treated with the basal trunk spray. Results show that the dinotefuran effectively moved into the trees and was translocated to the canopy at rates similar to those of other trunk-injected insecticides, and faster than other soil-applied neonicotinoid products.

As with imidacloprid treatments, control of EAB with dinotefuran has been variable in research trials. In an MSU study conducted in 2007 and 2008, dinotefuran trunk sprays reduced EAB larval density by approximately 30 percent to 60 percent compared to the heavily infested untreated trees. The treatment was effective for only one year and would have to be applied annually. In general, control is better and more consistent in smaller trees than in large trees, but more research is needed with larger trees. Studies to address the long-term effectiveness of annual dinotefuran applications for control of EAB are underway.

Protective Cover Sprays

MSU studies have shown that applications of Onyx™, Tempo® and Sevin® SL provided good control of EAB, especially when the insecticides were applied in late May and again in early July. Acephate sprays were less effective. BotaniGard® (*Beauvaria bassiana*) was also ineffective under high pest pressure. Astro® (permethrin) was not evaluated against EAB in these tests, but has been effective for controlling other species of wood borers and bark beetles.

In another MSU study, spraying Tempo® just on the foliage and upper branches or spraying the entire tree were more effective than simply spraying just the trunk and large branches. This suggests that some cover sprays may be especially effective for controlling EAB adults as they feed on leaves in the canopy. A single, well-timed spray was also found to provide good control of EAB, although two sprays may provide extra assurance given the long period of adult EAB activity.

It should be noted that spraying large trees is likely to result in a considerable amount of insecticide drift, even when conditions are ideal. Drift and potential effects of insecticides on non-target organisms should be considered when selecting options for EAB control.

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Key Points and Summary Recommendations

- Insecticides can effectively protect ash trees from EAB.
- Unnecessary insecticide applications waste money. If EAB has not been detected within 10-15 miles, your trees are at low risk. Be aware of the status of EAB in your location. Current maps of known EAB populations can be found at www.emeraldashborer.info. Remember, however, that once a county is quarantined, maps for that county are no longer updated.
- Trees that are already infested and showing signs of canopy decline when treatments are initiated may continue to decline in the first year after treatment, and then begin to show improvement in the second year due to time lag associated with vascular healing. Trees exhibiting more than 50 percent canopy decline are unlikely to recover even if treated.
- Emamectin benzoate is the only product tested to date that controls EAB for more than one year with a single application. It also provided a higher level of control than other products in side-by-side studies.
- Soil drenches and injections are most effective when made at the base of the trunk. Imidacloprid applications made in the spring or the fall have been shown to be equally effective.
- Soil injections should be no more than 2-4 inches deep, to avoid placing the insecticide beneath feeder roots.
- To facilitate uptake, systemic trunk and soil insecticides should be applied when the soil is moist but not saturated or excessively dry.
- Research and experience suggest that effectiveness of insecticides has been less consistent on larger trees. Research has not been conducted on trees larger than 25-inch DBH. When treating very large trees under high pest pressure, it may be necessary to consider combining two treatment strategies.
- Xytect™ soil treatments are labeled for application at a higher maximum rate than other imidacloprid formulations, and we recommend that trees larger than 15-inch DBH be treated using the highest labeled rate. Merit® imidacloprid formulations are not labeled for use at this higher rate. When treating larger trees with Merit® soil treatments, best results will be obtained with two applications per year. Imidacloprid formulations for homeowners (Bayer Advanced™ Tree & Shrub Insect Control and other generic formulations) can be applied only once per year.
- Homeowners wishing to protect trees larger than 15-inch DBH should consider having their trees professionally treated.
- Treatment programs must comply with any label restrictions on the amount of insecticide that can be applied per acre in a given year.

The Cooperative Emerald Ash Borer Program

For more information and to order additional copies of this bulletin:

www.emeraldashborer.info/

The Ohio State University EAB Outreach Team

www.ashalert.osu.edu

Purdue Extension

www.entm.purdue.edu/eab/

University of Wisconsin

www.entomology.wisc.edu/emeraldashborer/

University of Illinois

ipm.illinois.edu/landturf/insects/

University of Minnesota

www.extension.umn.edu/issues/eab/

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Appendix H

Woodlot Management

Emerald Ash Borer and Forest Management

Revised February 2010

The emerald ash borer (EAB), *Agrilus planipennis*, is an exotic insect that was first identified in southeast Michigan in 2002. EAB infests and kills all true ash species (*Fraxinus* spp.) that are native to Wisconsin. Even healthy ash trees decline and die within several years.

EAB has been detected in Wisconsin. In August 2008, EAB was detected in northwest Ozaukee County and northeast Washington County. Since then, EAB has been found in several areas around the state (Figure 1).

EAB has also been found in numerous states and Canadian provinces. A current distribution map is available at www.emeraldashborer.wi.gov.

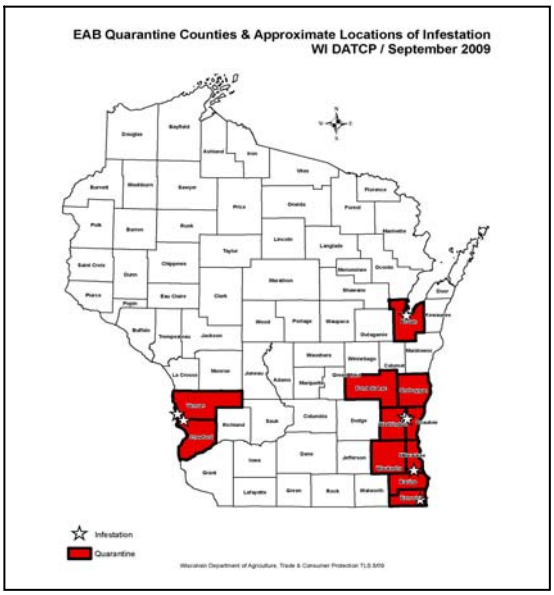

Figure 1. EAB detections in Wisconsin as of February 15, 2010. Counties in red are quarantined.

Regulatory Considerations

Generally, state and/or federal quarantines follow a confirmed EAB find. The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and the USDA Animal Plant Health Inspection Service (APHIS) determine the quarantine areas. When an area is quarantined, it means that the following items cannot be transported out of the quarantined area:

(a) The emerald ash borer, *Agrilus planipennis* Fairmaire, in any living stage.
(b) Ash trees.
(c) Ash limbs, branches and roots.
(d) Ash logs, slabs or untreated lumber with bark attached.
(e) Cut firewood of all hardwood (non-coniferous) species.
(f) Ash chips and ash bark fragments (both composted and uncomposted) larger than one inch in diameter (in two dimensions).
(g) Any other item or substance that may be designated as a regulated item if a DATCP pest control official determines that it presents a risk of spreading emerald ash borer and notifies the person in possession of the item or substance that it is subject to the restrictions of the regulations.

Additional counties will be quarantined as new EAB finds occur. **For a current list of quarantined counties and regulations, visit the Wisconsin EAB website, www.emeraldashborer.wi.gov.**

Response Considerations

The Wisconsin DATCP and the Department of Natural Resources (DNR) have developed a response plan for EAB. For each EAB detection, a delimitation survey will be conducted to determine the extent of the infestation. Following the delimitation, a plan of action will be recommended to manage or slow the spread of the infestation. Each infestation will be individually examined and evaluated to determine the most responsible and reasonable course of action, based on the most scientifically sound information available at the time. In addition to the collection of scientific data, site surveys will be conducted to determine environmental sensitivity, endangered resources and social impacts. Where

appropriate, Native American Traditional Ecological Knowledge will also be taken into consideration. These assessments will be done with guidance from the US Fish and Wildlife Service and DNR Endangered Resources. It is unlikely that there is a one-size-fits-all strategy for managing an infestation of EAB. The response plan may be viewed at **www.emeraldashborer.wi.gov.**

Symptoms and Signs

EAB-infested trees usually have multiple symptoms of infestation if they have been infested for several years (Figs. 2-5). Be aware that similar signs and symptoms can be due to other causes.

Fig. 2. Thinning crown.

Fig. 3. Epicormic sprouts at the base of an infested ash tree.

Fig. 4. S-shaped larval galleries.

Fig. 5. D-shaped exit hole created by an EAB adult beetle.

Symptoms and signs of EAB infestation include thin foliage and/or dieback in the upper crown, epicormic sprouts on the stem or at the base, heavy woodpecker activity, S-shaped larval galleries under the bark and 1/8" D-shaped exit holes.

Adult beetles are approximately ½" in length and emerald green (Fig. 6). Collecting a suspected EAB specimen is very important for proper identification. Freezing the insect or preserving it in rubbing alcohol will maintain the specimen until an expert can examine it.

Fig. 6. EAB adult. Photo by H. Russell, Michigan State University.

Reporting Suspects

Monitor for symptoms of EAB infestation and report suspect trees and insects to the Wisconsin EAB hotline (1-800-462-2803), or email reports to eab@datcp.state.wi.us.

Risk of Introduction

It is very likely that there will be additional detections of EAB in Wisconsin due to accidental transport of the insect in firewood, nursery stock and unprocessed logs. Campgrounds and urban areas are currently thought to be at highest risk of EAB introduction. Landowners should consider the likelihood of introduction in the local area when considering management options. Natural spread of EAB from an infested site is currently thought to be about ½ mile per year.

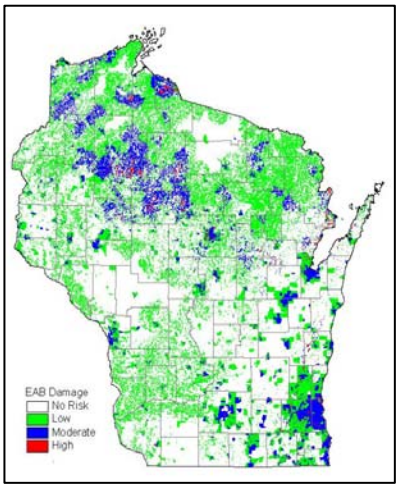

Fig. 7. Potential extent of ash mortality from EAB in Wisconsin. The level of ash mortality was predicted by the risk of introduction and number of ash trees.

Future Impacts

Early observations have revealed no natural resistance to EAB in the native ash population, yet it is too early to dismiss native resistance as a possibility. Insecticide treatments can stop or reverse tree decline in moderately-infested yard trees, but are not practical for treatment of ash in forests.

There is very little data on the impacts of various population levels of EAB on the ash forest. Over time, predicting impact will be based on a better understanding of the insect's population dynamics. Research may reveal new management options, and maintaining an ash component will help to maintain species diversity and other benefits that ash provides.

Landowners should carefully evaluate long-term management options and determine which silvicultural practices are suitable for their stands. Preparing a stand for EAB impacts may allow the stand to remain adequately stocked with non-ash species and able to meet management objectives if all of the ash dies or is harvested. **Removing all ash prior to EAB establishment in the local area is not recommended.** EAB detection in the local area may lead to increased harvesting of ash and thus affect ash timber prices. Be aware that EAB impacts may affect lands enrolled in Managed Forest Law (MFL) and Conservation Reserve Program (CRP).

It is important that landowners evaluate the potential impacts of EAB and consult with a forester to determine whether it is appropriate to adjust their management plan. The decision to alter a management plan will depend on several factors, including quarantines, distance from known EAB infestations, stand composition and age, management goals, and markets for the wood. In all cases, sustainable forest management practices should be followed.

The Ash Resource in Wisconsin

There are over 700 million ash trees > 1" in diameter in Wisconsin's forests, comprising approximately 7% of all forest trees greater than 1" in diameter (Fig. 8). Ash is also a common street and yard tree. Approximately 20% of urban street trees and 12% of all urban trees are ash.

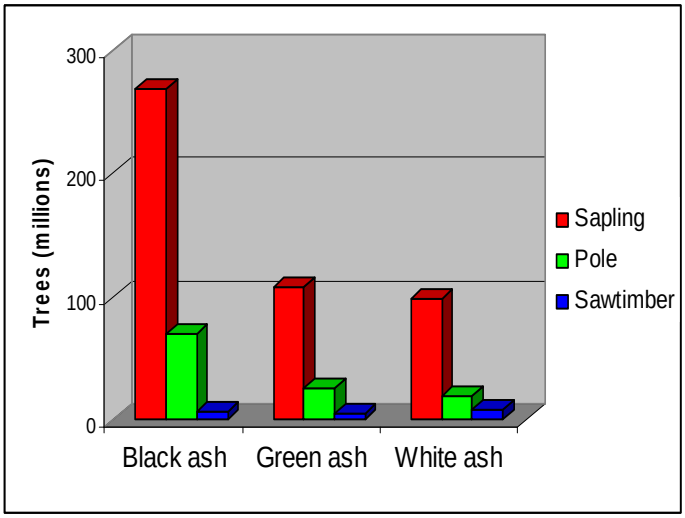

Fig. 8. Number of Wisconsin ash trees greater than 1 inch in diameter. Data are from USDA Forest Service Forest Inventory and Analysis plot network, 2006.

White ash (*Fraxinus americana*) is rarely found growing in pure stands but is present throughout the state, occasionally as the dominant component in a forest. White ash grows on a variety of sites but is most frequently found on fertile, well-drained soils.

Green ash (*F. pennsylvanica*) is found throughout the state, but is most common in southern Wisconsin. It may form pure stands or grow in association with black ash, red maple, silver maple, swamp white oak, and elm. It grows as an associate in upland hardwood stands, but is most common in and around stream banks, floodplains, and swamps.

Black ash (*F. nigra*) is distributed over the entire state but is most frequently found in northern Wisconsin. It is most common in swamps, but is also found in other wet forest types.

Blue ash (*F. quadrangulata*) is a threatened species that is currently found only at a few sites in Waukesha County. The species is at the edge of its range in Wisconsin, but is common in states farther south. The species is not of commercial importance.

Mountain ash (*Sorbus americana* and *S. decora*) is not a true ash and is not susceptible to EAB infestation.

Ash Management in Forests

Landowners should contact a professional forester for assistance with the management of their forests and ash trees. Landowners should carefully evaluate long-term management options and determine which silvicultural practices are suitable for their stands. Research may reveal new management options, and maintaining an ash component will help to maintain species diversity and other benefits that ash provides. Removing all ash prior to EAB establishment in the local area is not recommended.

