

2014 Urban Forest Management Plan

Fredericksburg, Iowa

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Community Tree Inventory

Fredericksburg, Iowa

Summary

This plan was developed to assist the City of Fredericksburg with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (does not include mountain ash). There is a strong possibility that 22% of Fredericksburg's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory & Results

In 2014, a tree inventory was conducted using Global Positioning System (GPS) data collectors. --The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. The inventory was a complete inventory of street and park trees. Below are some key findings of the **562 trees inventoried**.

Inventory Overview

- ◆ Fredericksburg's trees provide \$99,874 of benefits annually, an average of \$178 a tree
- ◆ There are over 43 species of trees
- ◆ The top three genus are: Maple 35.6%, Ash 22% Apple 11.2%
- ◆ 41.75% of trees are in need of some type of management
- ◆ 28 trees are recommended for removal.

General Recommendations

The following are key recommendations from the inventory:

- ◆ Of the 28 trees needing removal, **19 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately**. Of the 28 removals, 18 are ash trees.
**City ownership of the trees recommended for removal should be verified prior to any removal*
- ◆ After the removal of the 28 critical concern trees, ash trees in poor health should be assessed for removal.
- ◆ 37 of the 124 ash trees should be re-evaluated at a later date, because they are displaying signs and symptoms associated with EAB.
- ◆ All trees should be pruned on a routine schedule - one third of the city every other year.
- ◆ Plant a diverse mix of trees that does NOT include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.
- ◆ Check ash trees with a visual survey yearly

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: **location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition.** Additionally, signs and symptoms of EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and woodpecker damage.

Detailed Inventory Results

The data collected for the 562 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

1. Annual Energy Benefits: Trees conserve energy by shading buildings and blocking winds. Fredericksburg's trees reduce energy related costs by approximately \$27,069 annually. These savings are both in Electricity (127.89 MWh) and in Natural Gas (17,716 Therms).

2. Annual Stormwater Benefits: Fredericksburg's trees intercept about 1,492,433 gallons of rainfall or snowmelt a year. This interception provides \$40,445 of benefits to the city.

3. Annual Air Quality Benefits: Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic matter (ozone). In Fredericksburg, it is estimated that trees remove 1,722 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$4,890.

4. Annual Carbon Benefits: Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Fredericksburg trees sequester about 459,948 lbs of carbon dioxide (CO₂) a year with an associated value of \$3,450. In addition, the trees store 6,202,897 lbs of carbon, with a yearly benefit of \$46,522.

5. Annual Aesthetics Benefits: Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Fredericksburg receives \$24,020 in annual social benefits from trees.

Financial Summary of all Benefits: According to the USDA Forest Service i-Tree STRATUM analysis, Fredericksburg's trees provide **\$99,874 of benefits annually**. Benefits of individual trees vary based on size, species, health and location, but **on average each of the 562 trees in Fredericksburg provide approximately \$178 annually**.

Table 1: Annual Benefits of Public Trees

Benefits	Per Tree	Cumulative
Energy	\$48.17	\$27,068.95
CO ₂	\$6.14	\$3,449.61
Air Quality	\$8.70	\$4,889.65
Stormwater	\$71.97	\$40,444.94
Aesthetic/Other	\$42.74	\$24,020.44
Total (\$)	\$177.71	\$99,873.60

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Forest Structure

1. Species & Genus Distribution: Fredericksburg has over 43 different tree species along city streets and parks. The following figures and tables show the distribution of the 13 most common trees by genus and the ten most common species. It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple, and it is recommended that they should not be planted until this percentage can be lowered.

