Report for Village of Brooklyn, Wisconsin

Urban Forest Management and Emerald Ash Borer Readiness Plan

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EXECUTIVE SUMMARY

The Village of Brooklyn (Village) has recognized the benefits that a properly maintained urban forest provides to air pollution reduction, energy conservation, increased property values, and a better quality of life for its citizens. To develop a system to increase these benefits through effective management, the Village hired Strand Associates, Inc.[®] (Strand) to inventory public trees utilizing Geographic Positioning System (GPS) equipment. Data collection was conducted in June of 2012 by Strand staff. The GPS tree data has been used in the development of the Urban Forest Management and Emerald Ash Borer Readiness Plans and serves as a basis for the following recommendations.

Urban Forest Management Recommendations

- 1. Remove trees and shrubs within right-of-ways as warranted to maintain clear sight lines and access to streets and sidewalks.
- 2. Modify Village tree ordinance to place control of public right-of-way and public property plantings within the jurisdiction of the Village Forester.
- 3. Monitor the condition of the new trees along Highway 92 and consider soliciting help from the residents in supplemental watering or the purchase of slow release tree watering bags to protect the investment in these trees and aid in their establishment.
- 4. Review and monitor the trees identified for removal and prioritize and schedule maintenance work over the next 5 years.
- 5. Review the trees identified as needing pruning and prioritize maintenance activities based on life/safety considerations, clearance pruning, and pruning to develop and maintain healthy structure and form.
- 6. Implement a long-range planting plan to further diversify the tree species and size distribution with a goal of no more than 5 percent of one species or 10 percent of one genus.
- 7. The top three urban trees consist of maples at 18 percent, spruce at 14 percent, and ash at 9 percent comprising 41 percent of the total urban forest. With the threat of Emerald Ash Borer (EAB), ash trees should no longer be planted within the Village. Planting restrictions should also be observed for maples and spruce trees since both plant groups exceed the recommended 10 percent of the urban forest.

EAB Management Recommendations

1. Stop all planting of ash trees on public property immediately and discourage planting of ash on private property within the Village. Plan and conduct public outreach to inform and educate Village residents concerning the Village EAB Plan and new tree ordinance.

- 2. Establish a plan to keep the geographical information system (GIS) tree database up to date by recording corresponding management and maintenance activities.
- 3. Establish a plan and schedule for proactively monitoring ash trees that are located on Village property. Remove any ash tree that declines and is consequently rated in poor condition except for ash trees located in the woodland areas where maintenance activities should only be performed as needed for public safety.
- 4. Proactively begin the removal of public ash trees starting with trees identified in the tree survey for removal and then from poorest health to trees in better condition until all of the public ash trees are removed or otherwise chemically treated.
- 5. Review ash trees on public property and identify trees that should be considered for protection from EAB through the use of annual chemical treatment. Prepare a plan, budget, and schedule for implementation for all trees designated to be chemically treated.

PART I-URBAN FOREST MANAGEMENT PLAN

Statement Of Purpose

The purpose of this Plan is to establish a 5-year plan of action for maintaining the Village's urban forest. The data collected during the GPS tree survey has been used to analyze the current structure of the tree population and has served as the basis for the following recommendations. This management plan focuses on existing conditions that require immediate attention, while developing long-term management guidelines that will help protect and preserve Village-managed trees in a cost-effective and efficient manner.

<u>Scope</u>

This plan provides an outline of the Village's urban forestry goals. It provides the Village citizens, decision makers, and staff with a clear set of strategies to achieve the following goals:

- Gain an overall understanding of the inventoried tree population composition.
- Provide a summary and analysis of the benefits provided by the inventoried population.
- Analyze the individual and overall health (condition) of the inventoried tree population.
- Maintain a 5-year pruning cycle.

Evaluating and Updating This Plan

This management plan provides urban forestry guidelines for the next 5 years. In order to measure the effectiveness of the implementation of the program in achieving the stated goals, a method for evaluation should be followed. Specific accomplishments can be measured in comparison to the Plan's goals and recommendations. These include the following:

- Within Year 1 of the plan, review all trees identified for removal and prioritize removals based on need and the forestry budget. Begin tree removals as necessary and establish a plan for tree removals over the next 5 years.
- Within Year 1 of the plan, review all trees identified for pruning and prioritize these trees to be pruned over the next 2 years recording the year scheduled for each tree in the GIS database.
- In Year 1 of the plan, evaluate the number of trees pruned annually in the Routine Pruning Program to match the goal of the 5-year maintenance cycle.
- Annually compare the number of trees planted to the desired number of plantings and the number of removals per year.
- At the end of each year, compare the Village's annual urban forestry budget to that projected in this Plan.

The Village Forester should be responsible for keeping this Plan and the inventory as up-to-date as possible.

URBAN TREE SURVEY

A. <u>Tree Survey–Within Managed Areas of the Village</u>

GPS equipment was used to survey 517 trees within the managed areas of the Village including trees within the public right-of-ways, parks, cemetery, fire station, and public works facility. Data collected includes tree species, diameter, approximate height, relative health, structure, action required, and general comments recorded for each tree. Of these trees, 9 percent are green and white ash; no blue or black ash were identified. Maple trees (silver, sugar, Norway, box elder, and amur) constituted the largest species group making up 18 percent of the total. The top ten most prominent tree species include 18 percent maple, 14 percent spruce, 9 percent ash, 8 percent Japanese tree lilac, 7 percent serviceberry, 4 percent walnut, 4 percent elm, 4 percent basswood, 4 percent arborvitae, 4 percent crabapple. These ten species comprise 76 percent of the individual trees recorded (see Table 1).



The overall quality of the public trees for health and structure is good with 54 percent of the trees rated as good for both health and structure, 13 percent of the trees rated as poor in health or structure, and the remaining 33 percent rated as fair in health or structure. Of the total trees surveyed, 32 percent were noted as requiring pruning (see Table 2).



B. <u>Tree Survey–Naturalized Public Lands</u>

A representative quadrant sampling method was used to collect information on three naturalized woodland parcels within the Village limits. The areas surveyed include the woodlot to the south of the cemetery, the Village yard waste/brush collection site, and the area surrounding the stormwater pond in the northeast area of the Village. Four tree species were prevalent at all three sites. Ash trees constituted the largest species group with an average of 28 percent, followed by 21 percent box elder, 19 percent elm, and 8 percent black walnut. Figures 5 and 6 show the approximate locations of where the quadrant sample surveys were performed.



C. <u>Street Trees</u>

Within the street right-of-ways, 235 trees and 15 shrubs were surveyed. Of these trees, 6 trees were identified as white ash, 5 trees were identified as green ash, and 1 tree was identified as mountain ash. Mountain ash is not a true ash tree (*Fraxinus* species); therefore, it is not susceptible to attack by EAB. The white and green ash trees vary from 6 inches to 36 inches in diameter with 6 of these trees rated in good condition for health and form. Of the remaining 5 trees, 2 are recommended for removal based on their health, form, and existing site conditions. Figure 1 shows an example of street trees.







Urban Forest Management and Emerald Ash Borer Readiness Plan

D. Parks, Cemetery, and Managed Public Lands

Within the public lands excluding the woodlots, 267 trees and shrubs were surveyed. Of these trees, 2 trees were identified as white ash and 33 trees were identified as green ash. The white and green ash trees vary from 6 inches to 47 inches in diameter with 10 of these trees rated in good condition for health and form. Of the remaining 25 trees, 8 are recommended for removal based on their health, form, and existing site conditions. There are 8 ash trees in Smithfield Park with all rated as in good to fair condition for health and form, 10 ash trees in Legion Park with 6 recommended for removal, and 10 ash trees in the cemetery with 2 trees recommended for removal.

E. <u>Cemetery</u>

Plantings are dominated by Norway spruce with scattered blue spruce and red cedars. A few large ash are located in the central portion of the cemetery with some large red oaks located along the borders. A variety of small, less than 16 inches, understory elm, ash, black walnut, and mulberry also exist in wooded property lines. Ten green ash trees were identified within the cemetery area with three noted in good condition, five noted in fair condition, and two noted for removal. These trees ranged in size from 6 inches to 47 inches in diameter with the majority of them in the 10- to 18-inch size range (see Figure 2).



Figure 2 Cemetery

F. Legion Park Playground and Field Areas

The play area contains good diversity and generally healthy mix of Norway spruce and deciduous species with no overplantings of any specific trees. However, it appears that ash trees and additional older sugar maple trees will require removal of cross branching, general trunk cleaning, or removal as based on age/decay (see Figure 3).



G. Smithfield Park

Trees in the park have been well laid out and maintained providing a nice mix of open space and shaded areas (see Figure 4). There are 32 trees in the park and a majority of them are shade trees in the 12 to 18 inches in diameter size range. Of these trees, 8 are green ash and they are all located in the southeast corner of the park. Four of the ash trees are rated in good condition and the remaining four trees are noted in fair condition. Other trees within the park are represented by a diverse mixture of basswood, maple, oak, and crabapple. The park boundary includes a white cedar screening planting along the west side, and other trees including mulberry, walnut, and box elder also are present near adjacent farm property to the east.



H. <u>Woodlots</u>

Naturalized parkland areas to the south of the cemetery are dominated by remnant/wildland Norway pines and oaks. This diverse woodland contains mature and pioneer species such as box elder, elm, silver maple, mulberry, cherry, poplar, and black walnut. The woodlands in the vicinity of the stormwater pond in the northeast area of the Village are predominantly populated with pioneer species including elm, box elder, ash, silver maple, and walnut and also contain a pine plantation section. Trees in this area are typically less than 12 inches in diameter.

I. <u>Cemetery Adjacent Lands and Village Waste/Brush Collection Site</u>

Naturalized areas to the south of the cemetery are dominated by remnant/wildland Norway pines and oaks. This diverse woodland contains mature and pioneer species such as box elder, elm, silver maple, mulberry, cherry, poplar, and black walnut (see Figure 5 for approximate locations where the representative quadrant sample surveys were performed). Tables 5 and 6 show species distribution and tree sample data.



Figure 5 Cemetery Adjacent Lands and Village Yard Waste/Brush Collection Site

Plot	Ash		DI - I					Woodland Survey Tally Sheet for Fixed Plot Size							
Number 1/			віаск		Red		Norway	Total Tre	e Count						
	4" 5-14"	Elm	Cherry	Boxelder	Oak	Walnut	Spruce	Ash	Other						
8 5	5 2	2	1	4	1	5	2	7	15						
9 26	26 2	4	20	1	1	2	4	28	32						

Table 5 Cemetery Adjacent Lands

					Black		Norway	Total Tree Count	
I-4"	5-14"	Elm	Mulberry	Boxelder	Cherry	Walnut	Spruce	Ash	Other
2	0	7	10	4	0	4	0	2	25
2	0	0	8	10	1	0	2	2	21
t	- 4'' 2 2	-4" 5-14" 2 0 2 0	-4" 5-14" Elm 2 0 7 2 0 0 ribution: 30 per	-4" 5-14" Elm Mulberry 2 0 7 10 2 0 0 8 ribution: 30 percent box eld 30 percent box eld	-4" 5-14" Elm Mulberry Boxelder 2 0 7 10 4 2 0 0 8 10 ribution: 30 percent box elder 26 percent	-4" 5-14" Elm Mulberry Boxelder Cherry 2 0 7 10 4 0 2 0 0 8 10 1 ribution: 30 percent box elder 26 percent multion: 30 percent box elder 26 percent multiple	-4" 5-14" Elm Mulberry Boxelder Cherry Walnut 2 0 7 10 4 0 4 2 0 0 8 10 1 0 ribution: 30 percent box elder 26 percent mulberry 16	-4" 5-14" Elm Mulberry Boxelder Cherry Walnut Spruce 2 0 7 10 4 0 4 0 2 0 7 10 4 0 4 0 2 0 0 8 10 1 0 2 ribution: 30 percent box elder 26 percent mulberry 16 percent ell	-4" 5-14" Elm Mulberry Boxelder Cherry Walnut Spruce Ash 2 0 7 10 4 0 4 0 2 2 0 7 10 4 0 4 0 2 2 0 0 8 10 1 0 2 2

J. <u>Stormwater Area–South of Douglas Drive</u>

Scattered silver maple, box elder, and willow have died around the basin from fluctuating water levels. Predominant young growth trees less than 12 inches diameter at breast height (DBH) in the areas near the planted red pine were (in order of prevalence) elm, box elder, ash, silver maple, and black walnut. Prevalence was based on representative quadrat sampling (see Figure 6 for approximate locations where the representative quadrant sample surveys were performed). Table 7 shows the species distribution and tree sample data.



Figure 6 Stormwater Area–South of Douglas Drive

Plot	Ash					Silver		Total Tree Count	
Number	1-4"	5-14"	Elm	Basswood	Boxelder	Maple	Walnut	Ash	Other
1	1	1	25	3	5	7	0	2	40
2	14	2	4	0	6	0	2	16	12
3	8	3	0	0	24	1	0	11	25
4	1	0	1	0	2	0	5	1	8
5	3	3	16	0	2	0	0	6	18
pecies D haple, and	istribu d 5 pe	ition: 3 rcent b	3 per	cent elm, 28 walnut.	percent bo	x elder,	26 perce	nt ash, 6 p	ercent silv

Pine Plantation–Approximately 300 trees ranging in size from 8 to 12 inches in diameter.

K. Brooklyn School and Adjacent Recreational Fields

Trees are limited to recent screening/plantings. This area is beyond the project scope. Early reference information was collected at the wastewater treatment plant site where pending plantings and a starter nursery are planned (see Figure 7).



Figure 7 Brooklyn School and Adjacent Recreational Fields

URBAN FOREST MANAGEMENT PLAN

In June of 2012, the Village took a significant step toward improving its urban forest by authorizing an inventory of the public trees within its community. The data collected and recorded in the Village's geographical information system (GIS) database has provided a foundation for the recommendations in this plan and will aid the Village in managing its urban forest and future planning efforts. The GPS inventory focused on collecting data on public trees located within street right-of-way, parks, and other open spaces. Trees that were located in Village woodlots were sampled in a woodlot-type survey.

A. <u>Street Trees</u>

Within the street right-of-ways, 235 trees and 15 shrubs were surveyed. The 15 shrubs and 22 evergreen trees that are located within the public right-of-way should be reviewed and monitored for encroachment on streets or sidewalks and/or for potential obstruction of visibility. These plants should be removed if they become a problem. The species and size distribution of the street trees is fairly diversified with the exception of the trees that were installed in conjunction with the reconstruction of State Highway 92 that bisects the Village running east and west. There are 114 trees along this corridor with 75 of the trees of two species consisting of Japanese tree lilac and serviceberry with a typical size of under 4 inches DBH. The drought conditions of the summer of 2012 were especially hard on small trees as can be seen in many of the trees along Highway 92. Maple trees are the most common street tree with a total of 54 trees or 23 percent of the total street trees within the Village. These trees are distributed between six subspecies with the silver maple representing the most common planted tree followed by amur, crimson, Norway maple, sugar maple, and box elder. Of the total 235 street trees, 107 have been identified as needing pruning based on their structure and survey notes, and 20 trees have been designated to be removed based on their health or structure.

The following management recommendations are suggested.

- 1. Remove trees and shrubs within right-of-ways as warranted to maintain clear sight lines and access to streets and sidewalks.
- 2. Modify Village tree ordinance to place control of public right-of-way and public property plantings within the jurisdiction of the Village Forester.
- 3. Monitor the condition of the new trees along Highway 92 and consider soliciting help from the residents in supplemental watering or the purchase of slow release tree watering bags to protect the investment in these trees and aid in their establishment.
- 4. Review and monitor the trees identified for removal and prioritize and schedule maintenance work as required.
- 5. Review the trees identified as needing pruning and prioritize maintenance activities based on life/safety considerations, clearance pruning, and pruning to develop and maintain healthy structure and form.
- 6. Implement a long-range planting plan to further diversify the tree species and size distribution with a goal of no more than 5 percent of one species or 10 percent of one genus. For example, all maple trees are in the genus acer, so no one species such as red maple should exceed 5 percent of the total tree population and all maples together should not exceed 10 percent. Ideally, the Village should strive for the greatest diversity it can manage.
- 7. The top three species of urban trees consist of maples at 18 percent, spruce at 14 percent, and ash at 9 percent comprising 41 percent of the total urban forest. With the threat of EAB, ash trees should no longer be planted within the Village. Planting

restrictions should also be observed for maples and spruce trees since both of these plant groups exceed the recommended 10 percent of the urban forest. Refer to the tree species selection section of this plan for additional information and the index for a list of trees recommended for urban forests.