Management of Artificial Regeneration

In quarantined counties, planting ash is not recommended. Outside of a quarantined county, limit ash to 10% or less of a new planting. It is unknown where EAB will become established in Wisconsin or how quickly it will spread, but there is a high risk that ash in a new planting will be killed before maturity.

Management of Natural Regeneration

In quarantined counties, review the 'Silvicultural Guidelines for Quarantined Counties' section. If outside a quarantined county, continue current management practices in seedling and sapling stands and sites that are naturally regenerating.

If the ash component represents > 10% of all regeneration, then consider reducing the ash component with release operations, favoring non-ash species. Retain the most vigorous ash stems. Active treatment of ash regeneration through cutting or herbicide may be needed. Supplemental planting of non-ash species is another option to increase the non-ash component.

Where ash regeneration is predominant (> 50%), and if feasible, implement practices that discourage young ash and encourage regeneration of non-ash species through natural or artificial techniques.

Management in Established Stands

In quarantined counties, review the 'Silvicultural Guidelines for Quarantined Counties' section.

Options for preparing forest lands will depend in part on the frequency of ash in the stand (Fig. 9). As the proportion of ash rises, fewer options will be available. The management guidelines have been developed based on three ash basal area levels: 1) ash < 20%, 2) ash 20-40%, and 3) ash > 40%.

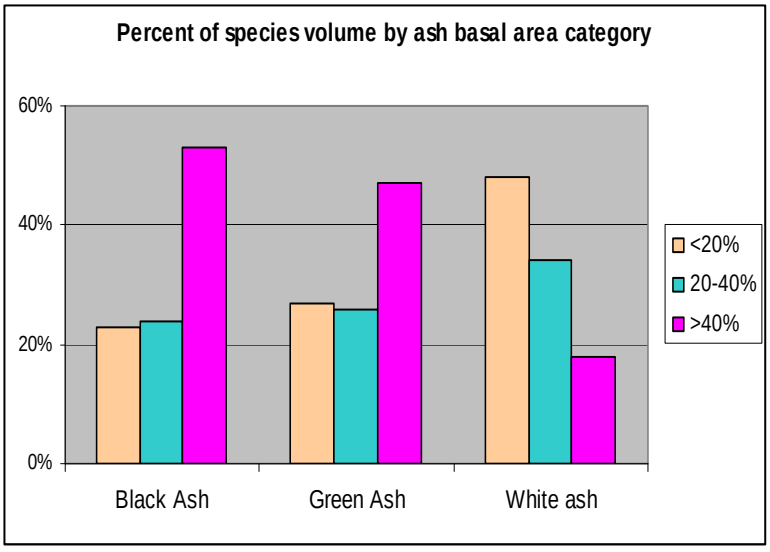

Fig. 9. Percentage of Wisconsin growing stock volume by ash dominance category. For example, a majority of black ash volume occurs in stands where black ash is more than 40% of the basal area. Data from USDA Forest Service Inventory and Analysis plot data, 2006.

Management in Established Stands Where Ash is a Minor Component (< 20%)

If the stand is within a quarantined county, review the 'Silvicultural Guidelines for Quarantined Counties' section. If outside a quarantined county, continue normal long-term management activities with incorporation of the following guidelines.

In most cases where ash is a minor component, management goals will still be met even if EAB becomes established and all of the ash die or are harvested.

Follow the standard order of removal guidelines when selecting trees to remove or retain while keeping the stand adequately stocked. Ash is not yet considered high risk. Ash may be considered a less desirable species in the order of removal. Removing low vigor, stressed ash may make a stand less attractive to EAB and thus delay initial stand infestation. Keep ash that are of good form and vigor and encourage species diversity.

Management in Established Stands Where Ash is a Medium Component (20-40%)

If the stand is within a quarantined county, review the 'Silvicultural Guidelines for Quarantined Counties' section. If outside a quarantined county, continue normal long-term management activities with incorporation of the following guidelines.

Reduce the proportion of ash during regularly-scheduled entries, aiming for a species composition (< 20% ash) that would leave the stand adequately stocked and able to meet landowner goals if all of the remaining ash were harvested or killed as a result of an EAB infestation. Some stands may need multiple entries to reduce the ash component to an appropriate level.

Follow the standard order of removal guidelines when selecting trees to remove or retain while keeping the stand adequately stocked. Ash is not yet considered high risk. No more than 20% of the crop trees should be ash. Ash should be considered a less desirable species in the order of removal. Removing low vigor, stressed ash may make a stand less attractive to EAB and thus delay initial stand infestation. Keep ash that are of good form and vigor and encourage species diversity.

In some stands, the non-ash component may be primarily non-merchantable species or low quality trees of commercial species. In this case, land managers should manage the stand using the recommendations where ash is a major component (> 40%).

Management in Established Stands Where Ash is a Major Component (> 40%)

If the stand is within a quarantined county, review the 'Silvicultural Guidelines for Quarantined Counties' section. If outside a quarantined county, continue normal long-term management activities with incorporation of the following guidelines.

Stands with a large proportion of ash (such as a bottomlands, swamps or plantations) will be heavily impacted by EAB unless the ash component is drastically reduced. When planning management activities consider two alternatives:

1) Reduce the proportion of ash during regularly-scheduled entries. Follow the standard order of removal guidelines when selecting trees to remove or retain, with these exceptions:
   - No more than 20% of the crop trees should be ash.
   - Ash is not yet considered high risk.

- Ash should be considered a less desirable species in the order of removal. Removing low vigor, stressed ash may make a stand less attractive to EAB and thus delay initial stand infestation. Keep the stand adequately stocked.
- **Because ash is a major component, multiple stand entries will be needed to bring the ash component down to a suitable level (ideally < 20% of stand basal area).**

2) Convert to other species through natural or artificial means, regardless of rotation age. Active treatment of ash regeneration through cutting or herbicide application may be necessary.

In many ash-dominated lowland stands, management of EAB will be difficult because silvicultural options will be limited and stand conversion may be impractical. EAB-caused mortality or excessive harvesting may lead to understocking, conversion to undesirable tree species or non-forest cover, elevated water tables or an increase in exotic plants such as reed canary grass. Attempt to keep the stand adequately stocked and favor species such as red and silver maple, swamp white oak and swamp conifers during release and thinning treatments. Active treatment of ash regeneration through cutting or herbicide application may be necessary. Consider establishing non-ash regeneration through natural or artificial means.

In many cases it will not be practical to reduce the proportion of ash because of harvesting impacts or lack of sufficient non-ash stems. EAB would still heavily impact the stand even if gradual species conversion was attempted, leaving it understocked and unable to meet landowner objectives. If a stand is in this situation, landowners may decide to:

- ✓ Allow EAB mortality to run its course.
- ✓ Alter management to non-timber objectives.
- ✓ Wait until rotation age, then convert to different species (if possible) prior to EAB establishing in the area. Shortening the rotation age may be appropriate.
- ✓ Wait until EAB establishes in the area, then pre-salvage harvest the stand and convert to different species (if possible). Be aware of quarantine restrictions.
- ✓ Wait until EAB impacts the stand, then salvage harvest the stand and convert to different species (if possible). Be aware of quarantine restrictions.

Silvicultural Guidelines for Quarantined Counties

15 mile zone around a known EAB infestation: It takes 2 to 3 years for a tree to show symptoms of EAB infestation, and thus, ash trees are likely infested outside known infestation zones. Also, delimitation surveys are imperfect. Therefore, trees within 5 miles of the known infestation are likely infested. On average, adult EAB beetles spread about ½ mile per year. It is expected that within 15 years EAB will spread naturally to an area 5 to 15 miles from a known infestation. For these reasons, salvage and pre-salvage harvests are recommended within a zone of 15 miles around a known infestation. Ash trees are high risk in this zone. Visit www.emeraldashborer.wi.gov for maps of areas currently known to be infested by EAB.

Recommendations within the 15 mile zone:

- Conduct a pre-salvage or salvage harvest of most or all ash. Consider retaining a few scattered ash trees for ecological purposes. Manage the residual stand or regenerate the stand based on the following guidelines:

- If pre-salvage or salvage harvest of ash will not result in a degraded stand (more than 40 crop trees per acre remain or the residual stocking of non-ash trees will be above C-line), manage according to cover type silvicultural guidelines.
- If pre-salvage or salvage harvest of ash will result in a degraded stand (less than 40 crop trees per acre or residual stocking will be less than the C-line), regenerate the stand to non-ash species according to cover type silvicultural guidelines using natural or artificial methods.
- Lowland sites with a high percentage of ash may be very difficult to regenerate to non-ash trees due to prevalence of ash in understory, aggressive invasive species (e.g. reed canary grass) and possible rise in water table levels. Consider group or patch regeneration methods, planting non-ash species in about 1/3 of stand. Once regeneration is established in these groups/patches, create regeneration groups/patches in another 1/3 of stand. Intensive site preparation and release treatments may be required for successful establishment of regeneration.

15+ miles from known EAB infestation:

- If in a quarantined county but farther away from a known infestation, consider accelerating harvest schedules to reduce ash levels. Sustainably manage stands containing ash following silvicultural guidelines for non-quarantined counties under the 'Management in Established Stands' section.

Additional Resources

Updated management guidelines and maps of EAB distribution will be available at **www.emeraldashborer.wi.gov** and **www.dnr.wi.gov/invasives.** Emerald ash borer is a relatively new pest in North America, and management guidelines will change over time due to changing insect distribution, new research findings, introduction of biological controls, and availability of funding for management.

Appendix I

Alternatives to Ash Trees

Alternative to Ash Trees: Commercially Available Species and Cultivars

Dr. Laura G. Jull
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Santamour (1990) established guidelines for tree planting within a city:
Plant no more than 30% of a family: i.e. Aceraceae
Plant no more than 20% of a genus: i.e. *Acer* × *freemanii*, *Acer rubrum*, *Acer platanoides*, *Acer saccharum*, etc.
Plant no more than 10% of a species: i.e. *Acer platanoides*

Large to medium-sized Street/Urban Trees

Acer* × *freemanii: Freeman maple, Zone 3b-4 (depends on cultivar), native hybrid of red and silver maple, oval to rounded form, ascending branches, 40-60' tall, 35-40' wide, moderate to fast growth rate, yellow, orange to red fall color, smooth, light gray bark when young, red samaras in spring, not fall, adaptable to most soils and pH, some cultivars can get chlorotic at very high pH, tolerant to wet soils, drought and urban conditions, moderate salt tolerance, can get verticillium wilt and leaf hoppers, some cultivars prone to included bark formation and narrow branch crotch angles, dioecious (separate male and female flowers produced on separate plants)

- 'Armstrong': narrow, fastigiate form, 45' tall, 15' wide, yellow fall color, female, produces seeds
- 'Celzam' (Celebration®): upright to oval form, 45' tall, 25-30' wide, better branch angles and straight central leader, yellow fall color, fast grower, male, seedless, drought tolerant
- 'DTR 102' (Autumn Fantasy®): broadly oval form, upright branches, 50' tall, 40' wide, bright to dark red fall color, female, produces seeds
- 'Indian Summer' or 'Morgan': broadly oval to rounded form, 45' tall, 40' wide, early, bright rosy-red fall color, vigorous, female, produces seeds, very sensitive to flooded soils
- 'Jeffersred' (Autumn Blaze®): broadly oval form with upright branches, 50' tall, 40' wide, bright orange-red to red fall color that is longer lasting, male, seedless, drought tolerant, tends to develop narrow crotch angles, included bark, and multiple leaders
- 'Marmo': upright, oval form, 55' tall, 45' wide, early, fair, mottled blend of deep red and green fall color starts at leaf tips and gradually works its way down leaf, good branching with straight central leader, male, seedless, slower grower
- 'Scarsen' (Scarlet Sentinel®): upright form becoming oval, 40' tall, 20' wide, yellow-orange to orange-red fall color, fast grower, male, seedless
- 'Sienna' (Sienna Glen®): pyramidal form, 50' tall, 35' wide, rusty orange to burgundy fall color, male, seedless, wider branch angles, from northern seed source, less susceptible to frost crack, hardy to zone 3

Acer miyabei: Miyabei maple, Zone 4a, native to Japan

- 'Morton' (State Street®), 40' tall, 25' wide, upright, oval form, dark green foliage, late, yellow fall color, corky-looking bark, faster grower, grafted higher up than straight species for street tree clearance, very adaptable to soils and pH, urban tolerant, moderate salt tolerance, not invasive, no pests

Acer nigrum: black maple, Zone 4, used to be considered a subspecies of sugar maple, native to central U.S.