Figure 1: Common Tree Genus by Percentage

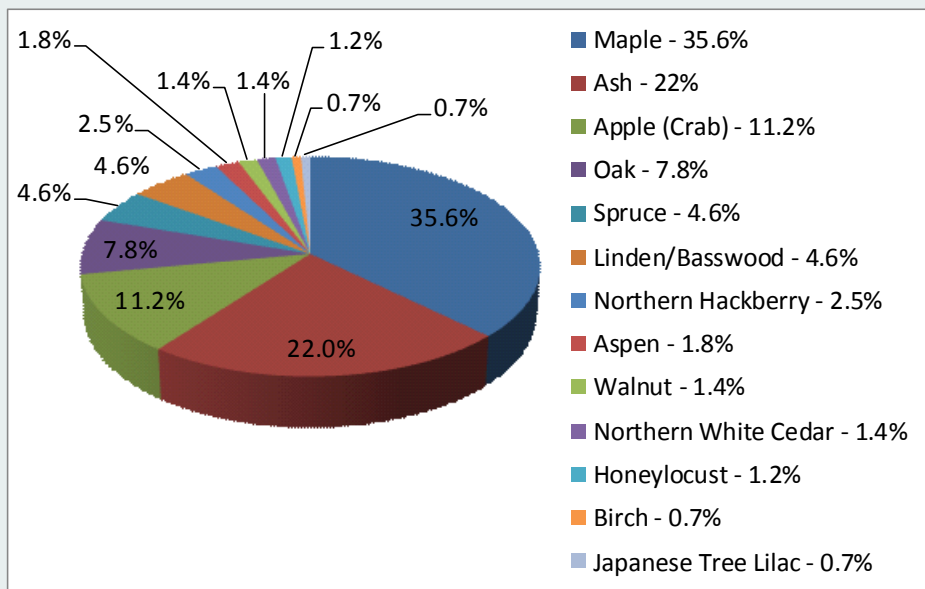
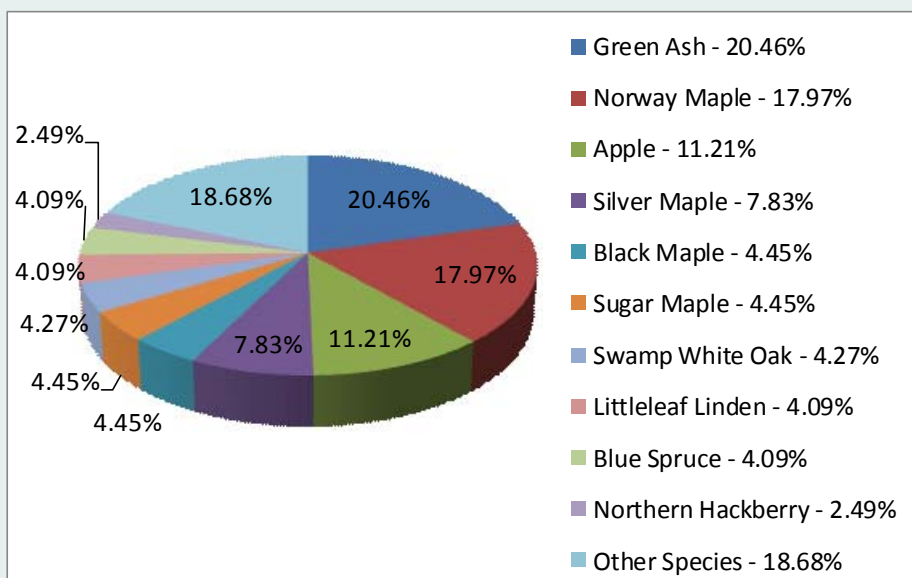


Table 2: Tree Genus

Genus	No. of Trees
Maple	200
Ash	124
Apple (Crab)	63
Oak	44
Spruce	30
Linden/Basswood	26
Northern Hackberry	14
Aspen	10
Walnut	8
Northern White Cedar	8
Honeylocust	7
Birch	4
Japanese Tree Lilac	4

Figure 2: Common Tree Species by Percentage



2. Age Class: Fredericksburg has a good balance of age classes. For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Fredericksburg's size curve is on the smaller side, indicating a younger than average stand. However, the most abundant genus, maple, is older than average.