8. Become a Tree City USA[®] community. The Tree City USA[®] program is sponsored by the Arbor Day Foundation in cooperation with the United States Department of Agriculture (USDA) Forest Service and the National Association of State Foresters, and it provides direction, technical assistance, public attention, and national recognition for urban and community forestry programs. The Village can easily meet the four standards required for recognition; see the Appendix for additional information.

B. <u>Parks Cemetery and Public Lands</u>

Within the Village public lands excluding the woodlots, 261 trees and 6 shrubs were surveyed. Of the trees, 2 trees were identified as white ash and 33 trees were identified as green ash. The white and green ash trees vary from 6 inches to 47 inches in diameter with 10 of these trees rated in good condition for health and form. Of the remaining 25 trees, 8 are recommended for removal based on their health, form, and existing site conditions.

The following management recommendations are suggested.

- 1. Cemetery
 - a. Prioritize and remove 15 trees noted for removal as the budget and resources permit. Seven of these trees are larger than 21 inches in diameter and will likely require removal by a contractor. Consider establishing a schedule to address the removal of these trees over a period of several years.
 - b. Remove the mulberry trees along the east property line and clean out other smaller trees to improve the character and enhance the growing conditions of the remaining shade trees.
 - c. Develop a replanting schedule to replace some of the trees removed and add additional trees to enhance the species, age, and size distribution of the trees in this area.
- 2. Legion Park
 - a. Remove two ash trees and a basswood identified as numbers 47, 63, and 49 in Figure 10, as these trees are located in the playground area of the park, and in their existing condition, they present a potential hazard for those using the area.
 - b. Remove trees identified along the south fence line to be removed and clean out other smaller trees to improve the character and enhance the growing conditions of the remaining shade trees.
 - c. Monitor the six new trees located north of the tractor pull area. These trees are in good condition; however, they will require pruning within the next few years to establish good structure and form.
 - d. Review the trees identified as needing pruning and prioritize maintenance activities based on life/safety considerations, clearance pruning, and pruning to develop and maintain healthy structure and form.

- e. Develop a replanting schedule to replace the trees removed in the playground area and add additional trees to enhance the species, age, and size distribution of the trees in this area.
- 3. Smithfield Park
 - a. Remove the mulberry tree located along the east property line.
 - b. Monitor the condition of the eight ash trees located in the southeast corner of this park and reference the EAB plan for additional management recommendations.
 - c. Consider planting additional trees near the southeast corner within the next year to begin reestablishing a tree canopy should it become necessary to remove the existing ash trees.
- 4. Fire Station
 - a. Clean up the trees along the east fence line and remove trees in this area as needed as many are in very poor condition.
 - b. For tree number 37, remove wood brace as it has begun to interfere with normal growth of the tree.
 - c. Continue to maintain the rows of evergreen trees located along the west and south edges of the property. Replace dead or damaged trees as needed during the next 5 years; as the trees grow larger, thin every other tree and limb up as needed.
 - d. Add several shade trees along the west side of the pavement.
- 5. Public Works Facility
 - a. Add additional trees, especially evergreens, around the perimeter of the treatment plant site to serve as a visual and wind screen.
 - b. Continue activities associated with the Village-owned tree nursery and consider purchasing 5- to 7-foot-tall bare root stock trees in the spring or fall for direct planting as needed throughout the Village or transplanting in the nursery.

C. <u>Public Lands Naturalized Woodlots</u>

The following management recommendations are suggested.

- 1. Cemetery Adjacent Lands and Waste/Brush Collection Site–Thin tree canopy by removing trees in poor condition and pioneer species including mulberry and box elder to promote healthy development of oak, cherry, black walnut, and elm trees.
- 2. Stormwater area–South of Douglas Drive
 - a. Thin tree canopy by removing trees in poor condition and pioneer species including mulberry and box elder to promote healthy development of oak, cherry, black walnut, and elm trees.
 - b. Implement a long range planting plan to further diversify the tree species and size distribution that is consistent with the land uses defined for this area.

D. <u>Tree Species Selection</u>

The Village is located in Zone 4 of the USDA Hardiness Zone Map, which identifies a climatic region where the average annual minimum temperature is between -30° and -20° F. Tree species selected for planting in the Village should be appropriate for this zone. In addition to considering site characteristics, such as availability of space, soils, soil pH, and irrigation, species-specific features must also be scrutinized. There are also many growing spaces within the Village's right-of-ways, (ROW) that are too small to support large trees. Native trees of southern Wisconsin will be more adaptable to weather conditions and other environmental forces but may be more susceptible to exotic pests. Green ash is a perfect example of a tree that is native to the Village but very susceptible to EAB. The planting of cultivated varieties and nonnative trees that are capable of growing in the Village should be carefully considered. Refer to the index for a list of trees recommended for urban forests. This list includes many varieties of maples that should be avoided until the overall species distribution is more balanced within the Village.

URBAN FOREST BUDGET

A. Budget Allocations

For 2012, the Village budgeted \$4,250 for tree removals, stump grinding, and replacements including \$750 allocated for the cemetery and \$3,500 for the public works facility and another \$1,500 for annual wood chipping coordinated through Green County. The Village should work to preserve the 2012 forestry budget allocations so that existing routine forestry operations can be maintained at the current levels. Special projects or initiatives such as addressing EAB management should be budgeted in addition to the base forestry budget.

B. <u>Urban Forestry Grant Funding</u>

The Village should apply for a 2013 Urban Forestry Grant through the Wisconsin Department of Natural Resources (WDNR) as the Village did in 2012. This program provides funding to communities across the state for projects that stimulate and support the development of urban forest management programs. For 2013, grant funding emphasis will continue to be on EAB readiness projects and plans that serve to increase species diversity and develop and enhance capacity for sustained urban and community forest management. Applicants are encouraged to consider projects that could improve their entire urban forest canopy, both public and private, or projects that could act as a model for others to adopt. Funding received from grants could be used to accelerate the implementation of the EAB management plan.

C. <u>Staffing, Training and Equipment</u>

Additional staff could be used especially to accelerate implementation of projects such as defined in the EAB plan, but this is not practical at this time. The present staff of three are adequately equipped and trained to complete pruning and removals of small to medium sized trees and all replacement plantings and restorations as required. The removal and pruning of larger trees or trees in tight locations or near obstacles such as power lines will be removed by contractors. The Village will also continue to contract the removal of stumps and annual chipping of the wood and brush at the disposal site.

PART II-EMERALD ASH BORER READINESS PLAN

INTRODUCTION

The EAB, Agrilus planipennis Fairmaire, is an exotic wood-boring beetle from Asia that has killed millions of ash trees (Genus Fraxinus) in the Northeastern United States and Canada. This insect was first reported near Detroit, Michigan, in the summer of 2002. It is understood that the insect arrived on wood packing material originating from Asia. Since its detection in Michigan, it has spread to neighboring states and providences and reached Wisconsin in 2008. The EAB continues to spread and, at this time, has been found in 15 states and two providences. In Wisconsin, it has been found in 14 counties and there are now 15 counties that have implemented guarantines. The rapid expansion of the areas infested with this insect is largely due to the transporting of ash wood products since the adult beetle is only able to expand its range by approximately 5 miles each year as they are not good flyers. The EAB larvae feed on the inner bark of the ash trees preventing the movement of water and nutrients through the tree resulting in the tree's death. We have learned from other states that, once infested, trees are killed quickly, usually within a few years. The impact to communities has been devastating and overwhelming because of the rapid loss of so many trees in the urban forest and the cost of tree removal, which is required to manage the risk of personal injury and property damage. EAB is the most destructive forest insect introduced into North America since the elm bark beetle that facilitated the spread of Dutch elm disease in the 1960s. Figure 1 shows the EAB distribution.



DEFINITIONS

DBH–Diameter at breast height; represents the diameter in inches of a tree trunk diameter measured at 54 inches above ground level.

EAB-The Emerald Ash Borer, Agrilus planipennis Fairmaire, an exotic wood-boring beetle from Asia.

EAB Readiness Team–A group of people responsible for preparing for the EAB within a particular jurisdiction/municipality; team members have specific roles and tasks.

EAB Readiness Plan–A document delineating local EAB readiness activities and processes; includes scope and purpose, authority, responsibility, policies and procedures, actions/tasks, available resources, forms and contracts, technical references, and educational information.

Infestation–Refers to an area where the ash trees have been positively identified as having a sustained population of EAB.

Preemptive Removal–Refers to removing trees before becoming infested with EAB. This management strategy may be appropriate in situations for ash trees that require pruning or other management or maintenance practices. Many communities have found it beneficial to implement management plans that begin systematic removal of ash trees over a period of years before infestation to more effectively control associated costs and labor.

Marshalling Yard–A controlled location within a quarantined area where infested trees are collected and stored for processing.

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 EAB infestation of new areas; *quarantines* can be applied to an individual property, township, county, or entire state.

READINESS PLAN

A. <u>Purpose</u>

With the discovery of EAB in Janesville, Wisconsin, in June of 2012, there is an increased need to adequately prepare the Village for possible infestation. A proactive EAB Readiness Plan will facilitate the following:

- 1. Establish an inventory of public trees by conducting a tree survey of all the trees located within Village parks, streets, cemetery, and other public lands.
- 2. Identify the ash trees that are at risk of infestation. Trees that are susceptible include green, white, blue, and black ash. Mountain ash trees are not at risk as they are not a true ash.
- 3. Revise appropriate public ordinances.

- 4. Establish a comprehensive ash tree policy.
- 5. Identify potential costs associated with EAB.
- 6. Train Village personnel in EAB identification and management.
- 7. Develop and strengthen community education and outreach.
- 8. Communicate important EAB updates to local authorities.
- 9. Establish reporting and action plans to follow when EAB is detected in the Village.
- 10. Establish a proactive ash tree management and replacement plan.

The mission of this plan is to serve as a guide to aid in the maintenance and enhancement of the urban forest for the long-term benefits of the Village. The primary goals are to prevent, detect, and manage the EAB to minimize the impacts and the potential loss of ash trees and the costs associated with these activities through proactive planning, education, and action.

AUTHORITY

The Village must establish the authority to control EAB through its Village ordinances and through existing federal regulations and state statutes. It will be the responsibility of the Director of Public Works and its designees to carry out the provisions of applicable ordinances and plans.

A. Laws Regarding EAB

The EAB is regulated by the WDNR through Chapter NR 40, Wisconsin Administrative Code and by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) in Chapter ATCP 21 and 21.17, Wisconsin Administrative Rules.

B. <u>Wisconsin Rules Helping Prevent EAB Spread</u>

DATCP revised the rule (DATCP 21) allowing Wisconsin to restrict the movement of certain items coming from areas infested with EAB (EAB quarantined areas). These items include firewood, logs, mulch, or nursery stock. The WDNR revised rule NR 45.04 (1) (g) restricting firewood movement onto WDNR managed properties in Wisconsin to prevent the spread of EAB to Wisconsin forests and recreational areas.

ORDINANCE

To effectively meet the challenge of EAB, Village tree ordinances should be reviewed and revised. EAB ordinances should be in place before an infestation. The Village's existing ordinance should be expanded adding a section for EAB and existing Dutch elm disease. Key considerations include the following:

A. <u>Public Safety/Risk</u>

- 1. Authority of city forester to enter private property.
- 2. Nuisance trees, condemnation, time frame for removal.
- 3. Removal of infested or dead ash trees on private property.
- 4. Assessment of costs of abatement on public and private lands.
- 5. Interference with the city forester prohibited.

B. <u>Control of EAB Spread–(Ordinance to refer to Village EAB Plan for this section)</u>

- 1. Transporting ash wood in the Village.
- 2. Contractors and compliance agreements for removing, hauling, and storing wood.
- 3. Wood disposal and storage.
- 4. Inspections of wood or trees.
- 5. Private tree wood disposal.

EAB INFESTATION REPORTING

A. <u>Wisconsin</u>

Wisconsin has established a toll free number for reporting EAB information: **1-800-462-2803** or e-mail **eab@datcp.state.wi.us**.

In addition to this phone number, the state has compiled information on a Web site that is designed to aid in identifying EAB activity and distinguish this activity from other causes and pests. Please refer to http://datcpservices.wisconsin.gov/eab/reporteab.jsp for additional information on identification of EAB larva and beetles, signs and symptoms of EAB infestations, identification of other ash tree pests, and how to identify ash trees.

If you have the insect or larva, or clear photos of the insect or larva, they should be sent to:

Mick Skwarok DATCP P.O. Box 8911 Madison, WI 53708-8911 DATCPEmeraldAshBorer@wisconsin.gov

B. Additional Wisconsin Contact

South Central Regional Urban Forestry Coordinator Jeff Roe 3911 Fish Hatchery Road Fitchburg, WI 53711 Phone: 608-275-3256 Fax: 608-275-3338 Email: Jeffrey.Roe@Wisconsin.gov

INITIAL EAB INFESTATION COMMUNICATION

When EAB infestation has been confirmed, the residents, landowners, and businesses within the area will have immediate needs for information. Announcements of an infestation will also require a response to other interested parties throughout the state and in adjoining states. The Wisconsin EAB Response Plan's modified Incident Command System (ICS) structure will likely be employed to meet response needs for approximately 1 year. This entails forming locally based EAB Response Units that will plan and implement survey, regulation, outreach, and management activities following a positive detection of EAB. Shortly after EAB confirmation, the local counties and possibly surrounding counties will be placed under quarantine.

WOOD MATERIALS STORAGE AND HANDLING 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. Before a public announcement of a confirmed EAB infestation, the Village Forester, local officials, WDNR Regional Forestry Coordinator, and adjacent landowners should be notified. In addition to a press release, a local informational meeting should be held to provide information and address concerns of citizens and property owners.

EAB QUARANTINES

When EAB is found locally and the counties are placed under quarantine, the Village will need to evaluate and change some of its current wood usage and storage methods. Until the counties are quarantined, the Village can continue current wood usage methods. With the Village falling within both Dane and Green counties, county-based quarantines may complicate the management of wood materials. The Village's existing brush disposal site is located in Dane County. If Dane County is quarantined first or if both counties are quarantined at the same time, the Village will be able to continue to use the existing brush disposal site. If Green County were to be placed under a quarantine before Dane County, the Village would not be allowed to move wood materials from the west side of town that is in Green County to the existing site. In this situation, the Village would likely need to establish and operate a second waste/brush disposal site within Green County. Initial contact with a representative from the DATCP revealed that it is not likely that the Village would be allowed to move wood materials from Green County into Dane County and that special agreements allowing said movement have never been done. Quarantine rules are subject to change and should be regularly reviewed as part on an overall EAB issue monitoring plan.

TREE SURVEY SUMMARY OF ASH TREE DATA

Data collection was conducted in June of 2012 by Strand staff. GPS equipment was used to survey 517 trees within the managed areas of the Village including trees within the public right-of-ways, parks, cemetery, fire station, and public works facility. Data collected includes tree species, diameter, approximate height, relative health, structure, action required, and general comments as recorded for each tree. Of these trees, 9 percent are green and white ash, but no blue or black ash were identified. Some of the ash trees surveyed exhibit characteristics of stress such as crown dieback and basal suckering; however, no specific evidence of EAB beetles, larva, galleries, or exit holes were found.

Naturalized woodland parcels within the Village limits were also surveyed using a representative quadrant sampling method. The areas surveyed include the woodlot to the south of the cemetery, the Village yard waste/brush collection site, and the area surrounding the stormwater pond in the northeast area of the Village. Four tree species were prevalent at all three sites. Ash trees constituted the largest species group within the naturalized woodland areas with an average of 28 percent, followed by 21 percent box elder, 19 percent elm, and 8 percent black walnut. Figures 5 and 6 show the approximate locations of where the quadrant sample surveys were performed. Refer to the pocket following the report for Figure 9–Ash Tree Distribution map.

A. <u>Street Trees</u>

Within the street right-of-ways, 235 trees and 15 shrubs were surveyed. Of these trees, 6 trees were identified as white ash, 5 trees were identified as green ash, and 1 tree was identified as mountain ash. Mountain ash is not a true ash tree (*Fraxinus* species); therefore, it is not susceptible to attack by EAB. The white and green ash trees vary from 6 inches to 36 inches in diameter with 6 of these trees rated in good condition for health and form. Of the remaining 5 trees, 2 are recommended for removal based on their health, form, and existing site conditions.

B. Parks, Cemetery, and Managed Public Lands

Within the public lands excluding the woodlots, 267 trees and shrubs were surveyed. Of these trees, 2 trees were identified as white ash and 33 trees were identified as green ash. The white and green ash trees vary from 6 inches to 47 inches in diameter with 10 of these trees rated in good condition for health and form. Of the remaining 25 trees, 8 are recommended for removal based on their health, form, and existing site conditions. There are 8 ash trees in Smithfield Park with all rated as in good to fair condition for health and form, 10 ash trees in Legion Park with 6 recommended for removal and 10 ash trees in the cemetery with 2 trees recommended for removal.