- 'Greencolumn': upright, narrow form, 50' tall, 20' wide, straight central leader, light green, thick, leathery leaves leaves, yellow orange fall color, slow grower, more heat and drought tolerant than sugar maple

Acer platanoides: Norway maple, Zone 4b, native to Europe, wide-spreading, rounded, dense form, 40-50' tall, 35-40' wide, dark green, large leaves, late, yellow fall color, adaptable to most soils and pH, easy to transplant, will not tolerate wet soils, salt and urban tolerant, susceptible to verticillium wilt, girdling roots, basal rot, leaf scorch, frost crack, very invasive, do not use near any natural area, shallow roots

'Cleveland': upright, oval, dense form, fast grower, 40' tall, 30' wide, older cultivar
'Columnarbroad' (Parkway®): oval form with straight central leader, broader and faster growing than 'Columnare', 40' tall, 25' wide
'Columnare': upright, narrow-columnar form, ascending branches, 40' tall, 15' wide
'Conzam' (Conquest™): narrow oval form, 40' tall, 20' wide, maroon-red leaves in spring turn bronzish
'Crimson King': older cultivar, oval becoming rounded, dark purple leaves all season, 40' tall, 35' wide, slower growing, hardy only to zone 5a
'Crimson Sentry': but sport off of 'Crimson King', dense, compact, pyramidal to oval form, deep purple leaves all season, 35' tall, 15' wide
'Deborah': common, broadly oval to rounded, reddish-purple leaves in spring turn dark green, 40-60' tall, 40' wide, straight leader
'Drummondii': variegated leaves with white margins, reverts readily to all green leaves, rounded to broadly oval form, 30-40' tall, 25' wide, slow grower, tends to scorch in hot sun and drought
'Ezestre' (Easy Street™): pyramidal to narrow oval form, 40' tall, 20' wide, faster grower
'Fairview': narrow, upright-oval form, reddish purple leaves in spring turn bronzish, 45' tall, 35' wide
'Globosum': dense, globular form, 15-20' tall, 18' wide, slow grower, formal looking
'Jade Glen': broad, rounded, open form, 45' tall, 40' wide, faster growing, says it is verticillium wilt resistant but it is not
'McGill No. 42' (Emerald Queen®): dense, oval to rounded form with upright, spreading branches, deep green, glossy leaves, 50' tall, 40' wide, good branch pattern, straight trunk
'National 2000' (Champtree™): upright spreading to broadly oval form, 50-60' tall, 40' wide
'Pond' (Emerald Lustre®): upright, spreading to rounded form, 45' tall, 40' wide, faster grower, good branching
'Princeton Gold': oval form, bright yellow leaves in spring that turn bright green, bright yellow fall color, 35' tall, 30' wide
'Royal Red': more cold hardy version of 'Crimson King', deep maroon leaves during growing season, oval to rounded form, 40' tall, 30' wide
'Schwedleri': bronzy-purple leaves in spring fade to dark green, broad-rounded form, 40' tall, 30' wide, older cultivar, not recommended, has multiple leaders and twisted look to trunk, prone to frost crack
'Summershade': broad, rounded form, lighter green leaves, 40-50' tall, 40' wide, fast grower, heat tolerant, leathery leaves are scorch resistant
'Superform': broadly oval to rounded form, 45' tall, 40' wide, fast grower, uniform habit

Acer rubrum: red maple (in acidic soils (pH below 7) only or else very chlorotic), hardy to zone 3b-5b (depends on cultivar), native to eastern and central U.S., Canada, and Wisconsin, oval to rounded to irregular form, 40-60' tall, 25-35' wide, moderate to fast grower, yellow, orange to bright red fall color, smooth, light gray bark when young, reddish flowers in early spring, red samaras in spring, not fall, dioecious (separate male and female flowers produced on separate plants), adaptable to most soils, requires acid pH or else develops serious chlorosis due to lack of manganese, not iron, easy to transplant, tolerant to wet soils (some cultivars), sensitive to salt and air pollution, susceptible to verticillium wilt, leaf hoppers, frost crack, girdling roots, prone to included bark formation and narrow, branch crotch angles, shallow roots

Autumn Flame®: dense, rounded with spreading branches, 40' tall, 35' wide, early, bright red fall color, male, seedless, slower grower
Autumn Radiance®: rounded, open, symmetrical form, 60' tall, 40' wide, early red-orange fall color
'Autumn Spire': narrow to oval form, 40-50' tall, 30' wide, bright red fall color, male, seedless, from a northern seed source, newer cultivar, Zone 3
'Bailcraig' (Scarlet Jewell™): upright form, 60' tall, 30' wide, early, deep crimson-red fall color, from a northern seed source, Zone 3, new cultivar
'Bowhall': upright, very narrow form, 40-50' tall, 15' wide, yellowish-orange to reddish fall color, female, produces seed, prone to included bark formation
'Brandywine': oval form 40' tall, 30' wide, deep red fall color for a longer period, male, seedless, newer cultivar
Fairview Flame™: good branching, 45' tall, fast growing, later, orange-red fall color
'Frank Jr.' (Redpointe™): broadly pyramidal form, 45' tall, 30' wide, bright red fall color, faster growing, straight central leader, better branch crotch angles, new cultivar
'Franksred' (Red Sunset®): upright, dense, oval form, symmetrical form, bright red to orange fall color, fast grower, 45-50' tall, 35' wide, female, produces seeds, dark green, glossy leaves, older cultivar

Karpick®: narrow, oval, dense form, 40' tall, 20' wide, yellow to orange fall color, male, seedless, prone to included bark formation

'Magnificient Magenta' (Burgundy Belle®): oval to rounded form, 45' tall, 40' wide, bright red fall color that changes to burgundy, symmetrical form, heat tolerant, prone to leafhoppers and witches' broom

'New World': upright, narrow-oval form, 40' tall, 20' wide, orange-yellow to orange-red fall color, male, seedless

'Northwood': symmetrical, broadly oval to rounded form, ascending branches, 40' tall, 35' wide, early orange to reddish fall color, male, seedless, from a northern seed source, Zone 3

'Olson' (Northfire®): oval form, 50' tall, 35' wide, early, bright red fall color, northern seed source, Zone 3

'PNI 0268' (October Glory®): not hardy, zone 5b-6a, broadly oval to rounded form, 40' tall, 35' wide, red fall color for a longer period, female, produces seeds, old cultivar

'Polara' (Ruby Frost™): upright, dense, broad oval form, 45' tall, 40' wide, ruby-red fall color, selected in NW Wisconsin, Zone 3

'Red Rocket': narrow, columnar form, 35' tall, 8' wide, red fall color, northern seed source, tolerant to leaf hopper

'Schlesinger': broadly vase-shaped to rounded, 45' tall, 35' wide, very early orange to purplish-red fall color, female, produced seed

'Somerset': broadly oval to rounded form, 45' tall, 35' wide, red fall color, leaf hopper resistant newer cultivar

Summer Red®: dense, broad oval form, 20' tall, 10' wide, burgundy red new leaves that turn purplish-green, yellow to orange to purple fall color, leaf hopper resistant, Zone 5

'Sun Valley': oval, symmetrical form, densely branched, 40' tall, 35' wide, bright red fall color

Acer saccharum: sugar maple, hardy to zone 3a-5 (depends on cultivar), native to eastern U.S., Canada, and Wisconsin (our state tree), upright, oval to rounded form, 60-75' tall, 35-50' wide, showy, bright yellow to orange-red fall color, prefers a fertile, moist, well-drained soil, will not tolerate heavy clay, poorly drained, or dry soils, sensitive to drought, salt and air pollution, susceptible to leaf tatter and leaf scorch, verticillium wilt, basal rot, girdling roots, leaf hoppers

'Astis' (Steeple®): narrow oval form, 45' tall, 20' wide, yellow-orange fall color

'Autumn Splendor': broadly oval to rounded form, 45' tall, 40' wide, glossy leaves, orange-red fall color, resistant to heat drought and leaf tatter, Zone 5, newer cultivar

'Bailsta' (Fall Fiesta®): broadly ovate to rounded form, 50' tall, 40' wide, glossy, leathery leaves, yellow-orange to red fall color, leaf tatter and leaf hopper resistant, faster grower, newer cultivar

'Barrett Cole' (Apollo®): symmetrical, narrow, columnar form, 35' tall, 10' wide, yellow-orange to red fall color

Bonfire™: broadly oval form, 50' tall, 40' wide, orange to red fall color, more heat tolerant, fast grower

Commemoration®: oval to rounded, dense form, 50' tall, 35' wide, thick, glossy, dark green leaves, yellow-orange to red fall color, vigorous, faster grower, resistant to leaf tatter

'Endowment': broad columnar form, 50' tall, 20' wide, bright yellow fall color, no leaf scorch

'Heartland' (Autumn Faith™): oval to vase-shape, dense form, 35' tall, 20' wide, new leaves are bronze opening to dark green, bronze fall color, slow grower

'Flax Mill' (Majesty®): broadly oval, symmetrical form, 50' tall, 40' wide, thicker leaves, orange to reddish fall color

'Jefcan' (Unity®): upright, oval form, 50' tall, 30' wide, yellow to orange-red fall color, selected for harsh prairie climate, from Canada, slower grower, resistant to frost crack, newer cultivar, zone 3

Legacy®: oval to rounded, dense form, 50' tall, 35' wide, glossy, thick, dark green leaves, later reddish-orange to red fall color or none, leaf scorch and leaf tatter resistant, faster grower, heat tolerant,

'Morton' (Cresendo™): broadly oval form, 45' tall, 40' wide, orange-red to red fall color, heat tolerant

'PNI 0285' (Green Mountain®): broadly oval form, 45-50' tall, 35' wide, reddish-orange to red fall color, leathery leaves less subject to leaf scorch, faster growing, more heat tolerant

'Wright Brothers': oval form, 50' tall, 35' wide, yellow-orange to red fall color, resistant to leaf scorch and frost crack, faster growing

***Acer* 'Keithsform'**: Norwegian Sunset®: not reliably hardy in zone 5, hybrid of Norway and Shantung maples, may not develop any fall color

***Acer* 'Warrenred'**: Pacific Sunset®: zone 4b, hybrid of Norway and Shantung maples, upright, oval to spreading form, good branching, 30-40' tall, 20-25' wide, glossy leaves, late yellow to bright orange-red fall color, heat, drought, and urban tolerant

Celtis occidentalis: common hackberry, zone 3b, native to eastern and central U.S., Canada, and Wisconsin, vase-shaped when young becoming rounded with drooping branches, moderate to fast growth rate, 50-70' tall, 40-60' wide, corky, warty looking bark, small, pea-sized, purplish-black fruit in fall, adaptable to most soils and pH, tolerates dry, sandy, rocky, and compact, heavy clay soils, slow to establish, plant in spring, drought, urban, wind, and wet soils tolerant, but sensitive to salt, susceptible to hackberry nipple gall on leaves, witches' brooming of twigs, resistant to DED, sensitive to Dicamba herbicides used near tree, branches tend to break in storms, prone to included bark formation, need to train to develop good branch structure

'Chicagoland': broad pyramidal form with upright branches, 55' tall, 40' wide, forms a straight central leader, rich green leaves, yellow fall color, warty bark
'Windy City': upright, spreading form, straight, central leader, fast grower

Corylus colurna: Turkish filbert, hardy to zone 4b, native to southeastern Europe and western Asia, broad, pyramidal form, formal looking even with age, dense, coarse texture, 40-50' tall, 20-25' wide, no fall color, scaly to corky, gray-brown bark, long, pendulous catkins in early spring are showy, may produce nuts, difficult to transplant, heat, urban, and drought tolerant, once established, sensitive to salt

Ginkgo biloba: ginkgo, maidenhair tree, hardy to zone 4b, native to eastern China, living fossil, found in fossil records dating back 150 million years ago, deciduous gymnosperm, pyramidal when young, becoming wide-spreading with age to upright, slow grower, 50-80' tall, 30-60' wide, very interesting, fan-shaped leaves, golden-yellow fall color, dioecious (separate male and female flowers produced on separate plants), female trees produce smelly, messy fruit, but not until 20 years old, so plant male cultivars only, tolerant to most soils and pH, prefers a sandy, deep soil, difficult to transplant, plant in spring, heat, salt, urban, and drought tolerant, no pests

'Autumn Gold': broadly pyramidal, symmetrical form, 45' tall, 35' wide, golden yellow fall color, male, no fruit, good, uniform branching
'Fairmount': dense, upright, pyramidal form, straight central leader, male, no fruit
'Halka': broadly pyramidal becoming oval, 45' tall, 40' wide, bright yellow fall color, male, no fruit
'Golden Globe™': broad, rounded form, 60' tall, 40' wide, slightly faster growth rate, male, no fruit, dense form, golden yellow fall color, Zone 5
'Magyar': upright form, 50' tall, 30' wide, bright yellow fall color, male, no fruit
'PNI 22720' (Princeton Sentry®): narrow pyramidal, upright form, 50' tall, 20-30' wide, bright yellow fall color, male, no fruit
'Saratoga': compact, dense, rounded form, with straight central leader, 20-30' tall, 15-20' wide, pendulous leaves, soft yellow fall color, slower and smaller than other ginkgos, male, no fruit
Shangri-La®: moderately pyramidal form, 45' tall, 25' wide, slightly faster growth rate, bright yellow fall color, male, no fruit
'Windover Gold®: upright, oval form, 40-60' tall, 30-40' wide, golden yellow fall color, strong grower, male, no fruit
'Woodstock' (Emperor™): uniform, oval form, strong, central leader, good branching, male, no fruit

Gleditsia triacanthos* var. *inermis: thornless honeylocust, hardy to zone 4a, native to central U.S. and southern Wisconsin (thorny type native, not var. *inermis*), fine texture, fast growing, vase-shaped form becoming flat-topped, spreading branches, open, 50-70' tall, 40-50' wide, early, bright golden-yellow fall color, no thorns, dioecious (separate male and female flowers produced on separate plants), female plants produce long, twisted, black pods that make a slippery, litter mess, tolerant to most soils and pH, tolerant to compacted, heavy clay soil, drought, salt, and urban tolerant, tolerant to periodic flooding, susceptible to leaf hoppers, plant bug, cankers, sunscald on trunk, high maintenance pruning, tends to develop co-dominate branches, can break in storms

'Christie' (Halka™): broad, oval to rounded form, 40' tall, 40' wide, horizontal branches, some pods, fast growing, yellowish fall color

'Emerald Kascade': irregular, weeping form with pendulous branches, grafted, 16' tall, male, no pods
'Harve' (Northern Acclaim®): symmetrical, upright, spreading form, 45' tall, 35' wide, yellow fall color, male, no pods, developed in North Dakota, hardy to zone 3b
'Impcole' (Imperial®): rounded form, symmetrical, wide-spreading, with good branching, 35' tall, 35' wide, seedless but can throw a few pods, susceptible to leaf hoppers and plant bug
'Moraine': uniform, rounded crown with vase-shaped branching, male, no pods, older cultivar
'PNI 2835' (Shademaster®): vase-shaped to rounded, irregular form, 45' tall, 35' wide, uniform, ascending branches, occasionally, some trees may produce pods
'Skycole' (Skyline®): broadly pyramidal form, ascending branches with wider crotch angles, 45' tall, 35' wide, develops a strong, central leader better than any other cultivar, male, no pods, bright golden yellow fall color
'Suncole' (Sunburst®): irregular, oval form, 40' tall, 35' wide, 8" of new leaves are bright yellow then fades to green, yellowish fall color, susceptible to leaf hoppers, plant bug, and canker, male, no pods
True Shade®: broadly oval form, 40' tall, 35' wide, wider branch angles, yellow fall color, faster grower, male, no pods
'Wandell' (Perfection™): develops a good crown at a younger age, 35' tall, 30' wide, dark green leaves, male, no pods