Figure 3: Age Distribution of Top 10 Public Tree Species (by Percentage)

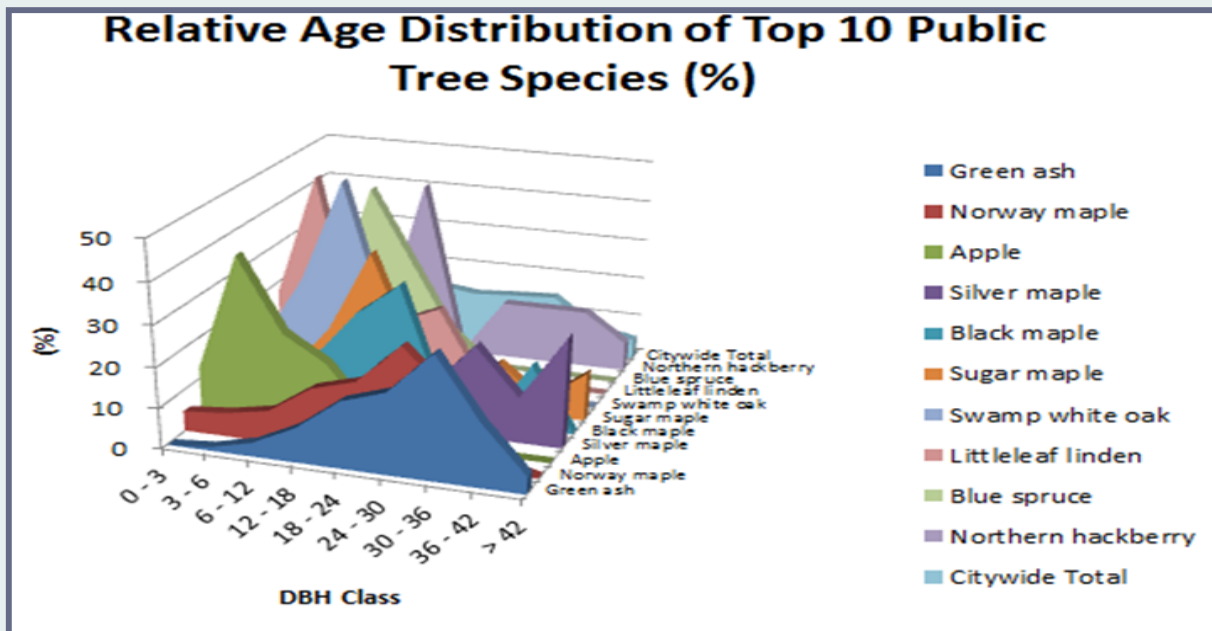


Table 3: Relative Age Distribution

Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	>42
Green ash	0.00	0.87	3.48	8.70	16.52	20.00	30.43	15.65	4.35
Norway maple	4.95	5.94	7.92	14.85	17.82	27.72	17.82	2.97	0.00
Apple	12.70	41.27	23.81	17.46	4.76	0.00	0.00	0.00	0.00
Silver maple	4.55	6.82	4.55	2.27	9.09	11.36	22.73	11.36	27.27
Black maple	0.00	12.00	12.00	24.00	32.00	4.00	0.00	16.00	0.00
Sugar maple	0.00	4.00	16.00	36.00	12.00	4.00	12.00	4.00	12.00
Swamp white oak	8.33	25.00	50.00	16.67	0.00	0.00	0.00	0.00	0.00
Littleleaf linden	17.39	47.83	4.35	13.04	17.39	0.00	0.00	0.00	0.00
Blue spruce	8.70	13.04	43.48	26.09	8.70	0.00	0.00	0.00	0.00
Northern hackberry	0.00	0.00	7.14	42.86	0.00	14.29	14.29	14.29	7.14
Citywide Total	6.76	12.28	13.70	14.41	12.99	13.70	14.23	6.94	4.98

3. Condition:- Wood and Foliage: Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Fredericksburg indicate that 99% of the trees are in fair-good health, with only 1% of the foliage in poor health, dead or dying. Similarly, 89% of Fredericksburg's trees are in fair-good health for wood condition. Wood condition that is in poor health, dead or dying is about 11% of the population. This 11% is an estimate of trees that need management follow up soon.

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4. Management Needs: The following management needs for Fredericksburg’s urban trees are outlined in Table 4. The table outlines the specific management needs of the street and park trees by number of trees and percent of the canopy.

- ◆ Crown cleaning removes dead, diseased, and damaged limbs.
- ◆ Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles.
- ◆ Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years.
- ◆ Tree staking includes staking, training, mulching, etc.