C. <u>Cemetery</u>

A few large ash are located in the central portion of cemetery with some additional trees along the borders. Ten green ash trees were identified within the cemetery area with three noted in good condition, five noted in fair condition, and two noted for removal. These trees ranged in size from 6 inches to 47 inches in diameter with the majority of them in the 10- to 18-inch size range.

D. Legion Park Playground and Field Areas

The play area contains good diversity and generally healthy mix of tree species. However, there are two older ash trees in the playground area that will require removal of cross branching, general trunk cleaning, or removal.

E. <u>Smithfield Park</u>

There are 32 trees in the park and a majority of them are shade trees in the 12 to 18 inches in diameter size range. Of these trees, 8 are green ash and they are all located in the southeast corner of the park.

Four of the ash trees are rated in good condition and the remaining four trees are noted in fair condition.

MANAGEMENT PLAN

After careful review of the information collected and using current budget projections, a preemptive management strategy is recommended for the Village that will not only manage for EAB but also help improve the overall well-being of the Village's urban forest. A preemptive management plan begins with the removal of ash trees that have been found to be in poor health or structure as identified in the GPS survey, selecting ash trees that may be good candidates for chemical treatment, monitoring of the existing ash trees for presence or signs of EAB, and limiting maintenance pruning on existing ash trees.

A. Initial–EAB Administrative Actions

The Village should prepare and adopt a tree ordinance to address EAB management, wood handling and disposal, nuisance trees, and safety. A community EAB readiness team should be formed to manage and guide EAB management for the Village. Village staff should be trained in EAB identification and management procedures. Community outreach and education should be implemented to keep the public informed on issues related to EAB including changes to ordinances, EAB awareness and identification, notification of infestation, requirements of quarantines and management, and maintenance activities planned by Village staff.

B. <u>EAB Coordinator–Designation and Responsibilities</u>

The Village should designate an individual with directing the EAB response and coordinating EAB activities. Some of the duties and responsibilities will include the following:

- 1. Prioritizing and budgeting for tree removals, treatments, and replanting.
- 2. Updating Village officials.
- 3. Coordinating work crews and EAB project duties.
- 4. Educating Village staff and the public regarding EAB activities and awareness.
- 5. Coordinating with state and other officials. Education and enforcement of new Village ordinances.
- 6. Coordinating contracts and other required services and activities associated with removal, transport, and disposal of wood materials

C. Long-Term Management Strategies

Identify ash trees that should be considered for preservation through the application of chemical treatment to prevent EAB infestation. Chemical treatment of trees would be required every 1 to 3 years for the remaining life of the tree and is typically not considered to be a long-term solution. However, it

can help by delaying the cost of removing the tree and provide additional time for companion or replacement trees to mature. Older trees that are in good health and superior form are considered to be the best candidates for chemical treatment. Ash street trees and those located in Smithfield Park, Legion Park, and the cemetery that are not identified for chemical treatment should be prioritized for removal and replacement over the next five years. Ash trees in the woodland areas should be monitored and maintenance activities performed only as needed for public safety. Tree replacements must also be prioritized considering the site and impacts of the loss of the previous ash tree. Replacements should be selected from a variety of tree species with the management objective of establishing species diversity with no more than 10 percent of any single tree species comprising the urban forest.

D. <u>Recommended Management Pre-EAB Actions</u>

- 1. Stop all planting of ash trees on public property immediately and discourage planting of ash on private property within the Village. Plan and conduct public outreach to inform and educate Village residents concerning the Village EAB Plan and new tree ordinance.
- 2. Evaluate the 11 ash trees identified in the tree survey for removal to confirm removal is required; prioritize removal and identify the trees that can be removed by Village staff as opposed to contract removal. Coordinate contract removal of trees as needed.
- 3. Notify adjacent residents and property owners before removal of identified trees.
- 4. Evaluate the sites/locations where trees have been removed to determine need for replanting.
- 5. Establish a plan to keep the GIS tree database up to date by recording corresponding management and maintenance activities.
- 6. Establish a plan and schedule for proactively monitoring ash trees that are located on Village property. Remove any ash tree that declines and is consequently rated in poor condition except for ash trees located in the woodland areas where maintenance activities should only be performed as needed for public safety.
- 7. Review ash trees on public property and identify trees that should be considered for protection from EAB through the use of annual chemical treatment. Prepare a plan, budget, and schedule for implementation for all trees designated to be chemically treated.

E. <u>Recommended EAB Management Operations</u>

Phase I:

 Remove and replace eleven ash trees from 6- to 36-inch diameter at DBH that are rated in poor health or structure.

Remove two ash trees between 6- to 7-inch diameter.

Assuming the Village will remove trees under 21 inches in diameter and perform the replanting and restorations, contractor costs for tree removals and stump grinding will be approximately \$3,300. It is recommended the Village complete Phase I by the end of 2013 by allocating an additional \$3,500 to address Phase I tree removals. In addition the Village should apply for a 2013 Urban Forestry Grant to help cover costs of replanting trees and to begin implementing the recommendations of the EAB plan.

Phase II:

• Remove and replace 18 ash trees in fair condition.

Assuming the Village will remove trees under 21 inches in diameter and perform the replanting and restorations, contractor costs for tree removals and stump grinding will be approximately \$5,700. It is recommended that the Village complete Phase II tree removals by the end of 2015 through the allocation of additional funds for EAB management activities in 2014 and 2015.

Phase III:

 Remove and replace all remaining ash trees in fair condition that have not been otherwise selected for protection–13 trees.

Assuming the Village will remove trees under 21 inches in diameter and perform the replanting and restorations, contractor costs for tree removals and stump grinding will be approximately \$9,800. It is recommended that the Village complete Phase III by the end of 2017 through the allocation of additional funds for EAB management activities in 2016 and 2017.

It is important to keep in mind that if EAB arrives sooner, tree removals and replacements may have to be conducted in an abbreviated time frame, which will be more costly and will strain the Village budget, staff, and resources.

F. <u>Ash Trees on Private Property</u>

When considering the overall health of the Village's forest, another concern is that the majority of the trees are typically located on private property. Although the exact number of ash trees in citizens' yards is not known, a general rule of thumb is ten private ash trees for every one ash street tree. With the potential of there being hundreds of ash trees located on private property within the Village, there is a possibility the Village will be faced with numerous hazardous trees located on private property. Also, if the trees have to be removed, there is concern about what will be done with the wood debris. Having effective communication and outreach with citizens will be important to increase awareness of EAB, help citizens understand their options for managing ash trees in their own yards, and increase awareness, understanding, and support for the Village's EAB Readiness Plan and tree ordinance. The Village held an initial public meeting where a draft of the Village EAB plan was summarized, EAB information was presented and EAB materials were distributed. In addition, the following procedures could be used for the dissemination of information to Village residents.

- 1. Inform the community through local media outlets, direct or indirect mailings (i.e., tax/utility bills), newsletters, fliers, the Village's Web site and additional public meetings.
- 2. Until EAB presence has been identified within the Village, information should be provided on how the community is addressing EAB through the EAB Plan.
- 3. If EAB is found, information should be provided on the location of the infestation and plans on how it will be addressed.

G. <u>Consumer Protection</u>

A licensing requirement for commercial tree companies performing arboricultural work within the Village needs to be considered. All commercial companies involved in providing private tree service for tree pruning, removal, stump removal, chemical treatment, and wood disposal would require a license, proof of insurance, and bonding for the protection of residents. A list of licensed firms and the requirements for the handling of wood materials would be maintained on the Village's Web site. The licensing requirement and wood management information will help to ensure the proper disposal of wood debris as well as compliance with other elements of the EAB Plan.

EAB MANAGEMENT COSTS AND BUDGET RECOMMENDATIONS

For 2012, the Village budgeted \$4,250 for tree removals, stump grinding, and replacements including \$750 allocated for the cemetery and \$3,500 for public works.

It is anticipated the Village public works staff has the equipment and capability to remove trees that are under 20 inches in diameter unless the trees are located adjacent to hazards such as electrical wires, structures, or other obstructions. The data in Table 4 reflects this information. The Village does not have the equipment required for removal of tree stumps in excess of 5-inch diameter, so all the stumps that are located in lawn areas would need to be removed by a contractor. It has been estimated that 24 stumps would need to be removed. If the Village removes all the trees that are 20 inches in diameter or smaller, it will need to contract for stump removal associated with 17 of the 33 trees for a cost of approximately \$2,000.

A. Tree Removal and Replacement Costs

Of the 46 ash trees, 20 should be replaced once the existing trees are removed. Replacements can be completed by Village public works staff at approximately \$135 per tree for a total cost of \$2,700 (see Table 8).

Tree Removal Costs								
Tree Size (DBH) (inches)	Number of Trees	In-House Removal Cost/Diameter Class	Total Cost	Contracted Removal Cost/Diameter Class	Total Cost			
1-5	0	\$50	\$0	\$105	\$0			
6-10	8	\$162	\$1,296	\$275	\$2,200			
11-15	12	\$210	\$2,520	\$450	\$5,400			
16-20	13	\$420	\$5,460	\$900	\$11,700			
21-25	4	\$0	\$0	\$1,125	\$4,500			
26-30	4	\$0	\$0	\$1,575	\$6,300			
31 +	5	\$0	\$0	\$1,800	\$9,000			
			\$9,276		\$39,10			

* Cost includes tree removal and restoration

* * Cost includes Tree removal, stump grinding and restoration.

Table 8 Tree Removal Costs

B. <u>Chemical Treatment</u>

To date, communities in North America have not successfully eradicated EAB once detected. Symptoms of EAB are slow to appear, making initial infestations hard to detect. Once EAB is found, it is usually estimated that it has been present for 3 to 5 years. As the population builds, EAB eventually infests and kills all ash trees in the area. Research has shown that insecticides can effectively treat trees for EAB. However, it should be noted that controlling insects that feed under the bark with insecticides has always been difficult and success is not guaranteed. 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, typically when EAB has been found within 15 miles. Some chemical formulations can be purchased and applied by homeowners; others must only be applied by professional applicators. It is unknown at this time the long-term ecological impact that chemical treatments would have on our environment.

The Village does not consider chemical treatment of its ash trees to be a long-term solution to managing EAB. However, the Village does acknowledge that chemical treatments offer benefits. Chemical treatment can provide a way to defer and spread removal costs over a longer length of time; help to minimize possible effects of an EAB infestation on a communities' resources; preserve the economic, ecological, and environmental benefits of the trees until replacement trees fill in the urban canopy; and help protect trees designated as specimen or heritage trees. Annual chemical treatment for a 20-inch-diameter tree would cost approximately \$150.

Criteria to be used in identifying ash trees that would be good candidates for chemical treatment include tree health, form, size, and location. Only trees in good health of good structure and between 12 and 26 inches in size should be considered for chemical treatment. In addition, the tree should be considered to be of significant value to the property on which it stands. Eleven of the 46 public ash trees within the Village of Brooklyn meet this criteria for chemical treatment. The cost for the treatment of these eleven trees is estimated to be \$725 dollars per year based on an annual treatment strategy.

C. <u>Funding</u>

1. WDNR Urban Forestry Grants

Each year the WDNR Urban Forestry Grant Program provides funding to communities across the state for projects that stimulate and support the development of urban forest management programs. The grant funds assist communities with tree inventories, management plans, EAB preparedness plans, ordinances, staff training, public awareness, and much more. For 2013, emphasis will continue to be on EAB readiness projects. In keeping with this, any tree planting project will need to focus on increasing species diversity to help reduce the impact of EAB and future invasive species. Emphasis will also be placed on projects that develop and enhance capacity for sustained urban and community forest management. Applicants are encouraged to consider projects that could improve their entire urban forest canopy, both public and private, or projects that could act as a model for others to adopt.

Approximately \$460,000 is available to Wisconsin cities, villages, towns, counties, tribal governments, and 501(c)(3) nonprofit organizations. Applicants may request from \$1,000 to \$25,000 with a 50/50 match. To be eligible for consideration, projects must relate to urban forestry and a grant application must be completed and returned along with all required attachments later 1. 2012. information. no than October For more visit: http://dnr.wi.gov/topic/UrbanForests/grants.html

2. Utility Companies

Some utility companies in Wisconsin 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.

3. Revenue From Wood Waste

In areas where EAB is killing a large number of trees, communities have developed relationships with private businesses to turn removed ash trees into lumber, furniture, mulch, fuel pellets, and other products.

4. Raising Taxes

Most communities do not like to consider this option; however, some have raised taxes so they are able to get an early start in removing and managing ash trees and wood materials in advance of an EAB infestation potentially saving time and money in the long term.

5. Reallocating Funds

Most communities will be faced with some form of fund reallocation if the EAB is found within their community limits. As part of the readiness plan, consider where these resources could best come from with the least impact on existing services. Some communities in infested states have set up nonlapsing accounts to have a ready source of funds for quick response. Others have begun to anticipate future expenditures and are acting preemptively to spread potential costs over a longer period of time.

6. Seeking Additional Support

Communities in infested states report that additional funds can come to those who ask. They recommend that community leaders enlist the aid of their state and federal elected officials to increase funding for EAB.

CONCLUSIONS

Although EAB has not been found locally, it is highly likely that it will work its way to the Village. We have learned from other states that EAB kills trees quickly. Village streets within a few years of infestation can be lined with dead and dying trees. The Village is taking a proactive approach to this serious threat through the preparation of this EAB Readiness Plan. The plan and its recommended strategies will help ensure that the Village has an effective response to EAB by reducing the associated risks and negative impacts, minimizing the effects on the budget, and planning for a healthy sustainable urban forest.

DRAFT-09/24/12

APPENDIX



Wisconsin Emerald Ash Borer Program

<u>What Will Happen If Emerald Ash Borer Is Found in Your Community?</u> <u>Quick Facts for Municipal Elected Officials</u>

The emerald ash borer is a major threat to Wisconsin's trees. Once present in an area, this insect kills all untreated ash trees within a few years. Most municipalities have a lot of ash trees and will be hit hard when this pest appears. EAB is present in and near several locations in Wisconsin and is expected to spread. Because it is easily moved long distances by human activity, EAB can appear anywhere at any time. This pest is regulated by state and federal agencies, so its spread is monitored and its appearance in a new location triggers a number of actions:

- 1. When EAB is first confirmed in your municipality, your chief elected official and/or appropriate staff will promptly be notified by Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) or Department of Natural Resources (DNR). Whenever possible, such notification is made by telephone.
- 2. After local notification, DATCP will issue a media advisory. News media may contact you for an interview. State staff will not call a press conference, but if you do, they will attend if invited.
- 3. Following notification, you will receive written confirmation of the EAB find. This follow-up letter will contain more complete information.
- 4. State agency experts may try to determine the extent of the EAB infestation. This surveying can take several months. Municipal staff may be asked to assist, if appropriate.
- 5. DATCP will quarantine your county and possibly adjacent counties to restrict movement of regulated ash material and all hardwood firewood, limiting further spread of EAB. DATCP will notify and work with affected businesses in the quarantine area to make their products safe for transport within the state, if possible. USDA APHIS will work with businesses on product transport outside Wisconsin.
- 6. State agencies may provide additional education & assistance for municipal officials and staff, residents, & businesses. DNR will direct you to the right resources to get your questions answered.
- 7. Generally, neither the federal nor state government will cut your ash trees or require you to cut ash trees. EAB is now considered to be permanently established in the upper Midwest and with current control tools, eradication is not possible.
- 8. You are strongly encouraged to prepare for the arrival of EAB! Actions taken now can blunt this insect's impact and save your community money.

To learn more about EAB, visit <u>www.emeraldashborer.wi.gov</u>. For assistance with EAB readiness planning for city, village and urban town officials, contact your DNR Regional Urban Forestry Coordinator found at <u>http://dnr.wi.gov/forestry/uf/staff/</u>. For EAB assistance for rural town officials, contact your DNR Regional Forest Health Specialist found at <u>http://dnr.wi.gov/forestry/FH/Staff/</u>.



www.emeraldashborer.wi.gov

Dying ash trees line the streets of an EAB-infested neighborhood.

Municipalities typically have a lot of ash trees. EAB quarantines restrict the movement of regulated ash material and all hardwood firewood.



EAB Hotline: 1-800-462-2803

The <u>Wisconsin Emerald Ash Borer Program</u> 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.6/13/2011

The EAB Life Cycle

Adults

Found mid-May to mid-September, the adults are responsible for the natural spread of the insect, usually less than ½ mile per year.

Eggs

A single female can lay 90 to 200 eggs in the cracks of ash tree bark which will hatch in approximately 3 weeks.