Gymnocladus dioica: Kentucky coffeetree, hardy to zone 4a, native to central U.S., southern Ontario, and Wisconsin (scattered distribution), vase-shaped form with upright branches becoming irregular and open, 50-75' tall, 40-50' wide, slow to moderate grower, coarse texture in winter with sparse branching when young, lacy texture when in leaf, yellow fall color, large, bluish-green leaves, ashy-gray, deeply furrowed bark with exfoliating plates, dioecious (separate male and female flowers produced on separate plants), females produce thick, sausage-like, pendulous pods, that can be a litter problem along with the leaf rachis in fall, adaptable to most soils and pH, slow to establish, tolerates compacted, heavy clay soil, salt, drought, periodic flooding, and urban conditions, no pests, can look a bit "gauntly" when young due to sparse branching

'Espresso': oval to vase-shaped form with arching branches, 50' tall, 35' wide, large, blue-green leaves, yellowish fall color, male, no pods, newer cultivar
'J.C. McDaniel' (Prairie Titan™): oval to vase-shaped form, 50' tall, 35' wide, large, blue-green leaves, yellowish fall color, male, no pods, newer cultivar

***Phellodendron amurense* 'Macho'**: Macho Amur corktree, hardy to zone 3b, native to northern China and Japan, broadly vase-shape, upright form, 40' tall, 30' wide, ascending branches, thick, dark green leaves, yellowish-green fall color, male, no fruit, corky bark when older, adaptable to most soils and pH, slow to establish, urban tolerant, moderate salt tolerance, no pests, shallow roots, low branching, avoid female trees as they produce invasive seeds

***Phellodendron lavallei* 'Longenecker'**: Eyestopper™ Lavalle corktree, hardy to zone 4b, native to Japan, upright, wide spreading form, 40' tall, 35' wide, bright yellow fall color, male, no fruit, corky bark when older, same culture as Amur corktree

***Phellodendron sachalinense* 'His Majesty'**: His Majesty Sakhalin corktree, hardy to zone 3b, native to Korea, northern Japan, and western China, broadly vase-shaped to rounded, open form, 35-40' tall, 35' wide, yellow fall color, male, no fruit, same culture as Amur corktree

***Sweating**: Most bare root oaks require sweating before planting to break bud. This involves dormant tree liners laid down and covered with wet packing material such as straw, shingle tow, and covered with a sheet of plastic. This should be done indoors, if possible, or in the shade. Temperatures should be between 45-70°F with high humidity (under plastic). Once the buds have begun to swell, usually within a few days, but usually not more than a week, the trees are ready to be lined out. The key to success is after the sweating process. Delay planting of oaks until the weather is warmer and humid (May) for better success after the sweating process. This is critical for success of sweated oak liners. Oaks are best transplanted in spring, rather than fall. It is best to move oaks at 2-2 1/2" caliper or lower, rather than bigger caliper as transplant shock reduces chances for survival. Other species that benefit from the sweating process include: birch, especially river birch, hawthorns, hackberry, ironwood (*Ostrya*), and redbud

Quercus bicolor: swamp white oak, hardy to zone 4a, native to eastern U.S. and Wisconsin, pyramidal when young, becoming broad, rounded, wide-spreading with age, 50-60' tall, 50-60' wide, slow to moderate growth rate, easier to transplant than bur oak, prefers acidic to neutral pH, but will tolerate a bit higher, but at very high pH, it will get chlorotic, adaptable to most soils including heavy clay, tolerant to wet soil, drought, and urban conditions

***Quercus* × *bimundorum* 'Crimschmidt'**: Crimson Spire™ oak, hardy to zone 4b, hybrid of *Q*. *alba* × *Q*. *robur*, columnar to tightly fastigiate form, 45' tall, 15' wide, dark green to blue green leaves, rusty-reddish fall color, supposed to be mildew resistant, zone 5

Quercus macrocarpa: bur oak, hardy to zone 3a, native to eastern and midwestern U.S. and Wisconsin, pyramidal when young, becoming very wide-spreading, rounded, 70-80' tall, 60-80' wide, slow growing, coarse texture, deeply furrowed bark, no fall color, adaptable to most soils and pH, drought and urban tolerant, difficult to transplant

***Quercus* × *macdenielli* 'Clemon's'**: Heritage® oak, hardy to zone 4, hybrid of *Q*. *robur* × *Q*. *macrocarpa*, broadly pyramidal becoming oval form, 60-80' tall, 40-50' wide, dark green, glossy leaves, no fall color, mildew resistant, vigorous, zone 4

Quercus muehlenbergii: chinkapin oak, hardy to zone 4b, native to eastern and midwestern U.S. and Wisconsin, wide-spreading, rounded, open form, 40-60' tall, 50-60' wide, yellow to orangish-brown fall color, ashy-gray, flaky bark, adaptable to most soils and pH, difficult to transplant, drought and urban tolerant

Quercus robur: English oak, hardy to zone 5a, native to Europe, northern Africa, and western Asia, oval to rounded form, short trunk, slow to moderate growth rate, 40-60' tall, 40-50' wide, no fall color, smaller leaves than other oaks, deeply furrowed bark, adaptable to most soils and pH, does not like compacted soils, urban tolerant, susceptible to powdery mildew, especially fastigiate forms, two-lined chestnut borer, scale, basal canker

'Fastigiata' (Skyrocket®): narrow, fastigiate form, 45' tall, 15' wide, tight branching, susceptible to mildew
'Pyramich' (Skymaster®): hardy to zone 5, narrow when young becoming pyramidal, 50' tall, 25' wide, straight central leader, good branch crotch angles, fast grower, may be a hybrid as it is vigorous
'Wandell' (Attention®): narrow, pyramidal to columnar form, 50' tall, 15' wide, resistant to powdery mildew, smaller leaves

***Quercus* Rosehill®**: Rosehill oak, hybrid of *Q*. *robur* x *Q*. *bicolor* 'Asjes', fastigiate to narrow-oval form, 40' tall, 20' wide, mildew resistant, zone 4b

Quercus* × *schuettei: swamp bur oak, hybrid of *Q*. *bicolor* × *Q*. *macrocarpa*, broad, rounded form, 75' tall, 70' wide, faster growing, better tolerance to high pH and easier to transplant, may be susceptible to leaf/twig galls, zone 3b

***Quercus* × *warei* 'Long'**: Regal Prince® oak, broad columnar becoming upright oval form, 40-60' tall, 20-25' wide, hybrid of *Q*. *robur* 'Fastigiata' × *Q*. *bicolor*, dark green leaves with silvery undersides, holds leaves late, no fall color or mildew, zone 4b

Taxodium distichum: baldcypress, northern provenance is critical, hardy to zone 4b, pyramidal form with straight terminal leader, 50-70' tall, 25-35' wide, fine texture, native to southeastern and southcentral U.S. into southern IL, mainly in swamps, needs training in nursery or it grows like a large bush, deciduous gymnosperm, feathery, soft, bright green leaves, with rusty-brown to orangish-bronze fall color, reddish-brown to grayish, fibrous, shreddy bark, does not form "knees" in urban conditions, only if grown near water, adaptable to most soils, prefers slightly acidic to neutral soils, can get chlorotic at very high pH, easy to transplant, heat, drought, salt, wet soil, and urban tolerant, few, if any pests

'Mickelson' (Shawnee Brave®): narrowly pyramidal form, 55' tall, 20' wide, richer green leaves, more upright form

Tilia americana: American linden, basswood, hardy to zone 3a, native to northeast and central U.S., Canada, and Wisconsin, pyramidal when young becoming upright-oval with age, 60-80' tall, 40-50' wide, fragrant, pale yellow flowers in early summer, small nutlet fruit attached to bract, large, heart-shaped leaves, prefers a deep, fertile soil, pH adaptable, easy to transplant, tolerant to wetter soils, sensitive to salt and air pollution, susceptible to Japanese beetle, linden borer, gypsy moth, basal and stem rots, sunscald on bark, tends to sucker at base, can break in storms, prone to included bark formation and narrow, branch crotch angles, girdling roots

'Bailyard' (Front Yard®): broadly pyramidal when young becoming rounded and dense, symmetrical form, 60-75' tall, 40' wide
'Boulevard': narrowly pyramidal form, 50' tall, 25' wide, ascending branches, yellow fall color
'DTR 123' (Legend®): broadly pyramidal form, 40' tall, 30' wide, well-spaced branches, thicker leaves, single leader, yellow fall color
'Lincoln': pyramidal, compact, dense form, 40' tall, 25' wide, upright branches, dark green leaves, yellow fall color
'Mcksentry' (American Sentry™): symmetrical, pyramidal form with straight central leader, 45' tall, 30' wide, better branch angles, lighter gray bark, yellow fall color

Tilia cordata: littleleaf linden, hardy to zone 3b, native to Europe, pyramidal when young becoming oval to round with age, formal, dense habit, 50-70' tall, 35-50' wide, fragrant, pale yellow flowers in early summer, small nutlet fruit attached to bract, small, heart-shaped leaves, prefers a fertile soil, but is adaptable, pH adaptable, easy to transplant, sensitive to poorly-drained, compacted soils and road salt, urban and air pollution tolerant, same pests as American linden

'Baileyi' (Shamrock®): symmetrical, pyramidal form, 40' tall, 30' wide, stouter branches, more open canopy, uniform branching no fall color
'Chancole' (Chancellor®): upright, narrow, pyramidal form, 40' tall, 20' wide, good branching, faster growing, wider branch crotch angles, yellowish fall color
'Corzam' (Corinthian®): narrowly pyramidal form, 45' tall, 15' wide, dense branching, evenly spaced branches, thick, glossy leaves, yellowish fall color
'Halka' (Summer Sprite®): dense, narrow, pyramidal form, dwarf, 16' tall, 8' wide, yellowish fall color
'Norbert' (Prestige®): broad, pyramidal form, good branching, wider branch crotch angles, shiny leaves, fewer seeds produced, harder to find, but much better form than 'Greenspire'
'PNI 6025' (Greenspire®): pyramidal, symmetrical form becomes rounded with age, 40' tall, 30' wide, yellowish fall color, very prone to narrow crotch angles and included bark formation, tight branching, needs a lot of training pruning, old cultivar
'Ronald' (Norlin™): broad, pyramidal form, 40-45' tall, 30' wide, faster grower, resistant to sunscald, more cold hardy

Tilia* × *euchlora: Crimean linden, hardy to zone 4b, hybrid of *T*. *cordata* × *T*. *dasystyla*, broadly pyramidal form to oval, 40-60' tall, 35' wide, can sucker from base of tree, yellowish fall color

***Tilia* × *flavescens* 'Glenleven'**: Glenleven linden, hardy to zone 4, hybrid of *T*. *americana* × *T*. *cordata*, pyramidal form, 50' tall, 30' wide, yellowish fall color, better branching, more open, larger leaves, faster growing, straight trunk and leader

***Tilia* 'Harvest Gold'**: Harvest Gold linden, hardy to zone 3, hybrid of *T*. *cordata* × *T*. *mongolica*, more cold hardy, upright, oval form, 30-40' tall, 20-25' wide, leaves are deeply lobed, resistant to sunscald, exfoliating bark, golden buds and fall color

***Tilia* 'Redmond'**: Redmond linden, hardy to zone 4, hybrid of *T*. *americana* × *T*. × *euchlora*, pyramidal to oval form, upright branches with terminal leader above the foliage, reddish stems and buds, can sucker at base, 50-70' tall, 30-40' wide, fragrant, pale yellow flowers in early summer, small nutlet fruit attached to bract, large, heart-shaped leaves

Tilia tomentosa: silver linden, hardy to zone 4b, native to southeastern Europe and western Asia, broad-pyramidal form becoming upright-oval, formal looking, dark green leaves with silvery-white undersides, pale yellow flowers in summer, small nutlet fruit attached to a bract, no fall color, prefers a deep, fertile soil, but is

adaptable, pH adaptable, easy to transplant, more heat, drought, and urban tolerant than other lindens, does not tolerate poorly-drained, compacted soils, same pests as American linden

'PNI 6051' ('Green Mountain®'): broadly pyramidal to oval form, 50' tall, 35' wide, dark green leaves with silvery undersides, yellowish fall color, prone to included bark formation

'Wandell' ('Sterling®'): broadly pyramidal form, 45' tall, 35' wide, green leaves with silvery undersides, yellowish fall color, prone to included bark formation

Ulmus americana: American elm (DED resistant cultivars), hardy to zone 3a, native to eastern and central U.S., Canada and Wisconsin, all have vase-shaped form with pendulous branches, 70-80' tall, 60-70' wide, yellow fall color, adaptable to most soils and pH, tolerant to compacted, heavy clay soils, easy to transplant, tolerant to periodic flooding, salt, urban, air pollution, and drought tolerant, pest prone

'New Harmony' (from U.S. National Arboretum): broad, vase-shaped form, arching branches, good form, easier to grow

'Princeton': (from Princeton Nursery) large, leathery leaves, vase-shaped form, more resistant to elm leaf beetle

'Valley Forge' (from U.S. National Arboretum): broad, vase-shaped form with arching branches, 70' tall, 70' wide, wild looking form and branching, vigorous, needs training

***Ulmus* hybrids**: hybrid elms, most are hardy to zone 4-5, all Dutch elm disease resistant, needs pruning in nursery to develop good form, adaptable to most soils and pH, tolerant to compacted, heavy clay soils, moderate salt tolerance, drought, urban, and air pollution tolerant

'Cathedral' (UW-Madison intro): hybrid of *U. japonica* × *U. pumila*, broadly vase-shaped, spreading form, 40-50' tall, 40-60' wide, prone to elm leaf beetle, zone 4

'Frontier' (from U.S. National Arboretum): hybrid of *U. carpinifolia* × *U. parvifolia*, broadly oval form, 35' tall, 25' wide, ascending branches, glossy, small, dark green, glossy leaves, late, burgundy fall color, can get elm leaf beetle, Zone 5

'Homestead' (from U.S. National Arboretum): hybrid of *U. pumila* × (*U.* × *hollandica* × *U. carpinifolia*), upright, narrow to oval form, 55' tall, 35' wide, upright, arching branches, prone to elm leaf beetle, fast growing, Zone 4b