Table 4: Management Needs

Technique	No of Trees	Percentage
Crown Cleaning	148	26.3%
Crown Raising	17	3%
Tree Staking	26	2.1%
Tree Removal	28	5.0%
Crown Reduction	23	4.1%

Table 5: Land Use

Single Family Residential	63.9%
Park/Vacant/Other	27.4%
Industrial/Large Commercial	0%
Small Commercial	8.5%
Multifamily Residential	.2%

Table 6: Location Type

Planting Strip	61.6%
Other Maintained Location (Park)	23.5%
Front Yard	12.1%
Cutout (Surrounded by Pavement)	2.8%

5. Canopy Cover: Fredericksburg occupies 576 acres. The tree canopy cover of Fredericksburg is approximately 15.04 acres, about 2.6%.

6. Land Use and Location: The majority of Fredericksburg’s city and park trees are in planting strips in single family residential neighborhoods. Table 5 & Table 6 describe the land use and locations for the street and park trees.

Recommendations

1. Risk Management: Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist’s vision of pedestrians, vehicles, traffic signs and signals, etc. should be removed.

2. Hazardous Trees: Fredericksburg has 28 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Image 4 & Image 5). It is recommended to start with the large diameter critical concern trees first. There are 19 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the *Six Year Maintenance Plan* at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are a total of 8 trees with these needs.

3. Poor Tree Species: After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Image 3 & Appendix B, Image 4). Of the 28 removals, 18 are ash trees. There are a total of 124 ash trees, and 25 of those have signs and symptoms that

have been associated with EAB. In addition, there are 21 trees that are in poor health. * *City ownership of the trees recommended for removal should be verified prior to any removal.*

4. Pruning Cycle: Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the *Six-Year Maintenance Plan* for further information.

5. Planting: Most of the planting over the next 5 years will replace the trees that are removed. **It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%.** It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Fredericksburg.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (35.6%). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut. All trees planted must meet the restrictions in the city tree ordinance.

The importance of species diversity was brought to the forefront with the loss of the American elm from Dutch elm disease. When one genus (Maple) makes up a majority of the species (Norway Maple, Silver Maple, Sugar Maple) in a planting it is an unbalanced population. These unbalanced populations leave the population open to destruction from diseases and pests. Unfortunately, the lessons of the American elm are only recently being heeded. Communities typically replaced lost elms with a small but reliable selection of ash and Norway and silver maple. This left cities in the predicament they are finding themselves in now as they stand to lose a large percentage of their ash trees to the emerald ash borer.

6. Continual Monitoring: It is important to continuously check the health of all trees. Due to the imminent threat of Emerald Ash Borer to ash trees, it is recommended that trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage. For a list of forest health threats, please visit the Iowa DNR's website at <http://www.iowadnr.gov/Environment/Forestry/ForestHealth>

Six Year Maintenance Plan with No Additional Funding

Year 1: Removal: 19 largest critical concern trees (includes 16 ash) or saving for ash tree treatment

Planting and Replacement: 23 trees to be planted in open locations

Visual Survey for signs and symptoms of EAB

Year 2: Removal: Remaining 9 critical concern trees of all species plus 10 ash or saving for ash tree treatment

Planting and Replacement: 22 trees in open locations from year one removals

Routine pruning: 1/3 of trees (187)

Visual Survey for signs and symptoms of EAB

Year 3: Removal: 19 ash in poor health or saving for ash tree treatment

Planting and Replacement: 23 trees to be planted in open locations and locations from previous removals

Visual Survey for signs and symptoms of EAB

Year 4: Removal: any new critical concern trees and/or 19 ash or saving for ash tree treatment

Planting and Replacement: 23 trees in open locations from previous removals

Routine pruning: 1/3 of trees (187)

Visual Survey for signs and symptoms of EAB

Year 5: Removal: 19 trees - new critical concern trees and/or ash in poor health, or saving for ash tree treatment

Planting and Replacement: 23 trees to be planted in open locations and locations from previous removals

Visual Survey for signs and symptoms of EAB

Year 6: Removal: 19 trees - new critical concern trees and/or ash in poor health, or saving for ash tree treatment

Planting and Replacement: 23 trees in open locations from previous removals

Routine pruning: 1/3 of trees (187)