Exit Holes

The mature beetles chew their way through the bark in the spring and early summer, creating distinct Dshaped exit holes.



<u>Larva</u>

Eat their way into the cambial layer (just under the bark) where they spend 1 to 2 years eating and growing.

Pupae

The EAB over-winters as a "pupa" just underneath the bark of the ash tree.

Galleries

The tunnels left by the feeding larva have a distinct S-shape pattern. Each gallery only damages a small section of the tree, but hundreds of galleries can kill the tree.

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:





EXTENSION

typically hang on the tree until

late fall, early winter. *Paul Wray, Iowa State Unive

Ash Tree Identification

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.



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.





Authors: Kimberly Rebek and Mary Wilson

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.



Elm (Ulmus species)

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





*Paul Wray, Iowa State Universit

Paul Wray, Iowa State Unive

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.



Iowa State Unive

*www.forestryimages.org



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Easy Guide for Emerald Ash Borer Regulations



Nurseries

Ash nursery stock is prohibited from being distributed outside of the Emerald Ash Borer (EAB) quarantine area.

Mills & Loggers



Ash logs cannot be moved out of the quarantine area during the adult flight period 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 April 30. 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 ¹/₂ inch of wood), kiln drying by approved standards, or fumigation prior to 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. Locations for wood waste drop-off may be established in the near future. Contact officials for more information.

Contact Information

Anna Healy, Regulatory Specialist Wisc. Dept. of Agriculture, Trade and Consumer Protection 608-224-4546 or <u>Anna.Healy@Wisconsin.gov</u>

> JoAnn Cruse, State Plant Health Director USDA, APHIS, Plant Protection & Quarantine 608-231-9545 or <u>Joann.m.cruse@aphis.usda.gov</u>



New quarantine areas may be added at any time. For updates visit www.emeraldashborer.wi.gov





Firewood Movement in Wisconsin

Two quarantines exist in Wisconsin that affect firewood movement for the general public: one for the **gypsy moth** and one for **emerald ash borer**.

Loggers, timber haulers, and sawmills are regulated. The inspections and certifications they require in order to move hardwood firewood **ARE NOT** available to the general public.

PERMITTED

Within Yellow Yellow to Green Within Green Within Red Within White White to Any Color

NOT PERMITTED

Green to Any Color Red to Any Color Yellow to White or Red

Firewood can be used at state properties if it comes from within 25 miles and obeys the **permitted list** above. Wood from yellow-shaded counties is permitted on state properties in non-quarantine counties within 25 miles. **No firewood from outside Wisconsin is allowed on state properties**.

DATCP-certified firewood can be used at any WI State Park.

If driving through a RED or GREEN quarantine area with firewood, you must not stop for any longer than it would take to gas up your vehicle.

If visiting a private, county, or municipal campground, call ahead to your destination for specific firewood policy information.

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer



Daniel A. Herms Deborah G. McCullough David R. Smitley Clifford S. Sadof R. Chris Williamson Philip L. Nixon











DRAFT-09/24/12

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer



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Insecticide Options for Protecting Ash Trees from Emerald Ash Borer

merald 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, according to the second s



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-ofways, 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 trunkinjected 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.



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



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 DD₅₀ (as black locust approaches full bloom) and a second spray four weeks later.



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

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 5to 20-inch DBH at three sites in Michigan, untreated trees had an average of 68 to 132 EAB larvae per m² of bark surface, which represents high pest pressure. In contrast, trees treated with emamectin benzoate had, on average, only 0.2 larvae per m², 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 15to 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 PointerTM (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/



INSECTICIDE OPTIONS FOR PROTECTING ASH TREES FROM EMERALD ASH BORER

DRAFT-09/24/12



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The Four Standards of Tree City USA

- 1. A Tree Board or Department
- 2. A Tree Care Ordinance
- A Community Forestry Program With an Annual Budget of at Least \$2 Per Capita
- 4. An Arbor Day Observance and Proclamation

Tree City USA Standards

1) A Tree Board or Department

Someone must be legally responsible for the care and management of the community's trees. This may be a professional forester or arborist, an entire forestry department, or a volunteer tree board. Often, both a professional staff and advisory tree board are present, which is a good goal for most communities.

A tree board, or commission, is a group of concerned volunteer citizens charged by ordinance with developing and administering a comprehensive tree management program. Balanced, broad-based community involvement is encouraged. Boards function best if not composed entirely of tree-related professionals such as forestry professors, nursery operators, arborists, etc. Fresh ideas and different perspectives are added by citizens with an interest in trees that is entirely avocational. Limited, staggered terms of service will prevent stagnation or burnout, while at the same time assuring continuity. Request a Tree City USA application.



Tree City USA Standards

2) A Tree Care Ordinance

The tree ordinance must designate the establishment of a tree board or forestry department and give this body the responsibility for writing and implementing an annual community forestry work plan. Beyond that, the ordinance should be flexible enough to fit the needs and circumstances of the particular community.

A tree ordinance provides an opportunity to set good policy and back it with the force of law when necessary. Ideally, it will provide clear guidance for planting, maintaining and removing trees from streets, parks and other public places. For tips and a checklist of important items to consider in writing or improving a tree ordinance, see Bulletin No. 9.

You can find a sample tree care ordinance at the International Society of Arboriculture.

Request a Tree City USA application.



Tree City USA Standards

3) A Community Forestry ProgramWith an AnnualBudget of at Least \$2Per Capita

Evidence is required that the community has established a community forestry program that is supported by an annual budget of at least \$2 per capita. At first, this may seem like an impossible barrier to some communities. However, a little investigation usually reveals that more than this amount is already being spent by the municipality on its trees. If not, this may signal serious neglect that will cost far more in the long run. In such a case, working toward Tree City USA recognition can be used to re-examine the community's budget priorities and re-direct funds to properly care for its tree resource before it is too late.

Ideally, this standard will be met by focusing funding on an annual work plan developed after an inventory is completed and a report is approved by the city council. Such a plan will address species diversity, planting needs, hazardous trees, insect and disease problems and a pattern of regular care such as pruning and watering.

Tree City USA Standards

An Arbor Day Observance and Proclamation

This is the least challenging and probably the most enjoyable standard to accomplish. An Arbor Day celebration can be simple and brief or an all-day or all-week observation. It can be a simple tree planting event or an award ceremony that honors leading tree planters. For children, Arbor Day may be their only exposure to the green world or a springboard to discussions about the complex issue of environmental quality.

The benefits of Arbor Day go far beyond the shade and beauty of new trees for the next generation. Arbor Day is a golden opportunity for publicity and to educate homeowners about proper tree care. Utility companies can join in to promote planting small trees beneath power lines or being careful when digging. Smokey Bear's fire prevention messages can be worked into the event, as can conservation education about soil erosion or the need to protect wildlife habitat.

Still another way to develop Arbor Day is to link it with a treerelated festival. Some that are currently celebrated include dogwood festivals, locust blossom festivals and Macon, Georgia's Cherry Blossom Festival that annually brings more than \$4.25 million into the local economy. In meeting the four standards, help is available! The urban and community forestry coordinator in your state forester's office will be happy to work with communities in taking these first steps toward better community forestry. Request a Tree City USA application.

Request a Tree City USA application.

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The benefits of Arbor Day go far beyond the shade and beauty of new trees for the next generation. Arbor Day is a golden opportunity for publicity



www.emeraldashborer.info





Frequently Asked Questions Regarding Potential Side Effects of Systemic Insecticides Used To Control Emerald Ash Borer

Jeffrey Hahn, Assistant Extension Entomologist, Department of Entomology, University of Minnesota Daniel A. Herms, Professor, Department of Entomology, Ohio Agricultural Research and Development Center, The Ohio State University Deborah G. McCullough, Professor, Department of Entomology and Department of Forestry, Michigan State University

What systemic insecticides are commonly used to protect ash trees from emerald ash borer (EAB)?

Systemic insecticides containing the active ingredients imidacloprid, dinotefuran or emamectin benzoate are commonly used to protect ash trees from EAB. All three are registered for agricultural use and have been designated by the Environmental Protection Agency as Reduced-Risk insecticides for certain uses on food crops. The most widely used insecticide in the world, imidacloprid has been utilized for many years to control pests of agricultural crops, turfgrass, and landscape plants. Because of its low toxicity to mammals, it is also used to control fleas and ticks on pets. Dinotefuran is a relatively new product that has properties similar to those of imidacloprid, but it has not been researched as thoroughly. Emamectin benzoate, derived from a naturally occurring soil bacterium, has been registered for more than 10 years as a foliar spray to control pests in vegetable and cotton fields and parasitic sea lice in salmon aquaculture. Similar products are used in veterinary medicine as wormers for dogs, horses, and other animals.

To control EAB, some products containing imidacloprid or dinotefuran are applied as a drench



The invasive emerald ash borer has killed millions of ash trees in North America.

directly to the surface of the soil or injected a few inches under the soil surface. Dinotefuran can also be applied by spraying the bark on the lower five feet of the trunk. Emamectin benzoate and specific formulations of imidacloprid are injected directly into the base of the tree trunk. Systemic insecticides are transported within the vascular system of the tree from the roots and trunk to the branches and leaves. This reduces hazards such as drift of pesticide to non-target sites and applicator exposure that can be associated with spraying trees with broad-spectrum insecticides, and has less impact on beneficial insects and other non-target organisms. Many products registered for control of EAB can be applied only by licensed applicators. In all cases, the law requires that anybody applying pesticides comply with instructions and restrictions on the label.



Ash trees lining a street before (left) and after (right) they were decimated by EAB.





Precautions should be taken to prevent pesticides from reaching surface or groundwater.

Will systemic insecticides applied to the soil impact ground or surface water quality?

Several surveys have been conducted in the United States and Canada to monitor imidacloprid in surface and groundwater. Results indicate that imidacloprid is rarely detected in surface water in agricultural or urban areas. Similar monitoring studies have not been conducted with dinotefuran, which is more soluble in water. In the presence of sunlight, imidacloprid and dinotefuran are very unstable in water and degrade rapidly, which reduces their environmental risk to surface water.

When not exposed to light, imidacloprid and dinotefuran break down slowly in water, and thus have the potential to persist in groundwater for extended periods. In surveys of groundwater, imidacloprid was usually not detected. When detected, it was present at very low levels, mostly at concentrations less than 1 part per billion (ppb) with a maximum of 7 ppb, which are below levels of concern for human health. The detections have generally occurred in areas with porous rocky or sandy soils with little organic matter, where the risk of leaching is high — and/or where the water table was close to the surface.

Every precaution should be taken to protect surface and groundwater from pesticide contamination. Trunk-injected insecticides pose little risk to ground and surface water when used as directed because the material is placed inside the tree.

To protect groundwater, soil applications of systemic insecticides should be made immediately adjacent to the trunk of the tree, which increases uptake (and efficacy) because the high density of absorptive roots in this area filters the chemical from the soil. Systemic insecticides bind to varying degrees to organic matter, silt, and clay, which restricts their movement in soil. They should not be applied to porous sandy soils lacking organic matter, especially where the water table is shallow, or when heavy rain is predicted within the next 24 hours.

To protect surface water, systemic insecticides should not be applied to soil near ponds, lakes, or streams. Soil drenches should not be applied to sloped surfaces from which runoff can occur, nor should pesticides be misapplied carelessly to impervious surfaces such as sidewalks or streets, or otherwise allowed to reach conduits to surface water such as drains, ditches, or gutters.

The imidacloprid profile presented in the Extension Toxicology Network Pesticide Information concluded there is generally not a high risk of groundwater contamination when products are used as directed and appropriate precautions are taken. Similarly, the Canadian Water Quality Guidelines for the Protection of Aquatic Life noted that when imidacloprid is used correctly, it does not characteristically leach into deeper soil layers.

Will these insecticides impact aquatic organisms?

The toxicity of imidacloprid to aquatic life varies. Studies indicate it has low toxicity to fish, amphibians, and some aquatic invertebrates such as Daphnia (small aquatic crustaceans), but high toxicity to other invertebrates such as mysid shrimp (a salt water species) and larvae of some aquatic insects such as midges, black flies, and mosquitoes. Dinotefuran is not as thoroughly researched, but existing data reflect a pattern of toxicity similar to that of imidacloprid. Toxicity to fish and Daphnia is low, while mysid shrimp are sensitive. As previously noted, imidacloprid and dinotefuran are broken down rapidly in water when exposed to light. In the rare occasions when imidacloprid has been detected in surface water, the levels were too low (less than 1 ppb) to impact even sensitive aquatic organisms.

Imidacloprid soil injections have been widely used in ravines of Smoky Mountain National Park and other forested areas to control hemlock woolly adelgid, an invasive insect that is devastating hemlock trees in the Appalachian Mountains. A risk assessment prepared for the USDA Forest Service ("Imidacloprid – Human Health and Ecological Risk Assessment") concluded that these treatments pose negligible risk to aquatic organisms when applied as directed to clay or loam soils, and that even a worst-case scenario of a major spill of imidacloprid into a small pond would have negligible effects on fish, amphibians, or tolerant aquatic invertebrates. When used as directed, imidacloprid soil treatments for EAB control are unlikely to impact aquatic organisms.

What about insecticide residues in senesced leaves that fall from trees in autumn?

This question has not been thoroughly researched. One study conducted in experimental microcosms found that imidacloprid residues in senesced (dead) leaves from treated trees had no effect on microbial respiration or decomposition, or survival of leaf-shredding insects that decompose dead vegetation. Insect feeding rates were decreased by imidacloprid concentrations of 1.3 parts per million (ppm), while lower concentrations (0.8 ppm) had no effect. When leaf-shredding insects or earthworms were given senesced maple leaves with higher concentrations of imidacloprid (3-11 ppm), their feeding rates were reduced but their survival was not affected. In another microcosm study, imidacloprid inhibited breakdown of leaf litter, but foliar concentrations in this study (18-30 ppm fresh weight) were more than an order of magnitude higher than those reported in leaves from trees treated for EAB control. In all of these experiments, organisms were exposed only to leaves from treated trees. In many situations, leaves from treated ash trees would be mixed with senesced leaves of other species growing nearby.

Similar studies have not been conducted with emamectin benzoate, which is broken down rapidly by microbial activity and sunlight. Because of its short residual activity on the surface of leaves, it is considered a biorational insecticide compatible with integrated pest management programs, including biological control. These characteristics suggest that environmental impacts will be negligible as emamectin benzoate is released from decomposing leaves. Regulatory agencies concluded that foliar applications of emamectin benzoate to vegetable crops will have no adverse effects on ground or surface water, birds, mammals, fish, or aquatic invertebrates when used as directed.

Will these insecticides harm honey bees?

Ash trees are wind-pollinated and are not a nectar source for bees. Furthermore, ash flowers are produced early in the growing season and are present for only a limited number of days. It is highly unlikely that bees would be exposed to systemic insecticides applied to ash.

Flowering plants that are pollinated by bees or other insects should not be planted immediately adjacent to ash or other trees that will be treated with systemic insecticides applied to the soil, as they may also absorb insecticide. Honey bees and other insects can be affected when systemic insecticides



Honey bees and other pollinators can be harmed by insecticides applied to flowering plants.

are translocated to nectar and pollen. Imidacloprid is fatal to honey bees when it reaches high enough concentrations, and can have harmful sublethal effects at lower concentrations.

There has been much concern recently about the potential role of imidacloprid and related neonicotinoid insecticides in colony collapse disorder (CCD). Research is ongoing to investigate the relative effects of pesticides, bee pathogens and parasites, and nutrition on honey bee health. To date there are no conclusive answers, but researchers have not been able to establish a link between imidacloprid and CCD. Stronger evidence implicates a combination of pathogens as well as other pesticides used in hives to control pests that afflict bees.

Will these insecticides harm other insects?

All of the systemic insecticides used to control EAB will impact other species of insects that feed on treated ash trees. However, ash trees that are not treated will be killed by EAB, which will also impact these insects. Some products can affect many kinds of insects, while others affect only certain groups of insects. For example, emamectin benzoate has been shown to affect a broad range of plant-feeding insects. Products with imidacloprid generally have little effect on caterpillars, mites, and armored scales, but will impact most sawflies, leaf-feeding beetles, and sap-feeding insects such as aphids and soft scales. Studies have shown that beneficial insect predators and parasitoids - such as lady beetles, lacewings, and parasitic wasps - can be killed by indirect exposure to imidacloprid through their prey, or directly by feeding on nectar from treated plants. However, systemic insecticides are generally considered to have less impact on natural enemies than broad-spectrum insecticides applied as foliar or cover sprays.



Woodpeckers are important predators of overwintering EAB larvae.

Will these insecticides harm woodpeckers?