'Morton' ('Accolade®') (from Morton Arboretum): hybrid of *U. japonica* × *U. wilsoniana*, vase-shaped form with arching branches, 70' tall, 60' wide, resistant to elm leaf beetle, vigorous, resistant to elm leaf beetle, dark green, glossy leaves, zone 4

'Morton Glossy' ('Triumph™') (from Morton Arboretum): hybrid of *U.* 'Morton Plainsman' × *U.* 'Morton', upright oval to vase-shape, 55' tall, 45' wide, very glossy, dark green leaves, good form, some elm leaf beetle, excellent drought tolerance, zone 4

'Morton Plainsman' ('Vanguard™') (from Morton Arboretum): hybrid of *U. japonica* × *U. pumila*, rounded, vase-shaped form, 45' tall, 40' wide, glossy, dark green leaves, prone to elm leaf beetle, zone 4

'Morton Red Tip' ('Danada Charm™') (from Morton Arboretum): complex hybrid of (*U. japonica* × *U. wilsoniana*) × *U. pumila* vase-shape form with arching branches, 70' tall, 60' wide, reddish new leaves, new leaves, prone to elm leaf beetle, zone 4

'Morton Stalwart' ('Commendation™') (from Morton Arboretum): complex hybrid of *U.* 'Morton' × (*U. pumila* × *U. carpinifolia*), upright, oval form, 60' tall, 50' wide, zone 5

'New Horizon' (UW-Madison intro): hybrid of *U. japonica* × *U. pumila*, upright, compact form, 50' tall, 25' wide, dark green leaves, wide crotch angles, susceptible to verticillium wilt, zone 3b

'Patriot' (from U.S. National Arboretum): complex hybrid of *U. wilsoniana* × *U. pumila* × *U. carpinifolia* × *U. glabra*, stiffly upright branches, narrow, vase-shape form, 50' tall, 40' wide, dark green leaves, straight central leader, zone 5

'Pioneer' (from U.S. National Arboretum): hybrid of *U. glabra* × *U. carpinifolia*, rounded form, 50' tall, 50' wide, dark green, glossy leaves, prone to elm leaf beetle, zone 5

'Regal' (UW-Madison intro): complex hybrid of *U. carpinifolia* × (*U. pumila* × *U.* × *hollandica*), upright, pyramidal form, 50-60' tall, 30' wide, prone to double leaders and narrow crotches, stiff branches, zone 4

***Ulmus japonica* 'Discovery'**: Discovery Japanese elm, hardy to zone 3, native to Japan and Asia, upright, vase-shape, compact form, 35-40' tall, 35-40' wide, resistant to DED and elm leaf beetle, yellow fall color

Ulmus parvifolia: lacebark elm, Zone 5b, native to China, Korea, and Japan, semi-exfoliating bark with mottled colors of gray, green, orange, and brown inner bark and orange lenticels, adaptable to most soils and pH, easy to transplant, tolerant to compacted, clay soils, urban, air pollution, tolerant, DED resistant

'Dynasty' (from U.S. National Arboretum), more cold hardy, zone 5a, upright, vase-shaped to rounded form, 40-45' tall, 40' wide, orange-yellow to red fall color, bark not as exfoliating as other cultivars

***Ulmus wilsoniana* 'Prospector'** Prospector elm (from U.S. National Arboretum): hardy to zone 4, dense, broad, vase-shaped form, slightly pendulous branches, 40' tall, 30' wide, resistant to elm leaf beetle, DED, and phloem necrosis, deep green, glossy leaves, yellow fall color

Small Urban Area or Street Trees

Acer tataricum: Tatarian maple, Zone 3a, native to southeastern Europe and central Asia, invasive, do not plant near any natural areas, single or multi-stemmed, upright form, 25' tall, 20' wide, yellow to reddish-brown fall color, pinkish-red samaras in summer changing to brown in fall, adaptable to most soils and pH, easy to transplant, drought, salt, and urban tolerant, very susceptible to verticillium wilt

'GarAnn' (Hot Wings™): upright, spreading form, 20-25' tall, 15-20' wide, bright red samaras, yellow to red fall color, drought tolerant
'Patdell' (Pattern Perfect™): upright form, 20' tall, 15-20' wide, bright red samaras, red stems, red-orange fall color
'Summer Splendor™: upright, spreading form, 15-20' tall, 15' wide, bright red fruit in summer

Acer tataricum* subsp. *ginnala: Amur maple, Zone 3a, native to China, Manchuria, and Japan, very invasive, do not plant near any natural areas, multi-stemmed, rounded form, low branches, 15-18' tall and wide (smaller cultivars are available), dagger-shaped leaves, orange to bright red fall color, red samaras in summer turn brown in fall, adaptable to most soils and pH, easy to transplant, drought, salt, and urban tolerant, very susceptible to verticillium wilt

'Compactum' or 'Bailey Compact': dense, compact, rounded, shrubby form, 6-8' tall, 6-8' wide, slower grower, orange to scarlet fall color
'Embers': rounded form, 15-20' tall, 15' wide, bright red samaras, scarlet fall color
'Emerald Elf': compact, rounded, dense, shrubby form, 5-6' tall and wide, scarlet to purple fall color
'Flame': multi-stemmed, spreading, irregular form, 15-20' tall, 20-25' wide, bright orange-red to deep red fall color
'JFS-UGA' (Red November™): multi-stemmed, low, rounded form, 18' tall, 24' wide, later, bright red fall color, heat tolerant, Zone 5

Acer truncatum: Shantung maple, Zone 3b, use a northern provenance (seed source), native to northern China, Russia, Korea, and Japan, broad-rounded, dense, symmetrical form, 20-30' tall, 20-30' wide, yellowish-orange to purple fall color, star-shaped leaves, adaptable to most soils and pH, drought, salt, heat and urban tolerant, no pest problems, harder to find, but worth trying

Amelanchier* × *grandiflora: apple serviceberry, hardy to zone 3a, native hybrid of downy and Allegheny serviceberry, multi or single-stemmed tree to large shrub, upright to irregular form, no suckers, 15-30' tall, 15-25' wide, produces bronze to purplish-red, fuzzy leaves in spring that turn smooth and green, white flowers in early spring, edible fruit in June, smooth, gray bark, yellowish-orange to red fall color, can develop chlorosis at high pH, prefers loamy soil, does poorly in poorly drained soils, difficult to transplant, plant in spring

'Autumn Brilliance': upright, spreading form, 20-25' tall, 15' wide, orange-red fall color, leaf spot resistant, multi-stemmed
'Cole's Select': upright, spreading form, 15-20' tall, 15' wide, multi-stemmed, orange-red fall color, leaf spot resistant, thicker, glossier leaf
'Forest Prince': oval form, 20' tall, 15' wide, red-orange fall color
'Princess Diana': wide spreading form, 15-20' tall, 15' wide, multi-stemmed, red-orange fall color, leaf spot resistant
'Robin Hill': upright, open form, 20-30' tall, 15-20' wide, flowers pink in bud open to pale pink fading to white, red fall color, single-stemmed

Amelanchier laevis: Allegheny serviceberry, hardy to zone 4a, native to eastern and central U.S., Canada, and Wisconsin, upright form, single or multi-stemmed tree, 15-25' tall, 15-20' wide, can sucker, produces white flowers in early spring, bronze to purplish-red new leaves in spring that turn green, edible fruit in June, orange to reddish-bronze fall color, prefers moist, loamy soils, does poorly in poorly drained soils, difficult to transplant, plant in spring

Cumulus®: upright, open form, 20-30' tall, 15' wide, orange-red fall color, minimal suckering, single-stemmed

'JFS-Arb' ('Spring Flurry®'): upright, oval form, 30-35' tall, 20' wide, orange fall color, single-stemmed, straight central leader, newer cultivar
'Rogers' ('Lustre®'): upright, open form, 20-30' tall, 15-20' wide, orange-red fall color, minimal suckering, single-stemmed
'Snowcloud': upright, oval form, 25' tall, 15' wide, scarlet fall color, single-stemmed

Cornus mas: Corneliancherry dogwood (more of a boulevard tree), hardy to zone 4b, native to Europe and western Asia, bright yellow flowers in early spring, long lasting, fruit is in summer and is bright red changing to dark purple and becoming edible, but tart, adaptable to most soils, but prefers rich soils, pH adaptable, easy to transplant, tolerates partial shade, straight species is sensitive to drought, but cultivars are more tolerant, sensitive to salt, no pest problems, hardy to zone 4b

'Golden Glory': narrow, upright form, 20-25' tall, 10' wide, much better form and darker green, glossy, thicker leaves, more flowers and fruit, good substitute to invasive tallhedge buckthorn!
'Pyramidalis': upright, pyramidal to upright form, 20' tall, 10-15' wide, dark green leaves

Crataegus crus-galli* var. *inermis: thornless cockspur hawthorn, hardy to zone 4a, native to eastern and central U.S., Canada, and Wisconsin, multi-stemmed tree, broad, spreading, horizontal, low branches, flat-topped crown, 20-30' tall, 20-35' wide, adaptable to most soils and pH, difficult to transplant, plant in spring, drought, salt, and urban tolerant, susceptible to cedar quince rust (on fruit) or cedar hawthorn rust (leaves), this variety has no thorns, white flowers in late spring, deep red fruit in early to mid fall that drops creating a litter problem, bronzish-orange to reddish fall color, dark green, leathery, spoon-shaped leaves

'Cruzam' ('Crusader®'): rounded form, 15' tall, 15' wide, thornless, bright red fruit, orange fall color

Crataegus phaenopyrum: Washington hawthorn, hardy to zone 4b, native to eastern U.S. and Canada, multi-stemmed tree, vase-shaped to broadly oval form, horizontal, low branches, 20-30' tall, 20-25' wide, adaptable to most soils and pH, difficult to transplant, plant in spring, tolerant to poor, sandy soils, drought and urban tolerant, moderate salt tolerance, susceptible to cedar quince rust (on fruit) or cedar hawthorn rust (leaves), has long, sharp thorns, white flowers in late spring to early summer, showy, persistent, glossy, bright-orange-red fruit fall to winter

'Westwood I' ('Washington Lustre®'): rounded, upright form, 20-25' tall, 20-25' wide, has fewer thorns than species, vigorous

***Crataegus viridis* 'Winter King'**: Winter King hawthorn, hardy to 4b, native to eastern U.S., vase-shaped to rounded, wide-spreading form, horizontal, low branches, adaptable to most soils and pH, difficult to transplant, plant in spring, drought and urban tolerant, moderate salt tolerance, less susceptible to cedar hawthorn rust but can get cedar quince rust on fruit, white flowers in late spring, very showy, bright orange-red, persistent fruit from mid fall to winter, silvery-gray bark that exfoliates on the trunk revealing orange inner bark, has few if any thorns, yellowish-purple fall color

Maackia amurensis: Amur maackia, hardy to zone 4a, native to Manchuria, vase-shaped to rounded form, upright, arching branches, 20-30' tall, 20-30' wide, slow grower, silvery and fuzzy leaves in spring turn olive-green and smooth, coppery-green to bronzish-brown, slightly exfoliating bark, off-white flowers in summer, small pods in fall, tolerant to most soils and pH, roots fix atmospheric N, tolerant to poor, infertile soils, urban and salt tolerant, prone to included bark formation, needs pruning when young, no pests, not invasive

'Starburst': upright, vase-shaped form with rounded crown, 25-30' tall, 20' wide, dark green leaves
Summertime®: upright, rounded form, 18-20' tall, 12-15' wide, white flowers in summer

***Malus* spp.**: flowering crabapple, most are hardy to zone 4a and are hybrids with parents originating from Asia, Europe and U.S., size and form are quite variable, adaptable to most soils and pH, prefers low nitrogen to decrease disease susceptibility, drought and urban tolerant, apple scab resistant species and cultivars listed below and have smaller fruit, some cultivars prone to suckering and watersprouts on branches

White Flowers/Red Fruit

'Adirondack': narrow, upright form, 18' tall, 10' wide, persistent fruit
'Guinzam' ('Guinevere®): rounded form, 8-10' tall, 10' wide, persistent fruit
'Jewelcole' ('Red Jewel®): upright, pyramidal form, 15' tall, 12' wide, persistent fruit, can get fireblight
'Kinarzam' ('King Arthur®): upright, rounded form, 12' tall, 10' wide, can sucker from base
'Sutyzam' ('Sugar Tyme®): upright, spreading, oval form, 18' tall, 15' wide, persistent fruit
Malus baccata 'Jackii': Jackii crabapple, hardy to zone 3, rounded form, 20' tall, 20' wide, glossy leaves, zone 3
Malus sargentii: Sargent crabapple, low, spreading form, 8' tall, 12' wide, alternate bearing, persistent fruit
'Select A' ('Firebird®): rounded, spreading form, 7' tall, 9' wide, persistent fruit, bears annually, persistent fruit
'Tina': small, rounded, dwarf form, 5' tall, 6' wide, slow growing
Malus × *zumi* var. *calocarpa*: redbud crabapple, rounded, spreading form, 20' tall, 24' wide, persistent fruit

White Flowers/Yellow Fruit
'Bob White': dense, rounded form, 20' tall, 20' wide, persistent fruit, but is a watersprouter
'Cinzam' ('Cinderella®): dwarf, rounded to upright form, 8' tall, 5' wide, persistent fruit
'Excazam' ('Excalibur™): upright form, 10' tall, 8-10' wide, good form
'Hargozam' ('Harvest Gold®): upright, oval form, 22' tall, 18' wide, persistent fruit, may get some scab
'Lanzam' ('Lancelot®): compact, upright, dense form, 8-10' tall, 8' wide, persistent fruit
'Ormiston Roy': broad, rounded form, 20-25' tall, 25' wide, furrowed, orangish bark, yellow fruit with a rosy blush turn orange-brown after a hard frost