Visual Survey for signs and symptoms of EAB

Reduction of ash over 6 years: Approximately 104 ash trees removed (approximately 45% of ash). It will take approximately 13 years to remove all ash with the proposed budget. EAB could potentially kill all ash within 4 years of its arrival. **** To remove all ash trees within 6 years and do nothing else, the budget would need to be increased to \$26,700 a year.**

Emerald Ash Borer Plan

1. Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first. Next will be all ash in poor condition and displaying signs and symptoms of EAB. ***City ownership of the tree recommended for removal should be verified prior to any removal.**

2. Treatment of Ash Trees

Chemical treatment can be effective, spreading removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit <http://extension.entm.purdue.edu/treecomputer/>

3. EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- ◆ nursery stock and green lumber of ash
- ◆ any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

4. Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees. Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml.

5. Canopy Replacement

As budget permits, all removed ash trees will be replaced. All trees will meet the restrictions in the city ordinance. The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

6. Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genus other than ash will be prioritized by hazardous or emergency situations only.



Emerald Ash Borer Beetle next to D-shaped exit holes.

Community Tree Inventory

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7. Monitoring (repeated)

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy die-back, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

8. Private Ash Trees

It is strongly recommended that private property owners start removing ash trees or treating healthy trees they desire to preserve on their property upon arrival of EAB or confirmed within 15 miles. Refer to City Tree Ordinance at the end of the report.

Proposed Budget

Total \$105,555 over 6 years (\$17,590/year)

FY 2015 Budget

Removal @ \$700/tree: \$13,300 *Or saving for ash tree treatment

Planting @ \$100/tree: \$2,200

Watering & Maintenance @ \$50/tree: \$1,100

FY 2016 Budget

Removal: \$13,300 *Or saving for ash tree treatment

Planting: \$2,200

Watering & Maintenance: \$1,100

Routine Pruning @ \$9/tree: \$1,685

FY 2017 Budget

Removal: \$13,300 *Or saving for ash tree treatment

Planting: \$2,200

Watering & Maintenance: \$1,100

FY 2018 Budget

Removal: \$13,300 *Or saving for ash tree treatment

Planting: \$2,200

Watering & Maintenance: \$1,100

Routine Pruning: \$1,685

FY 2019 Budget

Removal: \$13,300 *Or saving for ash tree treatment

Planting: \$2,200

Watering & Maintenance: \$1,100

FY 2020 Budget

Removal: \$13,300 *Or saving for ash tree treatment

Planting: \$2,200

Watering & Maintenance: \$1,100

Routine Pruning: \$1,685

*Reduction of ash over 6 years: 104 ash trees removed (45% of ash). **It will take approximately 13 years to remove all ash with the current budget.**