This is unlikely. Woodpeckers feed on live, mature EAB larvae, mostly in late fall, winter and early spring. Many of these mature larvae overwinter in the nonliving, outer bark where they will not be exposed to systemic insecticides. Imidacloprid, dinotefuran, and emamectin benzoate are much more toxic to insects than to birds that have been tested, and insecticide concentrations that have been measured in treated trees are far below the levels known to be toxic to birds. An EAB larva that has been killed by insecticide will desiccate quickly and decompose. There is little evidence that woodpeckers will feed on larval cadavers. Furthermore, living larvae that are suitable prey for woodpeckers will not have been exposed to a lethal dose of insecticide, and these products do not bio-accumulate in animals in the way that fat-soluble insecticides such as DDT do. In Michigan and Ohio, where EAB has been established for several years, many ash trees have been treated with systemic insecticides. There have been no reported cases of woodpecker poisoning caused by insecticides applied for control of EAB.

Does injecting insecticides into trunks injure the trees?

Drilling through the outer bark creates a wound in the tree. The response of the tree to these wounds is affected by factors such as the size and depth of the hole and the vigor of the tree. In recent studies, the injury associated with drilling holes and injecting two insecticide products (Imicide® applied with Mauget® capsules and TREE age[™] applied with the ArborjetTree IV[™] and Quickjet[™]) into trunks of ash trees was examined. In nearly all cases, ash trees that were relatively healthy and properly injected showed little evidence of damage. New, healthy wood was produced over the injection sites and there was no evidence of pathogen infection, decay, or other signs of serious injury. Other devices used to inject ash trees generate wounds that differ from those caused by drilling discrete holes in the tree. However, their impact has not been thoroughly evaluated in research projects. We do know that untreated ash trees in areas with EAB infestations will eventually be killed.

Will treating ash trees result in development of resistance of EAB to insecticides?

This is highly unlikely. Pests typically evolve resistance to pesticides only in situations where a high proportion of the insect population was subjected to strong selection pressure. For example, pesticide resistance has evolved in insect and weed populations in agricultural fields, greenhouses, and grain storage bins where nearly all of the pest population was exposed to the pesticide. Ash trees are very common in many natural environments. Landscape trees represent a small fraction of all the ash that will be colonized by EAB in a given area, and only a small proportion of high-value trees will ever be treated to control EAB. Thus, most of the EAB population will never be exposed to insecticides. Because the selection pressure is so low, and there will be plenty of cross breeding with individuals that have never been exposed to insecticides, the risk of a resistant EAB population evolving is minimal.

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Alternative to Ash Trees: Commercially Available Species and Cultivars

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

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 and will need training pruning when young, dioecious (separate male and female flowers produced on separate plants)

<u>Armstrong</u>': narrow, fastigiate form, 45' tall, 15' wide, yellow fall color, female, produces seeds
 <u>Celzam</u>' (<u>Celebration</u>[®]): 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

<u>'DTR 102</u>' (<u>Autumn Fantasy</u>[®]): broadly oval form, upright branches, 50' tall, 40' wide, bright to dark red fall color, female, produces seeds

<u>'Indian Summer</u>' or <u>'Morgan</u>': 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 orangered to red fall color that is longer lasting, male, seedless, drought tolerant, tends to develop narrow crotch angles, included bark, and multiple leaders
- <u>'Marmo</u>': 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
- <u>'Scarsen'</u> (Scarlet Sentinel[®]): upright form becoming oval, 40' tall, 20' wide, yellow-orange to orange-red fall color, fast grower, male, seedless
- <u>'Sienna</u>' (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: Miyabe maple, Zone 4a, native to Japan

- <u>'Morton'</u> (<u>State Street</u>[®]), 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 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, <u>very invasive</u>, do not use near any natural area, shallow roots

'<u>Cleveland</u>': upright, oval, dense form, fast grower, 40' tall, 30' wide, older cultivar

<u>'Columnarbroad'</u> (<u>Parkway</u>[®]): 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

<u>'Conzam'</u> (<u>Conquest</u>): narrow oval form, 40' tall, 20' wide, maroon-red leaves in spring turn bronzish <u>'Crimson King</u>': older cultivar, oval becoming rounded, dark purple leaves all season, 40' tall, 35' wide, slower growing, hardy only to zone 5a

- <u>'Crimson Sentry</u>': but sport off of 'Crimson King', dense, compact, pyramidal to oval form, deep purple leaves all season, 35' tall, 15' wide
- "<u>Deborah</u>": common, broadly oval to rounded, reddish-purple leaves in spring turn dark green, 40-60" tall, 40" wide, straight leader
- <u>'Drummondii</u>': 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
- <u>'Ezestre'</u> (<u>Easy Street</u>): pyramidal to narrow oval form, 40' tall, 20' wide, faster grower
- <u>'Fairview</u>': narrow, upright-oval form, reddish purple leaves in spring turn bronzish, 45' tall, 35' wide <u>'Globosum</u>': dense, globular form, 15-20' tall, 18' wide, slow grower, formal looking
- <u>'Jade Glen</u>': broad, rounded, open form, 45' tall, 40' wide, faster growing, says it is verticillium wilt resistant but it is not
- "<u>McGill No. 42</u>" (<u>Emerald Queen</u>"): dense, oval to rounded form with upright, spreading branches, deep green, glossy leaves, 50' tall, 40' wide, good branch pattern, straight trunk

'<u>National 2000</u>' (<u>Champtree</u>[™]): upright spreading to broadly oval form, 50-60' tall, 40' wide

- <u>'Pond'</u> (<u>Emerald Lustre</u>[®]): upright, spreading to rounded form, 45' tall, 40' wide, faster grower, good branching
- <u>'Princeton Gold</u>': 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

<u>'Schwedleri</u>': 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

<u>'Summershade</u>': 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 (<u>in acidic soils (pH below 7) only or else very chlorotic</u>), 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 and drought, susceptible to verticillium wilt, leaf hoppers, frost crack, girdling roots, prone to included bark formation and narrow, branch crotch angles, shallow roots
 - <u>Autumn Flame</u>[®]: dense, rounded with spreading branches, 40' tall, 35' wide, early, bright red fall color, male, seedless, slower grower
 - <u>Autumn Radiance</u>[®]: rounded, open, symmetrical form, 60' tall, 40' wide, early red-orange fall color <u>'Autumn Spire</u>': 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
 - '<u>Brandywine</u>': 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

- '<u>Frank Jr.</u>' (<u>Redpointe</u>[™]): broadly pyramidal form, 45' tall, 30' wide, bright red fall color, faster growing, straight central leader, better branch crotch angles, new cultivar
- '<u>Franksred</u>' (<u>Red Sunset</u>[®]): 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
- "<u>Magnificient Magenta</u>" (<u>Burgundy Belle</u>"): 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

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

<u>'Northwood</u>': 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 (<u>PNI 0268</u>' (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
- <u>'Schlesinger</u>': broadly vase-shaped to rounded, 45' tall, 35' wide, very early orange to purplish-red fall color, female, produced seed
- <u>'Somerset</u>': broadly oval to rounded form, 45' tall, 35' wide, red fall color, leaf hopper resistant newer cultivar

<u>Summer Red</u>[®]: dense, broad oval form, 20' tall, 10' wide, burgundy red new leaves that turn purplishgreen, 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* 'Warrenred': <u>Pacific Sunset</u>[®]: 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

<u>'Chicagoland</u>': 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; will grow faster if you apply water and fertilizer at certain time of year (late spring?)

<u>'Autumn Gold</u>': broadly pyramidal, symmetrical form, 45' tall, 35' wide, golden yellow fall color, male, no fruit, good, uniform branching

<u>'Fairmount</u>': dense, upright, pyramidal form, straight central leader, male, no fruit

<u>'Halka</u>': broadly pyramidal becoming oval, 45' tall, 40' wide, bright yellow fall color, male, no fruit
 <u>'Golden Globe</u>: 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

<u>'PNI 22720</u>' (<u>Princeton Sentry</u>[®]): 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 <u>Shangri-La[®]</u>: 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

'<u>Woodstock</u>' (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

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

<u>'Emerald Kascade'</u>: irregular, weeping form with pendulous branches, grafted, 16' tall, male, no pods <u>'Harve'</u> (<u>Northern Acclaim</u>[®]): symmetrical, upright, spreading form, 45' tall, 35' wide, yellow fall color,

male, no pods, developed in North Dakota, hardy to zone 3b

'<u>Impcole</u>' (<u>Imperial</u>[®]): 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

'<u>Moraine</u>': 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

<u>'Skycole</u>' (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

<u>'Suncole'</u> (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

<u>True Shade</u>[®]: broadly oval form, 40' tall, 35' wide, wider branch angles, yellow fall color, faster grower, male, no pods

'<u>Wandell</u>' (<u>Perfection</u>[™]): 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; nurseries say the tree is hard to ship as it is very brittle when shipping and forms no central leader

"<u>Espresso</u>": 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. <u>The key to success</u> 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*), redbud, ash, lindens, musclewood, pagoda dogwood, pears, weeping willow, honeylocust, serviceberry, Japanese barberry, potentilla, roses, variegated dogwood, spreading cotoneaster
- *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
- *Quercus imbricaria*: shingle oak, hardy to zone 4b, native to eastern and central U.S., pyramidal when young becoming oval to rounded with age, wide-spreading, 50-60' tall, 40-60' wide, slow to moderate growth rate, late, russet-brown fall color, leaves hold late into winter, <u>requires acidic soil</u>, gets chlorotic at high pH, tolerates dry soil, urban tolerant, susceptible to oak wilt
- *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': <u>Heritage</u>[®] 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

- *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 palustris*: pin oak, hardy to zone 4b, native to eastern U.S. to Midwestern U.S., nice pyramidal form with tight branching, 70-80' tall, 40-50' wide, fast growth rate, late, russet to orange-red fall color, prefers a rich, loamy soil, <u>requires acidic soil only</u>, tolerates wet soil, urban tolerant, susceptible to oak wilt
- *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

<u>'Fastigiata'</u> (<u>Skyrocket</u>[®]): narrow, fastigiate form, 45' tall, 15' wide, tight branching, susceptible to mildew
 <u>'Pyramich'</u> (<u>Skymaster</u>[®]): 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
 <u>'Wandell'</u> (<u>Attention</u>[®]): 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', zone 4b, fastigiate to narrow-oval form, 40' tall, 20' wide, mildew resistant
- *Quercus* × *schuettei*: swamp bur oak, hybrid of *Q. bicolor* × *Q. macrocarpa*, zone 3b, 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
- *Quercus* × *warei* 'Long': <u>Regal Prince</u>[®] oak, zone 4b, 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
- **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
 - '<u>Mickelson</u>' (<u>Shawnee Brave</u>[®]): 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, <u>susceptible to Japanese beetle</u>, 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
 - "<u>Bailyard</u>" (Front Yard[®]): broadly pyramidal when young becoming rounded and dense, symmetrical form, 60-75' tall, 40' wide
 - <u>'Boulevard</u>': narrowly pyramidal form, 50' tall, 25' wide, ascending branches, yellow fall color
 <u>'DTR 123'</u> (<u>Legend</u>[®]): broadly pyramidal form, 40' tall, 30' wide, well-spaced branches, thicker leaves,
 - single leader, yellow fall color

"<u>Lincoln</u>": 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

"<u>Baileyi</u>" (<u>Shamrock</u>[®]): symmetrical, pyramidal form, 40' tall, 30' wide, stouter branches, more open canopy, uniform branching no fall color

"<u>Chancellor</u>"): upright, narrow, pyramidal form, 40' tall, 20' wide, good branching, faster growing, wider branch crotch angles, yellowish fall color

"<u>Corzam</u>" (<u>Corinthian</u>"): narrowly pyramidal form, 45' tall, 15' wide, dense branching, evenly spaced branches, thick, glossy leaves, yellowish fall color

'<u>Halka'</u> (<u>Summer Sprite</u>[®]): dense, narrow, pyramidal form, dwarf, 16' tall, 8' wide, yellowish fall color '<u>Norbert'</u> (<u>Prestige</u>[®]): broad, pyramidal form, good branching, wider branch crotch angles, shiny leaves,

fewer seeds produced, harder to find, but much better form than 'Greenspire'

<u>(PNI 6025</u>' (<u>Greenspire</u>[®]): 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

'<u>Ronald</u>' (<u>Norlin</u>[™]): 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, broadpyramidal 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

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

"<u>Wandell</u>' (<u>Sterling</u>"): 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

- "<u>New Harmony</u>" (from U.S. National Arboretum): broad, vase-shaped form, arching branches, good form, easier to grow
- <u>'Princeton</u>': (from Princeton Nursery) large, leathery leaves, vase-shaped form, more resistant to elm leaf beetle

<u>'Valley Forge</u>' (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, * are ones that I think are the best
 - "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
 - *'<u>Frontier</u>' (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
 - '<u>Homestead</u>' (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
 - *'<u>Morton</u>' (<u>Accolade</u>[®]) (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
 - <u>'Morton Plainsman</u>' (<u>Vanguard</u>) (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
 - "<u>New Horizon</u>' (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
 - <u>'Patriot</u>' (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
 - "<u>Pioneer</u>" (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
 - '<u>Regal</u>' (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

⁽<u>Dynasty</u>' (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 reddishbrown 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
 - '<u>GarAnn</u>' (<u>Hot Wings</u>[™]): upright, spreading form, 20-25' tall, 15-20' wide, bright red samaras, yellow to red fall color, drought tolerant
 - <u>'Patdell</u>' (<u>Pattern Perfect</u>[™]): 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, <u>very invasive</u>, 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
 - '<u>Embers</u>': rounded form, 15-20' tall, 15' wide, bright red samaras, scarlet fall color
 - <u>'Emerald Elf</u>': compact, rounded, dense, shrubby form, 5-6' tall and wide, scarlet to purple fall color <u>'Flame</u>': multi-stemmed, spreading, irregular form, 15-20' tall, 20-25' wide, bright orange-red to deep red fall color
 - '<u>JFS-UGA</u>' (<u>Red November</u>[™]): 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
- *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, multistemmed 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), <u>has long, sharp thorns</u>, white flowers in late spring to early summer, showy, persistent, glossy, bright-orange-red fruit fall to winter "<u>Westwood I</u>' (<u>Washington Lustre</u>"): 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 olivegreen 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

'<u>Starburst</u>': upright, vase-shaped form with rounded crown, 25-30' tall, 20' wide, dark green leaves <u>Summertime</u>[®]: 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

<u>Malus baccata</u> 'Jackii': Jackii crabapple, hardy to zone 3, rounded form, 20' tall, 20' wide, glossy leaves, zone 3

<u>Malus sargentii</u>: Sargent crabapple, low, spreading form, 8' tall, 12' wide, alternate bearing, persistent fruit

<u>'Select A'</u> (<u>Firebird</u>[®]): rounded, spreading form, 7' tall, 9' wide, <u>persistent fruit</u>, bears annually, persistent fruit

'<u>Tina</u>': small, rounded, dwarf form, 5' tall, 6' wide, slow growing

<u>Malus × zumi</u> var. <u>calocarpa</u>: redbud crabapple, rounded, spreading form, 20' tall, 24' wide, <u>persistent</u> <u>fruit</u>

White Flowers/Yellow Fruit

<u>Bob White</u>': dense, rounded form, 20' tall, 20' wide, <u>persistent fruit</u>, but is a watersprouter <u>'Cinzam'</u> (<u>Cinderella</u>[®]): dwarf, rounded to upright form, 8' tall, 5' wide, <u>persistent fruit</u> <u>'Excazam'</u> (<u>Excalibur</u>): upright form, 10' tall, 8-10' wide, good form

'Lanzam' (Lancelot[®]): compact, upright, dense form, 8-10' tall, 8' wide, <u>persistent fruit</u>

<u>'Ormiston Roy</u>': 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

<u>'Camzam</u>' (<u>Camelot</u>[™]): rounded form, 10' tall, 8' wide, pinkish-white flowers, burgundy-green leaves, persistent fruit

<u>Malus sargentii</u> 'Candymint': low, spreading, horizontal form, 10' tall, 15' wide, purple tinted foliage becoming bronze-green

'<u>Canterzam</u>' (<u>Canterbury</u>[™]): rounded, compact form 10' tall, 8-10' wide, light, pinkish-white flowers (<u>Cardinal</u>': 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, orangered fall color, <u>persistent fruit</u>

'Orange Crush': spreading form, 12-15' tall, 12-15' wide, bronze to purplish-green leaves

(<u>Parrsi</u>' (<u>Pink Princess</u>[®]): low, spreading form, 8' tall, 12' wide, purple leaves become bronze-green (<u>Prairifire</u>': upright, spreading to rounded form, 20' tall, 20' wide, slower growing, purple leaves become

reddish-green <u>'Prairie Maid</u>': 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