Pink or Reddish Flowers/Red to Purplish-Red Fruit
'Camzam' ('Camelot™): rounded form, 10' tall, 8' wide, pinkish-white flowers, burgundy-green leaves, persistent fruit
Malus sargentii 'Candymint': low, spreading, horizontal form, 10' tall, 15' wide, purple tinted foliage becoming bronze-green
'Canterzam' ('Canterbury™): rounded, compact form 10' tall, 8-10' wide, light, pinkish-white flowers
'Cardinal': irregular, spreading form, 16' tall, 22' wide, dark purplish-red, glossy leaves
'JFS-KW5' ('Royal Raindrops®): upright, spreading form, 20' tall, 15' wide, cutleaf, purple leaves, orange-red fall color, persistent fruit
'Orange Crush': spreading form, 12-15' tall, 12-15' wide, bronze to purplish-green leaves
'Parrsi' ('Pink Princess®): low, spreading form, 8' tall, 12' wide, purple leaves become bronze-green
'Prairifire': upright, spreading to rounded form, 20' tall, 20' wide, slower growing, purple leaves become reddish-green
'Prairie Maid': rounded to spreading form, 20' tall, 25' wide, burgundy tinged leaves in spring, but is a watersprouter
'Purple Prince': rounded form, 20' tall, 20' wide, purple leaves become bronzish-green, persistent fruit

Weeping Form
'Coral Cascade': semi-weeping form, 15' tall, 20' wide, white flowers, coral fruit, persistent fruit
'Louisa': graceful weeper, 15' tall, 15' wide, pink flowers, fruit are yellow turning orange-brown, not showy or persistent
'Luwick': graceful, low weeper, 7' tall, 14' wide, deep pink buds open to light pink to whitish flowers, bright red fruit
'Manbeck Weeper' ('Anne E.®): wide spreading, horizontal weeper, 10-12' tall, 10-12' wide, white flowers, cherry-red fruit, persistent fruit, is difficult to find, but is one of the nicest crabs
'Molazam' ('Molten Lava®): broadly weeping form, 14' tall, 20' wide, white flowers, bright red fruit

Prunus sargentii: Sargent cherry, hardy to zone 4b, native to Japan, oval to vase-shaped form, 25-35' tall, 20-30' wide, showy, single, pink flowers in clusters in early spring, small, purplish-black fruit in summer, bronze to orange-red fall color, reddish-gray to chestnut-brown, polished bark, adaptable to most soils and pH, does not tolerate compacted, heavy-clay soils, plant in spring, likes roots kept cool, must have good drainage, resistant to black knot, may form included bark

'Columnaris': narrow, columnar to narrow, vase-shape form, 25-35' tall, 15' wide, orange to orange-red fall color
'JFS-KW58' (Pink Flair®): upright, narrow, vase-shape form, 25' tall, 15' wide, orange-red fall color

***Prunus* 'Accolade'**: Accolade cherry (hybrid with *P. sargentii* and *P. subhirtella*), hardy to zone 4b, 20-25' tall, 20-25' wide, horizontal branching with vase-shaped form, semi-double, early, pink flowers in drooping clusters before the leaves in early spring, no fruit, golden to orange fall color

Pyrus calleryana: callery pear, hardy to zone 4b, native to China and Korea, upright, pyramidal to oval form, 25-35' tall, 20-30' wide, adaptable to most soils and pH, drought, urban, and salt tolerant, can get fireblight, fast grower, dark green, glossy, leathery leaves, late, reddish-orange to purple fall color, white flowers in mid spring, small, brown, rounded fruit

Aristocrat®: pyramidal form with open branching, 35' tall, 25' wide, yellow to red fall color but is inconsistent for fall color, wider branch crotch angles
'Autumn Blaze': rounded form, 30' tall, 25' wide, earlier, bright red to purplish fall color, wide crotch angles, less prone to included bark formation
'Cambridge': upright, narrowly pyramidal form, 35' tall, 15' wide, bright orange fall color
'Capital': narrow, columnar form, 30' tall, 12' wide, reddish-purple fall color, susceptible to limb breakage in storms, susceptible to fireblight, zone 5
'Cleveland Select' or 'Glenn's Form' (Chanticleer®): formal, upright, narrowly pyramidal form, 25-30' tall, 15' wide, late orangish to reddish fall color, not as good as other cultivars for fall color, rarely produces fruit
'Redspire': pyramidal, dense, symmetrical form, 35' tall, 25' wide, yellow to reddish fall color or none at all, susceptible to fireblight, slower grower
'XP-005' (Trinity®): broadly oval to rounded form, 30' tall, 25' wide, glossy, lighter green leaves, orange-red fall color

***Pyrus* 'Edgedell'**: Edgewood® pear, hardy to zone 5, hybrid of *P. calleryana* x *P. betulifolia*, rounded, open form, 30' tall, 25' wide, silvery leaf undersides, white flowers, good branch crotch angles, reddish-purple fall color

Syringa pekinensis: Peking lilac, Pekin lilac, hardy to zone 4a, native to northern China, loose, rounded form, 20-25' tall, 15-20' wide, moderate to fast grower, no fall color, reddish-brown, shiny bark, creamy-white, large flowers in early summer that do not smell like lilacs but rather like a privet, tends to flower heavily every other year, adaptable to most soils and pH, easy to transplant, salt and urban tolerant, susceptible to bacterial blight and verticillium wilt, resistant to mildew

'DTR 124' (Summer Charm®): upright, spreading, better form, 20' tall, 15' wide, single-stemmed
'Morton' (China Snow®): upright, spreading, wild form, big crown, 25' tall, 20' wide, vigorous, showy, showy, exfoliating, coppery to orangish-brown bark, single-stemmed
'Zhang Zhimming' (Beijing Gold™): upright, rounded form, 25' tall, 20' wide, vigorous, single or multi-stemmed, yellow flowers instead of white

Syringa reticulata: Japanese tree lilac, hardy to zone 3a, native to Japan and Manchuria, upright with a rounded to oval form, 20-25' tall, 15-20' wide, no fall color to yellowish, reddish-brown, shiny bark, creamy-white, large flowers in early summer that do not smell like lilacs but rather like a privet, tends to flower heavily every other year, adaptable to most soils and pH, easy to transplant, salt and urban tolerant, susceptible to bacterial blight and verticillium wilt, resistant to mildew

'Elliott' (Snowcap™): upright, more compact form, 15-20' tall 10-12' wide, uniform branching, thick, dark green leaves, good form
'Golden Eclipse': upright, compact form, 18-24' tall, 8-14' wide, new leaves in spring emerge green with a darker center, the edge of the leaf gradually turns bright gold with the dark green center remaining
'Ivory Silk': over used, upright, spreading becoming oval to rounded, 20' tall, 15' wide, susceptible to bacterial blight
'Summer Snow': broad, rounded, compact form, 20' tall, 15' wide, good form, glossy, dark green leaves
'Williamette' (Ivory Pillar™): upright, pyramidal, narrower form, 20-25' tall, 10-15' wide

Wholesale nursery sources used in this guide (does not imply endorsement by me of nurseries named, nor criticism of similar nurseries not mentioned)

Bailey Nurseries: St. Paul, Minnesota, www.baileynurseries.com, (800) 829-8898
Beaver Creek Nursery: Poplar Grove, Illinois, www.beavercreeknursery.com, (815) 737-8758
Carlton Plants: Dayton, Oregon, www.carltonplants.com, (800) 398-8733
Femrite Nursery: Aurora, Oregon, www.femrite.com (800) 547-2161
Heritage Seedlings: Salem, Oregon, www.heritageseedlings.com (503) 371-9688
J. Frank Schmidt and Son: Boring, Oregon, www.jfschmidt.com, (800) 825-8202
Johnson's Nursery: Menomonee Falls, Wisconsin, www.johnsonsnursery.com, (262) 252-4980
Mariani Nurseries: Kenosha, Wisconsin, (866) 627-4264
McKay Nursery: Waterloo, Wisconsin, www.mckaynursery.com, (920) 478-2121
Meadow Lake Nursery, McMinnville, Oregon, www.meadow-lake.com (503) 435-2000
Silver Creek Nurseries: Manitowoc, Wisconsin, (920) 684-6267

U.S.D.A. Cold Hardiness Zones

Zone 3a (cold hardy to –35 to –40ºF): northwestern Wisconsin
Zone 3b (cold hardy to –30 to –35ºF): most of northern Wisconsin

Zone 4a (cold hardy to –25 to –30ºF): northern central and extreme northwestern Wisconsin
Zone 4b (cold hardy to –20 to –25ºF): southwestern and central Wisconsin and along shore of Lake Superior

Zone 5a (cold hardy to –15 to –20ºF): southeastern and eastern Wisconsin up to Door County and Madison near the lakes
Zone 5b (cold hardy to –10 to –15ºF): Milwaukee, Racine, and Kenosha areas near Lake Michigan

Appendix J

Federal and State EAB Regulations

Federal and State Authority for EAB Control

Federal Laws and Regulations:

- **Plant Pest Act 2000 – Prevent spread of plant pests**
  http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/PPAText.pdf

- **7CFR 301.53 – 301.53-9 – EAB regulations**
  http://www.access.gpo.gov/nara/cfr/waisidx_05/7cfr301_05.html

- **7CFR 319.40 – Solid wood packing material**
  http://www.access.gpo.gov/nara/cfr/waisidx_01/7cfr319_01.html

Wisconsin Statutes Providing State Authority:

- **26.30 – Forest insects and diseases, department jurisdiction and procedure**
  http://www.legis.state.wi.us/statutes/Stat0026.pdf

  (1) PURPOSE. It is the public policy of the state to control forest pests on or threatening forests of the state in order to protect the forest resources, promote good forest management, enhance the growth and maintenance of forests, promote stability of forest-using industries, aid in fire control by reducing the menace created by dying and dead trees, conserve forest cover on watersheds and protect wildlife, recreational values and other values of the forest.

  (2) POWERS. The department [Natural Resources] is vested with authority and jurisdiction in all matters relating to the prevention, detection and control of forest pests on the forest lands of the state, and to do all things necessary in the exercise of such authority and jurisdiction, except that this shall not be construed to grant any powers or authority to the department for the silvicultural control of forest pests on any land. This section shall apply only to the detection and control of forest pests on forest lands and does not affect the authority of the department of agriculture, trade and consumer protection under chs. 93 and 94. The action of the department under sub. (4) shall be coordinated with the department of agriculture, trade and consumer protection in accordance with s. 20.901.The secretaries of natural resources and agriculture, trade and consumer protection shall execute annually a memorandum of agreement to enable the coordination of pest control work of their departments.

- **94.01 – Plant inspection and pest control authority**
  http://www.legis.state.wi.us/statutes/Stat0094.pdf

  (1) In the conduct of survey and inspectional programs for the detection, prevention and control of pests, the department [Agriculture, Trade and Consumer Protection] may impose quarantines or such other restrictions on the importation into or movement of plants or other material within this state as necessary to prevent or control the dissemination or spread of injurious pests.
  (2) In accordance with sub. (1), the department, by summary order, may prohibit the removal of any plant, host plant, or other pest-harboring material from any private or public property, or any area of the state which in its judgment contains or is exposed to injurious pests, except under such conditions as in its judgment are necessary to prevent the dissemination or spread of pests, giving written notice thereof to the owner or person in charge of the property. While such order is in effect no person with knowledge thereof shall cause or permit the removal of any such plant, host plant or other pest-harboring material from such property or area, unless it is in compliance with the conditions of such order. Orders issued under this subsection shall be in writing, have the

force and effect of an order issued under s. 93.18, and are subject to right of hearing before the department, if requested within 10 days after date of service. Any party affected by the order may request a preliminary or informal hearing pending the scheduling and conduct of a full hearing.
(3) No person may obstruct or interfere with the examination or testing, by authorized inspectors and agents of the department, of any plants or other material suspected of being infested or infected with any injurious pests; nor may any person move any plants, plant parts, pests or pest-harboring materials contrary to the terms of any quarantine, rule, notice or order under this section.
(4) The department, through its authorized agents or inspectors, may enter at all reasonable times any property for purposes of inspection, investigation and control of suspected pest infestations or infections and may intercept, stop and detain for official inspection any person, truck, vessel, aircraft or other conveyance believed to be carrying plants or other materials infested or infected with pests, and may seize and destroy any such plants or other materials moved, shipped or transported in violation of any law, rule, quarantine notice or order.

- **94.02 – Abatement of pests**
(1) If the department finds any premises, or any plants, plant parts, or pest-harboring materials located thereon are so infested or infected with injurious pests as to constitute a hazard to plant or animal life in the state, or any area thereof, it may notify the owner or person having charge of such premises to that effect, and the owner or person in charge shall, within 10 days after such notice, cause the treatment of the premises or the treatment or removal and destruction of infested or infected plants, host plants or other pest-harboring material as directed in the notice. No person may violate the terms of any notice received under this subsection, nor may any damages be awarded to the owner for such treatment, removal or destruction. Any person affected by a notice or order may appeal to the department and request a hearing under s. 94.01 (2).
(2) If the owner or person in charge fails to comply with the terms of the notice, within 10 days after receiving it, the department or any cooperating local unit of government may proceed to treat the premises or to treat or destroy the infested or infected plants or other material. The expense of such abatement shall be certified to the town, city or village clerk and assessed, collected and enforced against the premises upon which such expense was incurred as taxes are assessed, collected, and enforced, and shall be paid to the cooperating unit of government incurring the expense, or into the general fund if the control work was conducted by the department.
(3) If a serious pest outbreak constituting a significant threat to agricultural production or plant life occurs, and cannot be adequately controlled by individual property owners or local units of government in any area of this state, the department may petition the joint committee on finance for emergency funds with which to conduct needed control work independently or on a cooperative basis with the federal or local units of government.
(4) This section pertains to the abatement of pests on agricultural lands and on agricultural business premises. This section does not affect the authority of the department of natural resources under ch. 26.

- **94.03 – Shipment of pests and biological control agents permits**
1) No person may sell or offer for sale, or move, transport, deliver, ship or offer for shipment, any pest, as defined in s. 93.01 (10) or any biological control agent as defined in sub. (2), without a permit as prescribed by rules of the department. Such rules may provide for reasonable exemptions from permit requirements. Permits may be issued only after the department determines that the proposed shipment or use will not create sufficient hazard to warrant refusal of a permit. Permits shall be affixed to the outside of every shipping container or accompany the shipment as the department directs.
(2) The department may by rule regulate and control the sale and use of biological control agents to assure their safety and effectiveness in the control of injurious pests and to prevent the introduction or use of biological control agents which may be injurious to persons or property or useful plant or animal life. The term "biological control agent" as used in this section means any living organism which because of its parasitic, predatory or other biological characteristics may

be effective for use in the suppression or control of pests by biological rather than chemical means.

- **94.10 – Nursery stock, inspection and licensing** *(relevant sections only)*

(2) Nursery dealer; annual license.

(a) *License required.* Except as provided in par. (f), no person may operate as a nursery dealer without an annual license from the department. A nursery dealer license expires on February 20. A nursery dealer license may not be transferred to another person.

(3) Nursery grower; annual license.

(a) *License required.* Except as provided in par. (f), no person may operate as a nursery grower without an annual license from the department. A nursery grower license expires on February 20. A nursery grower license may not be transferred to another person.

(3g) Christmas tree grower; annual license.

(a) *License required.* Except as provided in par. (e), no person may operate as a Christmas tree grower without an annual license from the department. A Christmas tree grower license expires on February 20. A Christmas tree grower license may not be transferred to another person.

(4) Nursery growers and dealers; records.

(a) *Nursery dealers; records of nursery stock received.* A nursery dealer shall keep a record of every shipment of nursery stock received by the nursery dealer. The nursery dealer shall include all of the following in the record:

1. A description of the types of nursery stock, and the quantity of nursery stock of each type, included in the shipment.
2. The name and address of the source from which the nursery dealer received the shipment.

(b) *Nursery growers and dealers; records of shipments to other nursery growers and dealers.* Each nursery grower and nursery dealer shall record every shipment of nursery stock that the nursery grower or nursery dealer sells or distributes to another nursery grower or nursery dealer. The nursery grower or nursery dealer shall include all of the following in the record:

1. A description of the types of nursery stock, and the quantity of nursery stock of each type, included in the shipment.
2. The name and address of the nursery grower or nursery dealer receiving the shipment.

(c) *Records retained and made available.* A nursery grower or nursery dealer who is required to keep records under par. (a) or (b) shall retain those records for at least 3 years and shall make those records available to the department for inspection and copying upon request.

(5) Labeling nursery stock.

(a) *Nursery stock shipped to grower or dealer.* No person may sell or distribute any shipment of nursery stock to a nursery grower or nursery dealer, and no nursery grower or nursery dealer may accept a shipment of nursery stock, unless that shipment is labeled with all of the following:

1. The name and address of the person selling or distributing the shipment to the nursery grower or nursery dealer.
2. A certification, by the person under subd. 1., that all of the nursery stock included in the shipment is from officially inspected sources.

(b) *Growers and dealers to report unlabeled shipments.* Whenever any person tenders to a nursery grower or nursery dealer any shipment of nursery stock that is not fully labeled according to par. (a), the nursery grower or nursery dealer shall promptly report that unlabeled shipment to the department.

(c) *Nursery stock sold at retail.* A person selling nursery stock at retail shall ensure that the nursery stock is labeled with the common or botanical name of the nursery stock.

(6) Care of nursery stock.

(a) *Adequate facilities.* A nursery grower or nursery dealer shall maintain facilities that are reasonably adequate for the care and keeping of nursery stock held for sale, so that the nursery grower or nursery dealer can keep the nursery stock in healthy condition pending sale.

(b) *Reasonable examinations.* Nursery growers and nursery dealers shall make reasonable examinations of nursery stock held for sale to determine whether that nursery stock is capable of reasonable growth, is infested with injurious pests or is infected with disease.

(7) Prohibitions.
(a) *Nursery dealers.* No nursery dealer may do any of the following:
1. Obtain, hold, sell, offer to sell or distribute nursery stock from any source other than an officially inspected source.
2. Misrepresent that the nursery dealer is a nursery grower.
(b) *Nursery growers and dealers.* No nursery grower or nursery dealer may do any of the following:
1. Sell, offer to sell or distribute any nursery stock that the nursery grower or nursery dealer knows, or has reason to know, is infested with plant pests or infected with plant diseases that may be spread by the sale or distribution of that nursery stock.
2. Sell, offer to sell or distribute any nursery stock that the nursery grower or nursery dealer knows, or has reason to know, will not survive or grow.
3. Misrepresent the name, origin, grade, variety, quality or hardiness of any nursery stock offered for sale or make any other false or misleading representation in the advertising or sale of nursery stock.
4. Conceal nursery stock to avoid inspection by the department, falsify any record required under this section or make any false or misleading statement to the department.
(8) Department inspection. The department may inspect nurseries and premises at which nursery stock is held for sale or distribution. The department may inspect premises at which evergreen trees are grown for eventual sale as Christmas trees and premises at which Christmas trees are held for sale or distribution.
(9) Department orders.
(a) *Holding orders and remedial orders.* An authorized employee or agent of the department may, by written notice, order a nursery grower or nursery dealer to do any of the following:
1. Temporarily hold nursery stock pending inspection by the department.
2. Remedy violations of this section.
3. Refrain from importing weeds or pests that threaten agricultural production or the environment in this state.
4. Permanently withhold nursery stock from sale or distribution, if the sale or distribution would violate this section or an order issued under this section and the violation cannot be adequately remedied in another manner.
5. Destroy or return, without compensation from the department, nursery stock that is sold or distributed in violation of this section, or an order issued under this section, if the violation cannot be adequately remedied in another manner.
(10) Reciprocal agreements with other states.
(a) *General.* The department may enter into reciprocal agreements with other states to facilitate interstate shipments of nursery stock.
(b) *Officially inspected sources.* As part of an agreement under par. (a), the department may recognize sources of nursery stock in another state as officially inspected sources.
(c) *Inspection and certification standards.* An agreement under par. (a) may specify standards and procedures for all of the following:
1. Inspecting officially inspected sources of nursery stock.
2. Inspecting and certifying interstate shipments of nursery stock.

- **94.46 – Stop sale, penalties, enforcement**

(1) The department may issue a written or printed "stop sale" order to the owner or custodian of any lot of agricultural or vegetable seed not conforming with ss. 94.38 to 94.46, or rules thereunder. The order shall specify the sections of the law or rules violated and shall prohibit the sale or other disposition of the seed except as the department authorizes or directs. Unless the seed is brought into compliance with the law or rules and is released from the "stop sale" order, or other disposition is agreed upon in writing within 30 days after service of the order, the seed shall be disposed of as the department by notice in writing may direct. This shall not preclude the voluntary signing of a disposal agreement without the issuance of a "stop sale" order. Any notice or order hereunder may be served personally or by mail and shall have the effect of a special order under s. 93.18 subject to review under ch. 227 if within 10 days after service of any notice

or order, the owner or custodian files with the department a written request for a hearing. Final disposition of the seed shall be stayed during pendency of the hearing but the "stop sale" order shall remain in effect.
(2) Any lot of agricultural or vegetable seed not in compliance with ss. 94.38 to 94.46, or rules thereunder, or not disposed of in accordance with any disposal agreement or order under sub. (1), shall be subject to seizure on complaint of the department to a court of competent jurisdiction. If the court finds the seed to be in violation of law and orders the condemnation of said seed, it shall be denatured, processed, destroyed, relabeled or otherwise disposed of as the court directs.
(3) In addition to or in lieu of other remedies provided for enforcement of ss. 94.38 to 94.46, the department may apply to the circuit court for a temporary or permanent injunction to prevent, restrain, or enjoin any person from violating ss. 94.38 to 94.46 or any rules or orders issued thereunder.
(4) (a) Any person violating ss. 94.38 to 94.46 or rules promulgated thereunder shall forfeit not less than $100 nor more than $500 for the first offense. For any subsequent offense occurring within 5 years of a previous offense, the person shall forfeit, for each offense, not less than $200 nor more than $1,000. The 5-year period shall be measured from the dates of the violations which resulted in convictions.
(b) Any person who knowingly violates ss. 94.38 to 94.46 or rules promulgated thereunder may be fined not more than $500 or imprisoned not more than 6 months or both.

Wisconsin Administrative Rules:

- **ATCP 21.17 – Emerald ash borer; import controls and quarantine**

(1) Importing or Moving Regulated Items From Infested Areas; Prohibition. Except as provided in sub. (3), no person may do any of the following:
(a) Import a regulated item under sub. (2) into this state if that item originates from an emerald ash borer regulated area identified in 7 CFR 301.53−3.
(b) Move any regulated item under sub. (2) out of an emerald ash borer regulated area that is identified in 7 CFR 301.53−3 and located in this state.

Note: The United States department of agriculture, animal and plant health inspection service (USDA−APHIS) periodically updates the list of regulated areas in 7 CFR 301.53−3. Subsection (1) applies to new regulated areas as those areas are identified in the CFR.
Each year, as a service, the Wisconsin department of agriculture, trade and consumer protection distributes an updated federal CFR listing to nursery license holders and other affected persons in this state. More frequent updates, if any, are available on the department's website at www.datcp.state.wi.us. Subsection (1) applies to new regulated areas as those areas are identified in the CFR, regardless of whether affected persons receive update notices from the department. Persons may request update notices by calling (608) 224−4573, by visiting the department's website, or by writing to the following address:
Wisconsin Department of Agriculture, Trade and Consumer Protection
Division of Agricultural Resource Management
PO Box 8911
Madison, WI 53708−8911

(2) Regulated Items. The following are regulated items for purposes of sub. (1):
(a) The emerald ash borer, *Agrilus planipennis* Fairmaire, in any living stage.
(b) Ash trees.
(c) Ash limbs, branches and roots.
(d) Ash logs, slabs or untreated lumber with bark attached.
(e) Cut firewood of all non−coniferous species.
(f) Ash chips and ash bark fragments (both composted and uncomposted) larger than one inch in diameter.
(g) Any other item or substance not listed in sub. (2) that may be designated as a regulated item if a pest control official determines that it presents a risk of spreading emerald ash borer and notifies

the person in possession of the item or substance that it is subject to the restrictions of the regulations.

(3) Inspected and Certified Items; Exemption. Subsection (1) does not prohibit the shipment of a regulated item if a pest control official in the state or province of origin does all of the following:
(a) Inspects the regulated item.
(b) Certifies any of the following in a certificate that accompanies the shipment:
1. The regulated item originates from non−infested premises and has not been exposed to emerald ash borer.
2. The regulated item was found, at the time of inspection, to be free of emerald ash borer.
3. The regulated item has been effectively treated to destroy emerald ash borer. The certificate shall specify the date and method of treatment.
4. The regulated item is produced, processed, stored, handled or used under conditions, described in the certificate, that effectively preclude the transmission of emerald ash borer.
History: CR 06−008: cr. Register October 2006 No. 610, eff. 11−1−06.

- **NR 45.04(1)(g) – Firewood restrictions on state property**
  No person may possess firewood that originates from greater than 50 miles from the campground on that property where the wood will be used, or the property itself if there is no campground, or from outside the borders of the state. Firewood from sources approved by the department of agriculture, trade and consumer protection is allowable. Firewood includes all wood, processed or unprocessed, intended for use in a campfire. The department may seize and dispose of firewood possessed in violation of this paragraph.

  Note: A list of firewood sources approved by the department of agriculture, trade and consumer protection can be obtained by contacting Robert Dahl, WI DATCP, PO Box 8911, Madison, WI 53708, 608−224−4573, Robert.Dahl@datcp.state.wi.us.

Wisconsin Statutes Providing Local Government Authority:

- **27.09 – City forester, duties; tree planting**
  http://www.legis.state.wi.us/statutes/Stat0027.pdf

  (1) The board of park commissioners of every city may employ a city forester to take charge of and direct, subject to its supervision and control, all of the work authorized to be done under this section. It may also designate a municipal employee to perform the duties of city forester .
  (2) The common council shall include in its annual budget such sum as it deems necessary, if any, to meet all expenses of doing said work during the following fiscal year, including the salary of the city forester and the compensation of employees assisting the city forester, but not including amounts assessable to abutting property; and the taxes levied to provide for such expense shall be in addition to all other taxes for park and boulevard purposes.
  (3) The board may plant, transplant, remove, trim, spray and otherwise care for and protect all trees and shrubs on or in that part of every street, the grade of which has been established, lying between the lot line and the curb, or in the center or side plots in all boulevards and parkways, and in all public parks or grounds belonging to the city and control all such planting and transplanting by others. The board may guard all trees within the city so as to prevent the spread of disease or pests and to eliminate dangerous conditions, and may proceed pursuant to subs. (4) to (7).
  (4) Whenever the board proposes the setting out, planting or removing of any such living shade tree, it shall give 2 weeks' written notice to the owner of the lot or parcel of land on which such tree stands or will stand, or the owner's agent, or, if neither is known and there be a tenant occupying said property, then to such tenant, of a time and place at which said contemplated work will be considered by the city forester , specifying in detail the street, avenue or boulevard and

portion thereof, upon or from which trees are proposed to be planted or removed, and the general nature and character of the changes and improvements contemplated. After such hearing, the city forester, subject to the direction of the board shall abandon said work or proceed with it as the city forester believes the best interest of the public requires.
(5) The entire or any part of the cost of protecting, trimming, spraying, planting, renewing and removal of trees and shrubs between the lot line and the curb in front of any lot or parcel of land abutting on a street, avenue or boulevard may be chargeable to and assessed upon such lot or parcels of land. The governing body shall hold a public hearing on the proposed assessment, and shall give notice thereof in such city or village, by publishing a class 2 notice, under ch. 985.
(6) The board shall keep a strict account of the cost of planting, protecting, renewing, removing, trimming, spraying and caring for trees and shrubs in front of each lot or parcel of land abutting on any street, avenue, or boulevard, and prior to November 10 in each year, shall make a report to the comptroller in cities having such an officer, and in other cities to the common council, of all work done for which assessments have been made as hereinbefore provided stating and certifying the description of land, lots, parts of lots or parcels of land abutting on a street, avenue or boulevard in which any such work shall have been done, and the amount chargeable to each such piece of property; and the comptroller at the time of making the comptroller's annual report to the common council of the lots or parcels of land subject to special assessments shall include therein the lots or parcels of land so reported to the comptroller by the board of park commissioners with the amount chargeable thereto for work done during the preceding year.
(7) The amounts so reported directly or through a comptroller to the council shall be levied on said lots or parcels of land, respectively, to which they are chargeable and shall constitute a lien thereon and shall be collected as other special taxes are levied and collected in the city. The board shall advance out of the park or other proper fund sufficient money for doing said work and said special assessments shall be credited to said fund of said city and shall not be diverted or used for any other purpose.