'<u>Coral Cascade</u>': semi-weeping form, 15' tall, 20' wide, white flowers, coral fruit, <u>persistent fruit</u>

- '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

<u>Manbeck Weeper</u>' (<u>Anne E.</u>[®]): wide spreading, horizontal weeper, 10-12' tall, 10-12' wide, white flowers, cherry-red fruit, <u>persistent fruit</u>, is difficult to find, but is one of the nicest crabs
 <u>Molazam</u>' (<u>Molten Lava</u>[®]): 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

"<u>Columnaris</u>": 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
 - <u>Aristocrat[®]</u>: pyramidal form with open branching, 35' tall, 25' wide, yellow to red fall color but is inconsistent for fall color, wider branch crotch angles
 - *'<u>Autumn Blaze</u>': 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

- '<u>Capital</u>': narrow, columnar form, 30' tall, 12' wide, reddish-purple fall color, susceptible to limb breakage in storms, susceptible to fireblight, zone 5
- <u>'Cleveland Select</u>' or '<u>Glenn's Form</u>' (<u>Chanticleer</u>[®]): 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
- <u>'Redspire</u>': pyramidal, dense, symmetrical form, 35' tall, 25' wide, yellow to reddish fall color or none at all, susceptible to fireblight, slower grower
- <u>'XP-005</u>' (<u>Trinity</u>[®]): broadly oval to rounded form, 30' tall, 25' wide, glossy, lighter green leaves, orangered 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

<u>DTR 124</u>' (<u>Summer Charm</u>[®]): upright, spreading, better form, 20' tall, 15' wide, single-stemmed
 <u>Morton</u>' (<u>China Snow</u>[®]): upright, spreading, wild form, big crown, 25' tall, 20' wide, vigorous, showy, showy, exfoliating, coppery to orangish-brown bark, single-stemmed

[•]<u>Zhang Zhimming</u>' (<u>Beijing Gold</u>): upright, rounded form, 25' tall, 20' wide, vigorous, single or multistemmed, 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

<u>'Elliott</u>' (<u>Snowcap</u>[™]): 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

<u>Summer Snow</u>: broad, rounded, compact form, 20' tall, 15' wide, good form, glossy, dark green leaves
<u>Williamette</u> (<u>Ivory Pillar</u>): upright, pyramidal, narrower form, 20-25' tall, 10-15' wide

Bailey Nurseries: St. Paul, Minnesota, <u>www.baileynurseries.com</u>, (800) 829-8898 Beaver Creek Nursery: Poplar Grove, Illinois, <u>www.beavercreeknursery.com</u>, (815) 737-8758 Carlton Plants: Dayton, Oregon, <u>www.carltonplants.com</u>, (800) 398-8733 Femrite Nursery: Aurora, Oregon, <u>www.femrite.com</u> (800) 547-2161 Heritage Seedlings: Salem, Oregon, <u>www.heritageseedlings.com</u> (503) 371-9688 J. Frank Schmidt and Son: Boring, Oregon, <u>www.ifschmidt.com</u>, (800) 825-8202 Johnson's Nursery: Menomonee Falls, Wisconsin, <u>www.johnsonsnursery.com</u>, (262) 252-4980 Mariani Nurseries: Kenosha, Wisconsin, (866) 627-4264 McKay Nursery: Waterloo, Wisconsin, <u>www.mckaynursery.com</u>, (920) 478-2121 Silver Creek Nurseries: Manitowoc, Wisconsin, (920) 684-6267

U.S.D.A. Cold Hardiness Zones

Zone 3a (cold hardy to –35 to –40°F): northwestern Wisconsin Zone 3b (cold hardy to –30 to –35°F): most of northern Wisconsin

Zone 4a (cold hardy to –25 to –30°F): northern central and extreme northwestern Wisconsin Zone 4b (cold hardy to –20 to –25°F): southwestern and central Wisconsin and along shore of Lake Superior

Zone 5a (cold hardy to -15 to -20°F): southeastern and eastern Wisconsin up to Door County and Madison near the lakes

Zone 5b (cold hardy to -10 to -15° F): Milwaukee, Racine, and Kenosha areas near Lake Michigan

<u>Wholesale nursery sources used in this guide</u> (does not imply endorsement by me of nurseries named, nor criticism of similar nurseries not mentioned)
TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
0	SB	Serviceberry	3	9	G	G	Prune	None	mow damage	Yes	Tree
1	SB	Serviceberry	3	9	G	G	Prune	None		Yes	Tree
2	AM	Amur Maple	3	0	F	Р	Remove	Signage		Yes	Tree
3	GB	Ginkgo Biloba	4	14	G	G	Protect	Signage		Yes	Tree
4	EL	Elm	9	20	G	G	Prune	Sidewalk	Hybrid	Yes	Tree
5	GB	Ginkgo Biloba	4	15	G	G	None	Sidewalk		Yes	Tree
6	EL	Elm	12	30	G	G	None	Sidewalk	Hybrid	Yes	Tree
7	GB	Ginkgo Biloba	5	16	G	G	None	Sidewalk		Yes	Tree
8	GB	Ginkgo Biloba	4	12	G	F	Prune	Sidewalk	needs upper prune	Yes	Tree
9	EL	Flm	10	25	G	G	None	Sidewalk	······ · · · · · · · · · · · · · · · ·	Yes	Tree
10	RΔ	Basswood	5	20	G	F	Prune	Sidewalk		Yes	Tree
11	CP	Common Pear	8	16	G	F	Prune	Sidewalk	heavy central growth needs thinned	Yes	Tree
12	BA	Basswood	6	16	G	Ġ	Druno	Sidewalk	can be thinned	Ves	Tree
12	DA DA	Basswood	0	22	G	G	Drupo	Sidowalk	can be thinned	Voc	Troo
14	CD DA	Dasswoou Common Door	0 6	12	G	G F	Drune	Sidowalk	can be trimmed	Yes	Troo
14	CP	Common Pear	5	12	G	г г	Drune	Sidewalk	needs timmed	Yes	Tree
15	CP DA	Common Pear	5	12	G	F	Prune	Sidewalk	ms can be thinned	res	Tree
16	BA	Basswood	8	1	G	-	Prune	Sidewalk	thin	Yes	Tree
1/	CP	Common Pear	5	1	G	+	Prune	Sidewalk	thin	Yes	Iree
18	BA	Basswood	5	18	G	G	Prune	Sidewalk	thin	Yes	Tree
19	KS	Katsura	3	12	G	F	Prune	Sidewalk	confirm, thin	Yes	Tree
20	KS	Katsura	3	12	Р	Р	Remove	Sidewalk	confirm	Yes	Tree
21	KS	Katsura	2	12	F	F	None	Sidewalk	aging	Yes	Tree
22	BO	Bur Oak	25	60	F	F	None	Street	central cavity, structure varies, pp?	Yes	Tree
23	GA	Green Ash	32	60	F	F	None	Street	trunk healings, structure gen ok, pp?	Yes	Tree
24	PC	Cleaveland Pear	4	12	G	G	None	Street	pyrus callery	Yes	Tree
25	PC	Cleaveland Pear	4	15	G	G	None	Street	pyrus callery, thin to suit	Yes	Tree
26	PC	Cleaveland Pear	3	12	G	G	None	None	pyrus callery, thin to suit	Yes	Tree
27	CL	Common Lilac	1	3	G	G	None	None		No	Shrub
28	CL	Common Lilac	1	4	G	G	None	None		No	Shrub
29	PL	St. Helens Plum	3	12	G	G	prune	None	being braced, poor root system	No	Tree
30	WB	Red Winterberry	1	1	G	G	None	None	x7	No	Shrub
31	WO	White Oak	3	15	G	G	None	None	Columnar Form track growth form	No	Tree
32	BG	Barberry gold	1	1	G	G	None	None	mulch hed	No	Shruh
32	00	Concolor Fir	2	2	D	D	Remove	None	compaction?	No	Tree
24	DT	Botontilla	1	2	Ġ	, E	Nono	None	mulch had	No	Shrub
25		Potentilla	1	2	c	-	None	None	mulah had	No	Shrub
33		Colorado Pluo Spruso	1	2	G	r C	Drotoct	None	much bed	No	Troo
30	BS	Colorado Blue Spruce	1	2	G	G	Protect	None	need tomuich and herb- 68 trees approx 30 are dead	NO	Tree
37	RO	Red Oak	2	10	P	F	Protect	Brace	compaction?, remove wood brace	NO	Tree
38	CA	Crabapple	1	5	P -	P -	None	None		Yes	Tree
39	CM	Crimson Maple	6	18	F	+	None	None	trunk damage	NO	Iree
40	SM	Sugar Maple	20	60	G	G	None	None	trunk damage	No	Tree
41	SM	Sugar Maple	26	65	G	G	None	None	trunk damage	No	Tree
42	BA	Basswood	20	60	G	G	None	None		No	Tree
43	HL	Honey Locust	22	65	F	F	None	None	braced w wire at 15ft	No	Tree
44	SL	Silver Maple	14	55	G	G	None	None	tall and spindley	No	Tree
45	SM	Sugar Maple	18	50	G	G	None	None	minor deadwood	No	Tree
46	HL	Honey Locust	16	50	G	G	Prune	None	remove deadwood	No	Tree
47	GA	Green Ash	12	45	Р	Р	Remove	Hazard	leaning deadwood	No	Tree
48	HL	Honey Locust	15	45	G	F	None	OH Wires	minor deadwood near ohw	No	Tree
49	BA	Basswood	26	60	F	Р	Remove	Hazard	lg cavity at 12ft	No	Tree
50	HL	Honey Locust	16	55	F	F	None	None	slight lean south over spruce	No	Tree
51	NS	Norway Spruce	17	45	F	F	None	OH Wires	near wires and parking	No	Tree
52	SP	Scots Pine	21	45	F	F	None	None	topped out	No	Tree
53	NS	Norway Spruce	18	60	G	G	None	None	nair	No	Tree
54	NS	Norway Spruce	22	70	G	G	None	None	nair	No	Tree
55	RΔ	Basswood	17	40	P	p	Remove	Hazard	cavity at 12ft	No	Tree
56	DA	Basswood	20	50	Ģ	E	Nono		reinspect annually pear bourge	No	Troo
50	DA DA	Basswood	20	50	c	Ċ	None	OH Wires	reinspect annually, near nouse	No	Tree
57	DA	Dasswoou	20	05	G	G	Davina	OH WITES	pruned recently above lence of heighbor. reinspect annually	NO	Tree
58	пL	Honey Locust	22	60	G	F	Prune	OH WIres		NO	Tree
59	HL	Honey Locust	20	60	G	-	Prune	OH Wires		NO	Iree
60	EL	Elm	21	45	F	Р	Prune	OH Wires	gnarly branching, past pruning, ne of shelter	No	Tree
61	SM	Sugar Maple	30	65	G	F	None	None	broad but lopsided groth	No	Tree
62	HL	Honey Locust	16	55	G	F	Prune	None	leaning west?, remove minor dw, near play area	No	Tree
63	GA	Green Ash	26	55	G	Р	Remove	None	20ft of split trunk, 3-4 inches deep	No	Tree
64	BA	Basswood	26	60	G	G	None	None	split bark areas healing, reinspect, check soundness	No	Tree
65	SL	Silver Maple	34	55	G	G	None	None		No	Tree
66	SL	Silver Maple	17	55	G	F	None	None		No	Tree
67	SM	Sugar Maple	12	40	G	F	None	None	recent low pruning	No	Tree
68	EL	Elm	36	55	F	F	None	None	chinese elm, on pl	No	Tree
69	SM	Sugar Maple	2	4	F	F	None	None	ms 2 x 10	No	Tree
70	EL	Elm	46	60	F	F	Protect	Street	near rd, pl, and st light. watch cavities, check soundness	No	Tree
71	SM	Sugar Maple	18	35	Р	Р	Remove	Street	split trunk	No	Tree
72	SM	Sugar Maple	17	35	F	F	Prune	Street		No	Tree
73	FI	Flm	48	65	F	F	Protect	Street	chinese elm. some prunings limb loss	No	Tree
74	۵۵	Arborvitae	16	30	G	, F	None	None	2 x 12 among shruh aa	No	Tree
74			10	20	6	C I	None	None		No	Tree
75	0147	Rlack Walnut	10	50	G F	G F	None	None	foncolina	No	Troo
70 77	BVV		10	25	-	r n	Roma	None	fenceline 2 v 12 colisting doo down d		Troo
77	GA	Green ASN	14	30	F	P	Remove	None	rencenne, Z x 12, spirtting, deadwood	INU No	тее
/8	MB	iviuiderry	6	20	4	P	кетоve	None	rencelline, deadwood with hsuckle	NO	ree
79	GA	Green ASN	22	40	F	F	rrune	NONE	renceme, can be cleaned up	INU	iree

TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
80	SL	Silver Maple	18	45	G	F	Protect	None	fenceline, remove ga 10ft east	No	Tree
81	GA	Green Ash	19	40	F	F	Prune	None	fenceline, clean up.	No	Tree
82	SL	Silver Maple	12	40	F	Р	Prune	None	fenceline, ms 5 x 12 may remove	No	Tree
83	SL	Silver Maple	15	50	G	Р	Prune	None	fenceline, ms 8 x 12 may retain	No	Tree
84	GA	Green Ash	17	45	F	F	Prune	None	fenceline, can cu and may retain	No	Tree
85	GA	Green Ash	17	45	Р	Р	Remove	None	fenceline, poor and split	No	Tree
86	GA	Green Ash	12	40	Р	Р	Remove	None	fenceline, poor, ms	No	Tree
87	SL	Silver Maple	12	40	F	F	Prune	None	fenceline, poor, ms, can retain	No	Tree
88	GA	Green Ash	18	40	Р	Р	Remove	None	fenceline	No	Tree
89	BX	Boxelder	4	15	F	F	Remove	None	fenceline	No	Tree
90	BC	Black Cherry	14	35	Р	Р	Remove	None	fenceline pl	No	Tree
91	PC	Cleaveland Pear	3	12	G	G	None	None	planted by owner	Yes	Tree
92	PC	Cleaveland Pear	3	50	G	G	None	None	planted by owner	Yes	Tree
93	CM	Crimson Maple	18	40	F	F	Prune	None	watch	Yes	Tree
94	CM	Crimson Maple	22	45	G	F	Prune	None	watch	Yes	Tree
95	EL	Elm	40	60	G	F	Protect	None	watch ms	Yes	Tree
96	AM	Amur Maple	4	10	F	Р	Prune	None	need mulch ring - trunk scar	Yes	Tree
97	AM	Amur Maple	3	10	F	G	None	None		Yes	Tree
98	AA	Arborvitae	5	12	G	G	None	None	4 trees	Yes	Tree
99	JTL	Japanese Tree Lilac	2	10	G	G	None	None		Yes	Tree
100	SL	Silver Maple	8	30	G	G	Prune	None		Yes	Tree
101	HA	Hawthorn	2	8	G	G	None	None		Yes	Tree
102	SL	Silver Maple	8	30	G	F	Prune	None		Yes	Tree
103	JTL	Japanese Tree Lilac	2	8	G	G	None	None		Yes	Tree
104	SL	Silver Maple	7	30	G	G	None	None		Yes	Tree
105	HA	Hawthorn	2	8	G	F	Prune	None		Yes	Tree
106	SI	Silver Manle	7	30	G	G	None	None		Yes	Tree
107	ITI	Jananese Tree Lilac	2	8	G	G	None	None	ivory silk	Yes	Tree
108	SI	Silver Manle	7	30	G	G	None	None		Yes	Tree
109	НΔ	Hawthorn	2	7	G	G	None	None		Yes	Tree
110	SI	Silver Manle	7	30	G	G	None	None		Ves	Tree
110	ITI	Japanoso Troo Lilas	, 2	0	G	G	None	Nono		Voc	Troo
111		Silver Maple	2	30	G	G	None	None		Yes	Troo
112	JL IIA		2	50	G	G	Devene	None		Yes	Tree
113	HA CL	Hawmorn Silver Meele	2	8	G	F	Prune	None		Yes	Tree
114	SL	Silver Maple	/	30	G	G	None	None	deed laves have been	Yes	Tree
115	SL	Silver Maple	45	75	F	F	Prune	None	dead large branches	Yes	Tree
116	SL	Silver Maple	45	75	G	G	None	None		Yes	Tree
11/	SL	Sliver Maple	45	75	G	F	None	None		Yes	Tree
118	KS	Katsura	6	15	G	+	Prune	Sidewalk		Yes	Tree
119	KS	Katsura	5	12	G	+	Prune	None		Yes	Iree
120	KS	Katsura	4	12	G	G	None	None		Yes	Iree
121	RO	Red Oak	24	75	G	F	Prune	None	cross branches	No	Tree
122	GA	Green Ash	18	40	G	G	Prune	None		No	Tree
123	BA	Basswood	14	60	G	G	None	None		No	Tree
124	BA	Basswood	14	60	G	G	None	None		No	Tree
125	BA	Basswood	14	60	G	G	None	None		No	Tree
126	BA	Basswood	15	60	G	F	Prune	None	prune all bhv in park	No	Tree
127	BA	Basswood	24	70	G	G	None	None		Yes	Tree
128	SM	Sugar Maple	13	70	G	G	None	None	2 trees next to eachother	Yes	Tree
129	CL	Common Lilac	3	6	G	G	None	OH Wires		Yes	Tree
130	EL	Elm	7	15	G	F	Prune	OH Wires	Also Mulberry intertwined	Yes	Tree
131	SL	Silver Maple	35	70	Р	Р	Remove	None	half dead	Yes	Tree
132	WA	White Ash	35	75	G	G	None	None		Yes	Tree
133	SL	Silver Maple	50	75	G	G	None	None		Yes	Tree
134	SL	Silver Maple	45	75	G	G	None	None		Yes	Tree
135	CL	Common Lilac	5	12	G	G	None	None		Yes	Tree
136	BW	Black Walnut	16	45	G	F	Prune	None		No	Tree
137	BW	Black Walnut	15	45	G	G	Prune	None		No	Tree
138	EG	Evergreen	13	35	D	Р	Remove	None	Dead Tree	No	Tree
139	BW	Black Walnut	12	35	G	G	None	None	2 trees	No	Tree
140	BW	Black Walnut	11	35	G	G	None	None		No	Tree
141	BW	Black Walnut	18	40	G	G	None	None		No	Tree
142	BW	Black Walnut	10	30	G	G	None	None		No	Tree
143	BW	Black Walnut	11	35	G	G	None	None		No	Tree
144	QA	Quaking Aspen	12	35	G	G	None	None		No	Tree
145	BO	Bur Oak	16	40	G	G	None	None	also 12 in wo adjont	yes	Tree
146	BO	Bur Oak	0	35	G	G	None	None	9 wo trees 6-15 in dia. good cond	yes	Tree
147	SM	Sugar Maple	12	30	G	Р	Remove	None	damaged trunk	yes	Tree
148	SL	Silver Maple	28	65	G	F	Prune	None		yes	Tree
149	CE	Chinese Elm	18	55	F	F	Prune	OH Wires		No	Tree
150	WS	White Spruce	10	40	G	G	Protect	None		No	Tree
151	WA	White Ash	26	65	F	Р	None	None	Leaning	No	Tree
152	NM	Norway Maple	13	40	F	G	Protect	None		No	Tree
153	SL	Silver Maple	22	45	Р	Р	Remove	None		No	Tree
154	WA	White Ash	12	35	G	F	Protect	None		No	Tree
155	CA	Crabapple	6	10	F	F	Prune	Sidewalk		No	Tree
156	BS	Colorado Blue Spruce	3	10	G	G	None	None		No	Tree
157	SM	Sugar Maple	12	30	F	F	None	None	watch	No	Tree
158	CM	Crimson Maple	14	40	G	F	Protect	None		Yes	Tree
159	MB	Mulberry	2	10	P	P	Remove	None	priv fence	Yes	Tree
	•	·		-				-			

TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
160	SL	Silver Maple	18	45	F	Р	None	None	ms x 3	Yes	Tree
161	GA	Green Ash	26	65	G	G	Protect	None	track, very large	Yes	Tree
162	SL	Silver Maple	1	8	G	G	None	None		Yes	Tree
164	SL	Silver Maple	40	10	G	G F	Prune	None	priv prop too	Yes	Tree
165	BW	Black Walnut	15	40	G	F	None	None	slight lean to road	Yes	Tree
166	GA	Green Ash	9	35	F	Р	Remove	None		Yes	Tree
167	BX	Boxelder	10	25	Р	Р	Remove	None	boxe and ash x 3 x 12in	Yes	Tree
168	GA	Green Ash	30	60	F	G	Prune	None	track for top dieback	Yes	Tree
169	RC	Red Cedar	10	30	F	F	None	None		Yes	Tree
170	EL	Elm	10	40	F	Р	None	None	4 trees x 8in dia end of rd	Yes	Tree
1/1	EL	Elm Common Lilos	8	35	F	Р	None	None	4th of 4	Yes	Tree
172	SI	Silver Manle	4 24	65	г G	P G	None	OH Wires	track	Yes	Tree
174	WA	White Ash	6	25	P	P	Remove	None	remove and grub big stump	Yes	Tree
175	BS	Colorado Blue Spruce	18	55	G	G	None	None	pp?	Yes	Tree
176	SL	Silver Maple	24	60	G	F	Prune	OH Wires	ms 24in x3	Yes	Tree
177	SL	Silver Maple	26	60	G	G	None	None	ms at 5 ft	Yes	Tree
178	SL	Silver Maple	24	60	G	F	None	OH Wires		Yes	Tree
179	RC	Red Cedar	18	40	G	F	None	None		Yes	Tree
180	BU	Beauty Bush	1	15	F	F	Prune	None	pp?	Yes	Shrub
182	ъз W/P	White Pine	26	45 60	г G	G	None	None	pp? NEARROADR	Yes	Tree
183	FL	Elm	32	70	F	F	None	OH Wires	elm at ppole	Yes	Tree
184	EL	Elm	17	60	F	P	Remove	OH Wires	elm x 2 24 + 17x12	Yes	Tree
185	AA	Arborvitae	7	28	G	F	Prune	Street		Yes	Tree
186	NM	Norway Maple	14	55	F	F	None	None	pp ?	Yes	Tree
187	SL	Silver Maple	32	55	F	Р	Prune	None	ms at 4ft, prune, watch	Yes	Tree
188	CM	Crimson Maple	18	55	G	F	Prune	OH Wires	eval remove	Yes	Tree
189	NM	Norway Maple	24	55	G	F	Prune	Street	watch	Yes	Tree
190	SE	Slippery Elm	5	30	P F	P F	Remove	None	pp remove?	Yes	Tree
191	CM	Crimson Maple	20 18	50	F	F	None	None	watch	Yes	Tree
192	SL	Silver Maple	23	55	F	P	Prune	None	large wound to watch	Yes	Tree
194	BHS	Black Hills Spruce	8	35	G	G	None	None	3 trees	Yes	Tree
195	PB	Paper Birch	13	35	G	G	None	None		Yes	Tree
196	CL	Common Lilac	6	7	G	G	None	None	2 3 in trees	Yes	Tree
197	BHV	Blackhaw Viburnum	5	7	G	G	None	None	multi stem	Yes	Tree
198	SL	Silver Maple	40	70	F	Р	Remove	None	large cavity in trunk	Yes	Tree
199	SL	Silver Maple	25	50	G	G	None	None	C in high hugh	Yes	Tree
200		Arborvitae	0	0	G	G	None	None	6 in high bush	Yes	Tree
201	WA	White Ash	17	40	G	G	None	None	o in high bush	Yes	Tree
203	NM	Norway Maple	16	35	G	G	None	None		Yes	Tree
204	NM	Norway Maple	9	30	G	G	None	None		Yes	Tree
205	BC	Black Cherry	19	40	Р	Р	Prune	None		Yes	Tree
206	CW	Cottonwood	25	80	G	G	None	None		Yes	Tree
207	BHS	Black Hills Spruce	8	20	G	G	Prune	None		Yes	Tree
208	NM	Norway Maple	1/	30	G	F	None	None	injured trunk	Yes	Tree
209	BHV	Magnolia Blackhaw Viburnum	7	35 15	G	G	Prune	None		Yes	Tree
210	BS	Colorado Blue Spruce	, 10	30	G	G	None	None		Yes	Tree
212	BS	Colorado Blue Spruce	14	40	G	G	None	None		Yes	Tree
213	SL	Silver Maple	30	50	G	G	None	None	split trunk	Yes	Tree
214	CW	Cottonwood	20	50	G	G	None	None		No	Tree
215	GA	Green Ash	7	25	G	G	None	None		No	Tree
216	WS	White Spruce	8	20	G	G	None	None		Yes	Tree
217	BS	Colorado Blue Spruce	10	30	G	G	None	None	2 hundra	Yes	Iree
218	BE ITI	Burning Busn Jananese Tree Lilac	2	15	G	G	None	None	2 busnes	Yes	Tree
220	JTL	Japanese Tree Lilac	3	15	G	G	None	OH Wires		Yes	Tree
221	JTL	Japanese Tree Lilac	3	15	G	G	None	OH Wires		Yes	Tree
222	JTL	Japanese Tree Lilac	4	15	G	G	None	OH Wires		Yes	Tree
223	JTL	Japanese Tree Lilac	3	15	G	G	None	OH Wires		Yes	Tree
224	JTL	Japanese Tree Lilac	3	15	G	G	None	OH Wires		Yes	Tree
225	JTL	Japanese Tree Lilac	4	15	G	G	None	OH Wires		Yes	Tree
226	JIL	Japanese Tree Lilac	3	15	G	G	None	OH Wires		Yes	Tree
227	ITI	Japanese Tree Lilac	4	15	G	G	None	OH Wires		Yes	Tree
229	JTL	Japanese Tree Lilac	4	15	G	G	None	OH Wires		Yes	Tree
230	SB	Serviceberry	3	10	G	G	None	OH Wires		Yes	Tree
231	SB	Serviceberry	3	8	G	G	None	Sidewalk		Yes	Tree
232	SB	Serviceberry	3	10	G	G	None	OH Wires		Yes	Tree
233	SB	Serviceberry	3	10	F	F	Remove	OH Wires	large trunk scar	Yes	Tree
234	KS	Katsura	3	10	G	F	Prune	None		Yes	Tree
235	SB	Serviceberry	3	10	G	F	Prune	None	droken limd	res	Tree
∠30 227	эв Sr	Serviceberry	2	/ 8	G	G	None	None		Yes	Tree
238	SB	Serviceberry	2	0	G	G	None	None		Yes	Tree
239	SB	Serviceberry	3	3	Р	P	Remove	None	main trunk dead. suckers	Yes	Tree

TreeID	Tree Code	Species_Name	Diameter	Height H	lealth	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
240	SB	Serviceberry	2	8	G	G	Prune	None		Yes	Tree
241	SB	Serviceberry	3	9	G	G	Prune	None		Yes	Tree
242	SB	Serviceberry	3	9	G	G	Prune	None		Yes	Tree
243	SB	Serviceberry	2	7	Р	Р	Remove	None		Yes	Tree
244		Common Lilac	0	10	G	G	None	None		Yes	Shrub
245	IN S	Arbonitzo	10	25	G	G	None	None	start as line	res	Tree
240		Arborvitae	4	15	G	G	None	None	start aa line	NO	Tree
247	MB	Mulberry	4	10	G	D	Remove	OH Wires	end aa mile. 23 trees	No	Tree
240	BHS	Black Hills Spruce	2	5	G	G	None	None		No	Tree
250	BHS	Black Hills Spruce	1	2	G	G	None	None	approx 28	No	Tree
250	HA	Hawthorn	8	12	F	G	None	None		No	Tree
252	AA	Arborvitae	10	9	G	G	None	None		No	Tree
253	AA	Arborvitae	10	9	G	G	None	None		No	Tree
254	AA	Arborvitae	10	9	G	G	None	None		No	Tree
255	AA	Arborvitae	10	9	G	G	None	None	start line	No	Tree
256	AA	Arborvitae	10	9	G	G	None	None	end line 5 trees same	No	Tree
257	NM	Norway Maple	2	8	G	G	None	None		No	Tree
258	CA	Crabapple	0	5	G	F	Prune	None	Brushy and low branching - Future Vision issue - Relocate	Yes	Tree
259	CA	Crabapple	0	6	G	F	Prune	None	Brushy and low branching - Future Vision issue - Relocate	Yes	Tree
260	CA	Crabapple	2	6	G	F	Prune	None	Brushy and low branching - Future Vision issue - Relocate	Yes	Tree
261	CA	Crabapple	0	6	F	G	Prune	None	Brushy and low branching - Future Vision issue - Relocate	Yes	Tree
262	CA	Crabapple	0	4	G	F	Prune	None	Brushy and low branching - Future Vision issue - Relocate	Yes	Tree
263	SH	Shrub	0	7	G	F	Prune	None	Multi-stem Shrub in Terrace	Yes	Shrub
264	EB	Elderberry	0	3	G	G	None	None	Shrub in Terrace	Yes	Shrub
265	BU	Beauty Bush	0	7	G	G	None	None	Shrub in Terrace	Yes	Shrub
266	CA	Crabapple	12	20	G	F	Prune	None		Yes	Tree
267	WA	White Ash	20	50	G	G	None	None	300 rutland	Yes	Tree
268	WA	White Ash	22	50	G	G	None	None	302 rutland	Yes	Tree
269	WA	White Ash	22	50	G	G	None	None	302 rutland	Yes	Tree
270	NM	Norway Maple	22	35	G	G	None	None		Yes	Tree
2/1	SL	Silver Maple	30	50	G	G	Prune	OH Wires		Yes	Tree
272	CA	Crabappie	2	5	G	G	None	None	Multi-Stem 2x1.5"	Yes	Tree
273	CA	Crabappie Silver Maple	2	7	G	F C	None	None	310 Kersch	Yes	Tree
274		Colorado Pluo Spruco	45	25	G	G	None	None	branches 5 hear ground	Yos	Troo
275	BS	Colorado Blue Spruce	18	25	G	G	None	None		Ves	Tree
270	SH	Shruh	0	3	G	G	None	None	Shruh Start Line - Vision issue?	Ves	Shruh
278	SH	Shrub	0	3	G	G	None	None	Shrub Start Line - Vision issue?	Yes	Shrub
279	SH	Shrub	0	2	G	G	None	None	Shrub Start Line - Vision issue?	Yes	Shrub
280	SH	Shrub	0	0	G	G	None	None	Shrub Stop Line - Vision issue?	Yes	Shrub
281	BHS	Black Hills Spruce	15	35	G	G	None	None	Close to Road	Yes	Tree
282	BHS	Black Hills Spruce	6	20	G	G	Remove	None	crowded out - Close to Road	Yes	Tree
283	BHS	Black Hills Spruce	12	35	G	G	None	None	Close to Road	Yes	Tree
284	BHS	Black Hills Spruce	5	25	Р	G	Remove	None	crowded out - Close to Road	Yes	Tree
285	BHS	Black Hills Spruce	12	35	G	G	None	None	Close to Road	Yes	Tree
286	AA	Arborvitae	10	9	G	G	None	None		No	Tree
287	AA	Arborvitae	10	9	G	G	None	None		No	Tree
288	AA	Arborvitae	10	9	G	G	None	None		No	Tree
289	CA	Crabapple	8	16	F	F	Prune	None		No	Tree
290	CA	Crabapple	8	16	G	G	Prune	None	diff. variety	No	Tree
291	CA	Crabapple	8	16	G	G	Prune	None	diff. variety	No	Tree
292	BA	Basswood	18	30	G	F	Prune	None	Prune cross branches	No	Tree
293	BA	Basswood	10	30	G	F	Prune	None	Prune cross branching	No	Tree
294	BA	Basswood	18	30	G	F	Prune	None	Prune cross branches	No	Tree
295	BA	Basswood	18	30	G	F	Prune	None	Prune cross branches	No	Tree
296	SM	Sugar Maple	17	40	G	F	Prune	None		No	Tree
297	SM	Sugar Maple	17	40	G	G	Prune	None		No	Tree
298	SM	Sugar Maple	18	40	G	G	Prune	None		No	Tree
299	RO	Red Oak	20	40	G	G	Prune	None		No	Tree
300	BW		30	65	G	G	None	None		NO	Tree
301	GA	Bod Maple	1/	45	G	G	None	None		NO	Tree
202	GA	Groop Ash	10	40	G	г с	None	None		No	Troo
303	GA	Green Ash	10	40	G	F	None	None		No	Tree
305	GΔ	Green Ash	10	40	G	Ġ	None	None		No	Tree
306	BS	Colorado Blue Spruce	6	40 15	G	G	None	None	Remove weeds	No	Tree
307	MB	Mulberry	5	45	F	P	Remove	None	12 Trees	No	Tree
308	GA	Green Ash	19	50	G	G	None	None		No	Tree
309	GA	Green Ash	17	30	G	F	None	None		No	Tree
310	GA	Green Ash	10	30	G	F	None	None		No	Tree
311	ВК	Buckeye	4	18	F	F	Prune	None	ms 4x2	No	Tree
312	SB	Serviceberry	4	21	F	F	Prune	None	shady	No	Tree
313	HA	Hawthorn	8	25	F	F	None	None	Hawthorn	No	Tree
314	HA	Hawthorn	8	25	G	F	None	None		No	Tree
315	CM	Crimson Maple	4	25	G	G	Protect	None		Yes	Tree
316	GA	Green Ash	13	35	F	F	None	None		No	Tree
317	GA	Green Ash	13	35	G	G	None	None		No	Tree
318	GA	Green Ash	13	35	F	F	None	None		No	Tree
319	MA	Mountain Ash	3	25	F	F	Prune	None	can replace	No	Tree

TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
320	GA	Green Ash	13	35	G	F	None	None		No	Tree
321	AM	Amur Maple	4	15	F	F	Prune	None		Yes	Tree
322	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
323	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
324	JIL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
325	JIL	Japanese Tree Lilac	3	12	G	G	Prune	OH WIres		Yes	Tree
326	JIL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
327	JIL	Japanese Tree Lilac	3	12	G	G	Prune	OH WIres		Yes	Tree
328		Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
329		Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
221		Japanese Tree Lilac	2	12	G	G	Prune			Yos	Troo
331		Japanese Tree Lilac	3	12	G	G	Drune	OH Wires		Ves	Tree
332	ITI	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
333	ITI	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
334	ITI	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
336	ITI	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
337	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
338	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
339	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
340	JTL	Japanese Tree Lilac	3	12	G	G	Prune	OH Wires		Yes	Tree
341	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
342	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
343	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
344	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
345	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
346	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
347	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
348	CA	Crabapple	3	10	G	G	Prune	OH Wires		Yes	Tree
349	CA	Crabapple	3	10	G	G	Prune	OH Wires		Yes	Tree
350	CA	Crabapple	3	10	G	G	Prune	OH Wires		Yes	Tree
351	CA	Crabapple	3	10	G	G	Prune	OH Wires		Yes	Tree
352	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
353	AM	Amur Maple	3	10	G	F	Prune	None		Yes	Tree
354	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
355	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
356	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
357	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
358	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
359	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
360	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
361	JTL	Japanese Tree Lilac	3	15	G	G	Prune	OH Wires		Yes	Tree
362	JIL	Japanese Tree Lilac	3	15	G	G	Prune	OH Wires		Yes	Tree
303	JIL	Japanese Tree Lilac	3	15	G	G	Prune	OH WIres		Yes	Tree
304		Japanese Tree Lilac	3	15	G	G	Prune	OH Wires		Yes	Tree
365	SB	Serviceberry	3	10	G	G	Drune	OH Wires		Ves	Tree
367	SB	Serviceberry	3	10	G	G	Druno	OH Wires		Vec	Tree
368	SB	Serviceberry	3	10	G	G	Prune	OH Wires		Yes	Tree
369	AM	Amur Manle	3	10	F	F	Prune	None		Yes	Tree
370	AM	Amur Maple	3	10	F	F	Prune	None		Yes	Tree
371	AM	Amur Maple	3	10	F	F	Prune	None		Yes	Tree
372	SB	Serviceberry	3	10	F	F	Prune	None		Yes	Tree
373	SB	Serviceberry	3	10	F	F	Prune	None		Yes	Tree
374	CA	Crabapple	3	10	F	F	Prune	None		Yes	Tree
375	CA	Crabapple	3	10	F	F	Prune	None		Yes	Tree
376	SB	Serviceberry	3	10	F	F	Remove	None		Yes	Tree
377	NS	Norway Spruce	38	70	F	F	Prune	None		No	Tree
378	NS	Norway Spruce	32	70	F	F	Prune	None	some dead growth east	No	Tree
379	NS	Norway Spruce	32	70	G	G	None	None		No	Tree
380	NS	Norway Spruce	28	70	G	G	None	None		No	Tree
381	NS	Norway Spruce	38	70	G	G	None	None		No	Tree
382	NS	Norway Spruce	28	70	G	G	Protect	Street	recent driveway cut, roots pruned	No	Tree
383	NS	Norway Spruce	24	70	G	G	Protect	Street	recent driveway cut, roots pruned	No	Tree
384	NS	Norway Spruce	26	80	G	G	Protect	Street		No	Tree
385	NS	Norway Spruce	35	85	G	F	Prune	Street	heavy south 18in branch, heavy regrowth at 40ft, inspect annually	No	Tree
386	NS	Norway Spruce	26	65	G	G	Protect	None	nails/rods in so side, clear adj trees	No	Tree
387	MB	Mulberry	16	35	G	Р	Remove	None	near ns	No	Tree
388	MB	Mulberry	16	35	G	Р	Remove	None	near ns, and pl	No	Tree
389	GA	Green Ash	9	35	F	P	Remove	None	near ns, and pl	No	Tree
390	GA	Green Ash	10	45	F	P	Remove	None	ms 9in x us, and pl	No	Tree
391	BW	Black Walnut	8	20	F	F	Remove	None	under ns	No	Tree
392	MB	Mulberry	22	65	G	G	Protect	Street		No	Tree
393	MB	wulberry	14	40	F	P	Remove	None	near ns	NO	Tree
394	BW	BIACK WAINUT	16	40	F C	۲ ۲	Remove	Hazard	iean, cneck pi	NO	Tree
395	EL NC		3 75	15	G	F	Remove	None	courd stay, ae	NO	Troc
390		Notway Spruce	25	15	G	г р	Pomovo	None	timmer broth than others	No	Troo
397	E1 RY	Elm	5	12	F	۲ P	Remove	None		NO	Troo
300 220	RO	Red Oak	12	33 45	F	F	Prupe	None	ms x 4 select trunk removal	No	Tree
555			10	-5			·······	. tone	no x ij select trunk removu		

TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
400	BO	Bur Oak	11	40	G	F	Prune	None	ms x 3, select trunk removal	No	Tree
401	GA	Green Ash	18	50	G	F	Prune	None	fair cond, many 3-in dia ash nearby	No	Tree
402	GA	Green Ash	6	35	G	G	None	None	fair cond, many 3-6i n dia ash nearby	No	Tree
403	RO	Red Oak	28	6	G	F	Prune	None		No	Tree
404	NS	Norway Spruce	28	80	G	G	Prune	Street		NO	Tree
405	NS	Norway Spruce	26	75	G	G	None	Street		NO	Tree
406	IN S	Norway Spruce	20	75	G	G	Drupo	None	unright branch /loadar 20in	NO	Tree
407	IN S NIS	Norway Spruce	3	75	G	F	Nono	None	upright branch/leader 20in	NO	Tree
408	NS	Norway Spruce	24	70	G	G	None	None		No	Tree
405	NS	Norway Spruce	24	70	G	G	None	None	somebark seem injury to watch	No	Tree
411	BX	Boxelder	12	40	G	F	None	None	ok to keep	No	Tree
412	AA	Arborvitae	40	45	G	G	None	None	ms above 9ft	No	Tree
413	AA	Arborvitae	4	6	G	G	None	None	x2	No	Tree
414	CC	Concolor Fir	24	55	G	G	Protect	None		No	Tree
415	NS	Norway Spruce	26	70	G	F	Prune	None	mult low branches massive, like ccf	No	Tree
416	NS	Norway Spruce	34	70	G	G	None	None		No	Tree
417	NS	Norway Spruce	36	65	Р	Р	Remove	None	cavity at 1.5ft ext 26in into 40in base	No	Tree
418	AA	Arborvitae	12	35	G	F	None	None	ms x5 plus 2nd aa to no 15ft	No	Tree
419	NS	Norway Spruce	26	60	G	Р	None	None	varioud prinings	No	Tree
420	GA	Green Ash	32	55	G	G	Protect	None	ga/wa good form	No	Tree
421	NS	Norway Spruce	22	45	F	Р	Remove	None	cavity at 1.5 ext 8in in, watch	No	Tree
422	NS	Norway Spruce	19	45	F	F	None	None	leaning, watch	No	Tree
423	NS	Norway Spruce	26	55	G	F	None	None	leaning, burrowing, watch	No	Tree
424	NS	Norway Spruce	26	55	P	F	None	None	watch	No	Tree
425	GA	Green Asn	47	55	G	G	Prune	None	old leader to prune, good form	NO	Tree
420		Rior Way Spruce	16	35	G	г с	Romovo	None	mc 16 + 12	No	Troo
427	NS	Norway Spruce	24	40	F	P	Remove	None	watch leans ne cavity and solit starting	No	Tree
429	MB	Mulherry	16	50	F	F	None	None	ok to keep or remove	No	Tree
430	NS	Norway Spruce	44	65	F	P	Remove	None	cav forming west, did not sound firm	No	Tree
431	GA	Green Ash	12	40	G	F	Prune	None	good stems X2	No	Tree
432	NS	Norway Spruce	36	60	F	Р	Prune	None	evaluate removal, 40% live growth	No	Tree
433	BW	Black Walnut	15	50	G	G	Protect	None	plus 12in + 6	No	Tree
434	BW	Black Walnut	6	28	G	G	Protect	None		No	Tree
435	NS	Norway Spruce	18	55	G	G	None	None	edge of woods	No	Tree
436	NS	Norway Spruce	26	60	G	F	None	None		No	Tree
437	NS	Norway Spruce	20	65	G	G	None	None		No	Tree
438	WO	White Oak	20	55	G	F	Protect	None	fl near dump	No	Tree
439	GA	Green Ash	16	50	G	F	Protect	Street	fl near dump	No	Tree
440	BX	Boxelder	18	50	F	F	None	Street	fl near dump,ok to keep	No	Tree
441	EL	Elm Conser Ask	18	50	P	P	Remove	Street	fl near dump,ok to keep	No	Tree
442	GA	Green Asn	20	50	F	F	None	Street	fi near dump,ok to keep	NO	Tree
445		Plack Walput	20	30	G	г с	Protect	Nono	fl noar dump	No	Troo
444	FI	Elm	17	45 50	G F	F	Prune	None	cem ext_try to clean up	No	Tree
445	BX	Boxelder	8	30	F	P	Remove	None	fl	No	Tree
447	WS	White Spruce	0	1	G	G	None	None	Seelding - Nurserv Stock	No	Tree
448	WS	White Spruce	0	1	G	G	None	None	Seelding - Nursery Stock	No	Tree
449	WS	White Spruce	0	1	G	G	None	None	Seelding - Nursery Stock	No	Tree
450	SM	Sugar Maple	0	1	G	G	None	None	Seelding - Nursery Stock	No	Tree
451	SM	Sugar Maple	0	1	G	G	None	None	Seelding - Nursery Stock	No	Tree
452	SM	Sugar Maple	0	1	G	G	None	None	Seelding - Nursery Stock	No	Tree
453	NS	Norway Spruce	28	65	G	G	None	None		No	Tree
454	SM	Sugar Maple	16	35	G	F	None	None	top heavy branching at 10ft	No	Tree
455	RO	Red Oak	18	55	G	F	Protect	Street		No	Tree
456	RO	Red Oak	24	55	G	G	Prune	Street	maybe private	No	Tree
457	BW	Black Walnut	11	38	G	G	None	None	fl	No	Tree
458	GA	Green Ash	21	40	G	G	Protect	None	watch	NO	Tree
459	SM	Sugar Maple	30	50	F	F	Prune	None	watch, prune or remove	NO No	Tree
460	SIVI	Sugar Maple	24	50	+ -	F	Prune	None	watch,prune or remove	NO No	Tree
401	וע	Sugar iviapie	3U 2	5U 20	r G	r C	None	None	Skuling	NO	Troo
402	BC	Black Cherry	5 ДQ	20 60	F	G F	None	None	watch prupe or remove	No	Tree
464	GA	Green Ash	36	65	Ġ	F	Remove	OH Wires	at powline, watch, prune or remove	Yes	Tree
465	MR	Mulberry	8	30	G	F	Remove	OH Wires	as portane, water, prone or remove	Yes	Tree
466	BW	Black Walnut	16	38	F	F	Remove	OH Wires		Yes	Tree
467	AM	Amur Maple	3	11	F	F	Prune	None		Yes	Tree
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TreeID	Tree Code	Species_Name	Diameter	Height	Health	Structure	Action	Site_Issue	Comment1	Street_Tree	Feat_Name
468	AM	Amur Maple	3	11	F	F	Prune	None	minor cleanup	Yes	Tree
469	BS	Colorado Blue Spruce	1	3	G	G	Protect	None	mulch	Yes	Tree
470	BS	Colorado Blue Spruce	1	3	G	G	Protect	None	mulch	Yes	Tree
471	BS	Colorado Blue Spruce	1	3	G	G	Protect	None	mulch	Yes	Tree
472	NS	Norway Spruce	19	65	F	F	Prune	Hazard	shot taken 50 w	No	Tree
473	NS	Norway Spruce	24	65	G	G	None	Hazard	shot taken 50 w	No	Tree
474	NS	Norway Spruce	18	60	F	F	Remove	None	shot taken 50 w	No	Tree
475	NS	Norway Spruce	20	60	G	G	Protect	None		No	Tree
476	NS	Norway Spruce	20	60	G	G	None	None		No	Tree
477	NS	Norway Spruce	24	65	G	G	None	None		No	Tree
478	NS	Norway Spruce	22	65	G	G	None	None		No	Tree
479	NS	Norway Spruce	19	65	F	F	Prune	None	prune, check soundness periodically or remove	No	Tree
480	NS	Norway Spruce	21	65	G	G	None	None		No	Tree
481	NS	Norway Spruce	28	70	G	G	None	None		No	Tree
482	NS	Norway Spruce	25	70	G	G	Prune	None	Ig branch leader to prune?	No	Tree
483	NS	Norway Spruce	21	70	G	G	None	None	minor lower trunck cut to watch	No	Tree
484	NS	Norway Spruce	17	70	G	G	None	None		No	Tree
485	NS	Norway Spruce	24	70	G	G	None	None		No	Tree
486	AA	Arborvitae	8	30	G	G	None	None	ms x3 + 1 aa 10fg n	No	Tree
487	NS	Norway Spruce	20	65	G	G	None	None		No	Tree
488	BC	Black Cherry	18	50	G	F	None	None	remove understory	No	Tree
489	BW	Black Walnut	10	30	G	F	None	None		No	Tree
490	BC	Black Cherry	15	40	G	F	Remove	None	blc x4	No	Tree
491	BW	Black Walnut	17	50	G	G	Protect	None	clear understory	No	Tree
492	SL	Silver Maple	30	38	Р	Р	Remove	None	ms recent prune, some dead	No	Tree
493	BW	Black Walnut	12	40	F	F	Remove	None	ok to stay	No	Tree
494	NS	Norway Spruce	17	50	F	F	Protect	None	14in ro 5ft ne, 24in ga 5ft s	No	Tree
495	BW	Black Walnut	15	50	G	G	Protect	None	edge of woods	No	Tree
496	GA	Green Ash	11	40	G	F	Protect	None	edge of woods	No	Tree
497	BW	Black Walnut	1	45	G	F	Protect	None	edge of woods	No	Tree
498	EL	Elm	11	4	G	F	Protect	None	edge of woods	No	Tree
499	BW	Black Walnut	15	45	G	G	Protect	None	edge of woods	No	Tree
500	QA	Quaking Aspen	11	38	F	F	Prune	None	edge of woods	No	Tree
501	BC	Black Cherry	15	45	F	F	None	None	ms x2 at 3ft	No	Tree
502	RM	Red Maple	3	15	G	G	None	None	Freemanii (Sienna Glen)	No	Tree
503	HL	Honey Locust	3	15	G	G	None	None		No	Tree
504	RM	Red Maple	3	15	G	G	None	None	Freemanii (Sienna Glen)	No	Tree
505	HL	Honey Locust	3	15	G	G	None	None		No	Tree
506	RM	Red Maple	3	15	G	G	None	None	Freemanii (Sienna Glen)	No	Tree
507	SM	Sugar Maple	24	55	F	F	Protect	None		No	Tree
508	SM	Sugar Maple	32	60	F	F	Protect	None		No	Tree
509	SM	Sugar Maple	34	60	F	F	Protect	None		No	Tree
510	SM	Sugar Maple	37	66	F	F	Protect	None		NO	Tree
511	SIVI	Sugar Maple	32	60	F	G	Protect	None		NO	Tree
512	SIVI	Sugar Maple	8	25	G	F	Protect	None		NO	Tree
513	CA	Crabappie	16	30	F	G	Prune	None		NO No	Tree
514	CA	Crabapple	16	30	G	G	Prune	None		NO	Tree
515	CA	Crabappie	10	30	G	G	Prune	None		INO No	Tree
510	CA	ставарріе	18	30	G	G	rrune	None		NÖ	rree