- **27.13 – Town and village parks**
  Every town and village may provide and maintain parks, parkways, boulevards or pleasure drives pursuant to the provisions of this chapter which are applicable to cities.

- **823.01 – Jurisdiction over nuisances**
  http://www.legis.state.wi.us/statutes/Stat0823.pdf

  Any person, county, city, village or town may maintain an action to recover damages or to abate a public nuisance from which injuries peculiar to the complainant are suffered, so far as necessary to protect the complainant’s rights and to obtain an injunction to prevent the same.

Appendix K

Ash Processing for Homeowners

Wisconsin Emerald Ash Borer Program

ASH WOOD PROCESSING OPTIONS FOR THE HOMEOWNER

Managing Emerald Ash Borer (EAB) Infested Wood

A key aspect of reducing the spread of emerald ash borer is properly managing the wood, brush and stump grindings generated by removal of infested trees. This requires an understanding of the processes that will destroy the insect, but also the federal, state and local regulations that apply to those processes. The preferred method of managing this wood is to have it processed in a manner that utilizes the wood and eliminates the risk of spreading EAB to new areas. If you suspect you have EAB, please contact the EAB Hotline at 1-800-462-2803 for confirmation. Additional information can be found at www.emeraldashborer.wi.gov.

Processing Options to Eliminate EAB

The following options are available for processing infested ash wood to kill EAB or prevent completion of its life cycle and spread to un-infested trees:

- ***Chipping***: Ash wood, brush and stump grindings must be chipped or ground down to a maximum size of no more than 1" in two dimensions (two of the three measurements - length, width and depth - must be 1" or smaller). The typical chipper used in tree care operations will not reliably create chips that meet this specification, but some may if fed through the chipper multiple times. Check with your manufacturer. Chippers equipped with a 1" screen will assure compliance. No Department of Natural Resources (DNR) waste program approvals or licenses are necessary for grinding or use of this material.
- ***Debarking for lumber***: Complete removal of all bark plus ½ inch of wood. The debarked wood can be milled into lumber. Any bark remaining on the lumber must be removed before the lumber can be moved out of quarantined areas. Note that the removed bark and wood must be chipped down to a maximum size of 1" by 1" in 2 dimensions. *(This option is designed for the professional but some homeowners may have the equipment to perform this task)*
- ***Burning:*** Wood, brush or chips may be burned prior to insect emergence. This should be used as a last resort.
    - **NOTE**: Before any burning is initiated homeowners should check with their community to see if they have any burning ordinances.
- ***Aging:*** Ash wood material that is aged for 2 years after tree death will be free of EAB. The wood will have dried to the point EAB can no longer survive in it and any EAB present when the tree died or that infested the wood shortly after cutting will have emerged during the 2 year period. If this processing option is used, it should be understood that EAB will continue to emerge during the 2 year aging period and this wood poses a risk of infestation to living ash in the area where it is being aged. This wood must not be moved out of a quarantined area during the aging period.

The Wisconsin Emerald Ash Borer Program is a cooperative effort between the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, the University of Wisconsin-Madison, the University of Wisconsin-Extension, the United States Department of Agriculture-Forest Service and the United States Department of Agriculture –Animal and Plant Health Inspection Service – Plant Pest Quarantine. *v. 10/15/2009*

Please note that a compliance agreement from DATCP is necessary to move any ash material such as firewood, lumber, mulch, or wood chips out of quarantined areas.

Storage Until Processing

- Adult emerald ash borers can emerge from infested wood from May through September. Infested wood should be processed by April 30 to avoid risk of emergence.
- Double-bagging: If processing before adult emergence is not possible, or if infested wood is found during an emergence period, double-bagging can be used to contain emerging adults. This procedure only is feasible for small quantities of infested wood. Double bag in 4mil or thicker plastic bags. Keep in closed bags until October 1 to contain emerging adults. This is a temporary storage plan; processing should occur after bagging to destroy EAB.
- Wood may be stored temporarily either on site or at dedicated collection sites if your community has one open to the public.

Some processing options for EAB infested wood are costly and complex. If you suspect you have EAB, please contact the EAB Hotline at 1-800-462-2803 for confirmation. Additional information can be found at www.emeraldashborer.wi.gov.

Official Contact Information

Wisconsin Department of Agriculture, Trade and Consumer Protection
Bob Dahl, Regulatory Supervisor
608-224-4573 or Robert.dahl@wisconsin.gov

USDA, APHIS, Plant Protection & Quarantine
JoAnn Cruse, State Plant Health Director
608-231-9545 or Joann.m.cruse@aphis.usda.gov

Wisconsin DNR Forest Products Utilization and Marketing
Terry Mace, Forest Resource Analyst
608-231-9333 or terry.mace@wisconsin.gov

Wisconsin DNR Waste and Materials Management
County contacts:
http://dnr.wi.gov/staffdir/dynamic/solidwaste.asp

Wisconsin Emerald Ash Borer Program Web Site
http://www.emeraldashborer.wi.gov/

Appendix L

EAB Planning for Homeowners

The Wisconsin Emerald Ash Borer Program

AN EAB GUIDE FOR HOMEOWNERS

Threats to your ash tree's health may be lurking in your neighborhood or woodlot. As a property owner you can take steps to reduce the threat and spread of the emerald ash borer (EAB) by following these simple guidelines. Doing so will contribute to healthy urban and rural forests in Wisconsin and potentially in surrounding states.

The emerald ash borer, first observed in Wisconsin in 2008, is a significant threat to the health of the state's ash resource. Here's what you can do about it:

- Keep ash that is infested with EAB in place – do not move it off your property.
- Keep hardwood firewood local – do not move your own from your property and if you are buying it, buy from a local or certified firewood dealer near where you will use it.
- Protect high value ash trees with products that are labeled for controlling EAB.
- Replace infested ash with other tree species.

Further information on how to identify and manage EAB is available at **www.emeraldashborer.wi.gov.**

Ash Tree Identification

Ash trees have:

An opposite branching pattern where two branches come off the main stem, one on each side and opposite each other.

(photos: Jeff Roe)

Compound leaves with 5-11 leaflets. Leaflets may have finely toothed or smooth edges. Leaflets may be on a short stalk, or without a stalk.

Locations of EAB Infestations

Information on the location of EAB changes quickly. For the most recent updates, visit **www.emeraldashborer.wi.gov** (statewide) or **www.uwex.edu/ces/cty/** (local) or contact your county extension office.

Laws Regarding EAB

The emerald ash borer is regulated by the Wisconsin Department of Natural Resources (DNR) through Chapter NR 40, Wis. Adm. Code and by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) in Chapter ATCP 21, Wis. Adm. Code.

It is illegal to move any life stages of EAB under NR 40 **(www.legis.state.wi.us/rsb/code/nr/nr040.pdf)**. DATCP, however, allows certain exemptions for businesses authorized through a compliance agreement. For more information about compliance agreements email **agriculture@wisconsin.gov**. Compliance agreements are available to businesses only. They are not available for individual or private use.

Management Options

Research has shown that EAB-infested trees may show no symptoms until they have been infested for more than two to three years. Assume that all ash trees within 15 miles of a known infestation are infested.

1. Treat with an Insecticide

Treat with an insecticide only if the tree is apparently healthy or less than 40 percent of the crown has died, is discolored or has sparse foliage. Research has shown that trees with more than 40-50 percent crown dieback do not benefit from treatment. *(photos: Courtesy of Michigan State University and the USDA Forest Service)*

0% dieback

30% dieback

50% dieback

80% dieback

Treating with an insecticide reduces the population of EAB and prolongs the life of your tree. Treatment requires a long-term commitment. It is not known how long EAB will remain in an area, threatening the health of ash, thus several treatments may be required or treatments may be needed for the rest of the tree's life. Contact a certified arborist **(www.waa-isa.org/arborists/search.asp)** to evaluate your treatment options. For more information on treating ash trees to prevent ash mortality visit **www.emeraldashborer.wi.gov/articleassets/InsecticideOptionsForProtectingTreesFromEAB.pdf**.

2. Remove and Replace

This is an option for ash in all stages of health. Contact a certified arborist to remove trees in your yard and to appropriately process wood to prevent additional spread of EAB. Replace trees with a non-ash species suitable to your site. A list of replacement trees can be found at **http://wihort.uwex.edu/landscape/AshAlternatives.doc**. Trees larger than 10 inches diameter produce more EAB and should be considered a priority for removal.

3. Do Nothing

Observations in states where EAB has been present for several years show that all ash trees are susceptible to infestation and mortality. If you take this option, expect your tree to become infested and die. Be prepared to handle the hazards associated with dead trees such as falling branches which may damage property or endanger life.

Disposal of Infested Ash Wood

- Keep the wood at your home and use it for firewood or mulch on site.
- Work with a certified arborist to properly dispose of infested material.

Wisconsin Emerald Ash Borer Program
Wisconsin Department of Agriculture, Trade & Consumer Protection, Wisconsin Department of Natural Resources, University of Wisconsin Madison & Extension, US Forest Service, US Department of Agriculture APHIS PPQ

www.emeraldashborer.wi.gov • 1-800-462-2803

Appendix M

EAB Resources

Wisconsin's Emerald Ash Borer Information source

- http://www.emeraldashborer.wi.gov/
- EAB internet portal for Wisconsin sponsored by DATCP, WDNR, and the University of Wisconsin-Madison.
- Contains detailed information on EAB biology and host preference, firewood and quarantine regulations, management options, information on what Wisconsin is doing about emerald ash borer, and related links.

Emerald Ash Borer Information Network

- http://www.emeraldashborer.info/
- EAB webpage that is a collaborative effort of the USDA Forest Service, Michigan State University, Purdue University and Ohio State University
- Contains information of EAB biology, distribution, control measures, current research and links to various EAB infested states' websites.

WDNR Emerald Ash Borer

- http://dnr.wi.gov/forestry/fh/ash/
- Contains information on EAB biology, signs, symptoms, risk maps, survey plans, how to report EAB and the community toolkit for EAB planning.

DATCP Emerald Ash Borer

- http://datcp.state.wi.us/arm/environment/insects/emerald-ash-borer/index.jsp
- Contains information on Wisconsin's response plan, rules and regulations, how to report EAB, and related links.

University of Madison Emerald Ash Borer

- http://www.entomology.wisc.edu/emeraldashborer/
- Contains information regarding EAB biology, signs, symptoms, and EAB look-alikes.

US Forest Service Emerald Ash Borer

- *Northeastern Area site*, http://www.na.fs.fed.us/fhp/eab/
- Contains information on EAB, identifying and reporting, surveys, infestations, quarantines, related links, and picture gallery.
- *Northern Research Area site*, http://nrs.fs.fed.us/disturbance/invasive_species/eab/
- Contains information on all aspects of EAB research.

USDA National Invasive Species Information Center

- http://www.invasivespeciesinfo.gov/animals/eab.shtml
- Contains information on the USDA-APHIS EAB New Pest Response Guidelines, and links to other federal and state EAB websites.

USDA-APHIS Emerald Ash Borer

- http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml
- Contains information on EAB, quarantine maps, surveys and trapping, and regulations.

Ash Utilization Options Project of Southeastern Michigan

- http://www.semircd.org/ash/
- Contains information on positive uses of EAB infested wood, demonstration projects, and research on ash utilization.

Emerald Ash Borer Cost Calculator

- http://extension.entm.purdue.edu/treecomputer/index.php
- Site sponsored by Purdue University Extension. Provides a way to compare different EAB management strategies.

Appendix N

Glossary

Compliance Agreement - tool used by DATCP to allow industries to conduct business and move affected material while protecting areas of the state not yet affected

DATCP – The Wisconsin Department of Agriculture Trade and Consumer Protection. DATCP is the regulatory authority and lead agency for Wisconsin's EAB response activities.

DBH – diameter at breast height. Represents the diameter in inches of a trunk cross-section measured at 4 ½ feet above ground level. It is a basis for estimating or identifying tree volume, value, management needs and costs, and utilization options.

WDNR – The Wisconsin Department of Natural Resources. A partner agency in Wisconsin's EAB response activities.

Delimit – to establish geographic limits or boundaries of an EAB infestation.

EAB – Emerald Ash Borer insect. As an adult it measures approximately ½" in length by 1/8" wide, is metallic green in color and often is described as "bullet shaped". EAB larvae can reach a length of a little more than 1" in length, are white to cream colored, and have a ten segmented abdomen with a pair of brown, pincher-like appendages on the last segment.

EAB Response Plan – a document defining local EAB readiness activities and processes. The plan includes scope and purpose, authority, responsibility, policies and procedures, actions and tasks, available resources, forms and contracts, technical references and support information, and other relevant content

EAB work group – a group of individuals representing Sheboygan County, and the cities, villages, and towns within the county. The group provided input, guidance, and direction in developing the Emerald Ash Borer (EAB) Resource Management Guide for Sheboygan County Communities.

Marshalling Yard – is a disposal site whose purpose is to help prevent ash wood which could potentially house EAB from being transported out of a quarantined area

Phloem – the living tissue found directly beneath a tree's bark that transports nutrients within the tree. EAB larvae feed on ash phloem, thus impairing the trees circulatory activities and eventually resulting in the tree's death.

Sapwood –is the living xylem that is actively involved in fluid transport. This is the area where emerald ash borer larvae overwinter in an ash tree.

Quarantine Area – a defined geographic area from which goods may not be transported. Quarantines will be established by federal or state agencies to restrict ash wood movement out of infested areas to avoid emerald ash borer infestation of new areas.

Xylem – the tissue found to the inside of the phloem. It is responsible for conducting water and nutrients to the leaves of the tree and provides strength to the tree. Xylem is made up of heartwood and sapwood. Heartwood is found at the center of the tree. It is composed of old xylem tissue that is no longer living, but still retains structural strength and infection resisting ability. The sapwood is the living xylem that is actively involved in fluid transport. This is the area where emerald ash borer larvae overwinter in an ash tree.