Proposed Budget Increase

EAB could potentially kill all ash trees in Fredericksburg within 4 years of its arrival. To remove all ash trees and do nothing else within 6 years the budget would need to be increased to \$26,700 a year. Additionally, it is recommended that Fredericksburg apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species									
Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	39.19	2,974.43	5,386.22	5,278.50	8,252.93	(N/A)	20.46	30.49	71.76
Norway maple	25.08	1,903.47	3,653.90	3,580.82	5,484.29	(N/A)	17.97	20.26	54.30
Apple	4.34	329.05	662.37	649.12	978.17	(N/A)	11.21	3.61	15.53
Silver maple	14.54	1,103.78	1,930.46	1,891.85	2,995.64	(N/A)	7.83	11.07	68.08
Black maple	5.68	430.93	764.22	748.94	1,179.87	(N/A)	4.45	4.36	47.19
Sugar maple	6.54	496.12	839.12	822.33	1,318.46	(N/A)	4.45	4.87	52.74
Swamp white oak	2.44	185.15	358.92	351.74	536.89	(N/A)	4.27	1.98	22.37
Littleleaf linden	1.88	142.84	264.41	259.12	401.96	(N/A)	4.09	1.48	17.48
Blue spruce	1.77	134.40	249.07	244.09	378.48	(N/A)	4.09	1.40	16.46
Northern hackberry	4.83	366.24	650.58	637.57	1,003.81	(N/A)	2.49	3.71	71.70
Northern red oak	1.41	107.17	196.44	192.51	299.68	(N/A)	2.31	1.11	23.05
Quaking aspen	3.47	263.17	489.05	479.27	742.43	(N/A)	1.78	2.74	74.24
White ash	2.76	209.11	339.09	332.31	541.41	(N/A)	1.60	2.00	60.16
Black walnut	3.18	241.46	435.81	427.10	668.56	(N/A)	1.42	2.47	83.57
Northern white cedar	0.97	73.29	129.39	126.80	200.08	(N/A)	1.42	0.74	25.01
Honeylocust	1.76	133.34	225.40	220.89	354.23	(N/A)	1.25	1.31	50.60
Norway spruce	0.60	45.27	81.45	79.82	125.08	(N/A)	1.25	0.46	17.87
American elm	0.84	63.41	114.51	112.22	175.63	(N/A)	1.07	0.65	29.27
Japanese tree lilac	0.37	28.07	61.08	59.86	87.93	(N/A)	0.71	0.32	21.98
White oak	0.83	62.71	105.82	103.70	166.41	(N/A)	0.71	0.61	41.60
Other city Trees	5.45	413.79	778.78	763.20	1,176.99	(N/A)	5.16	4.35	35.06
Total	127.89	9,707.19	17,716.08	17,361.76	27,068.95	(N/A)	100.00	100.00	48.17

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species						
Species	Total Rainfall Interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	515,833.03	13,979.08	(N/A)	20.46	34.56	121.56
Norway maple	255,941.35	6,936.01	(N/A)	17.97	17.15	68.67
Apple	16,666.01	451.65	(N/A)	11.21	1.12	7.17
Silver maple	229,091.87	6,208.39	(N/A)	7.83	15.35	141.10
Black maple	49,181.62	1,332.82	(N/A)	4.45	3.30	53.31
Sugar maple	70,146.93	1,900.98	(N/A)	4.45	4.70	76.04
Swamp white oak	13,668.53	370.42	(N/A)	4.27	0.92	15.43
Littleleaf linden	14,762.41	400.06	(N/A)	4.09	0.99	17.39
Blue spruce	22,290.60	604.08	(N/A)	4.09	1.49	26.26
Northern hackberry	45,863.04	1,242.89	(N/A)	2.49	3.07	88.78
Northern red oak	9,693.34	262.69	(N/A)	2.31	0.65	20.21
Quaking aspen	44,072.26	1,194.36	(N/A)	1.78	2.95	119.44
White ash	31,616.93	856.82	(N/A)	1.60	2.12	95.20
Black walnut	46,074.25	1,248.61	(N/A)	1.42	3.09	156.08
Northern white cedar	21,183.53	574.07	(N/A)	1.42	1.42	71.76
Honeylocust	20,334.88	551.08	(N/A)	1.25	1.36	78.73
Norway spruce	8,045.76	218.04	(N/A)	1.25	0.54	31.15
American elm	9,115.31	247.02	(N/A)	1.07	0.61	41.17
Japanese tree lilac	1,771.67	48.01	(N/A)	0.71	0.12	12.00
Other City Trees	67,080.09	1,817.87	(N/A)	5.87	4.49	44.47
Citywide total	1,492,433.39	40,444.94	(N/A)	100.00	100.00	71.97

Table 3: Annual Air Quality Benefits & Table 4: Annual Carbon Sequestered

Annual Air Quality Benefits of Public Trees by Species																	
Species	Deposition			Total			Avoided			Total Avoided			BVOC		Standard Error	Avg. \$/tree	
	O3 (lb)	NO2 (lb)	PM10 (lb)	SO2 (lb)	Deposition (\$)	NO2 (lb)	PM10 (lb)	VOC (lb)	SO2 (lb)	SO2 (lb)	Emissions (lb)	Emissions (\$)	Total (\$)	Total (lb)			
Green ash	74.17	11.86	33.89	3.32	390.44	187.33	27.26	25.98	177.59	1,166.36	0.00	0.00	541.40	1,556.79	(N/A)	20.46	13.54
Norway maple	54.94	9.48	26.66	2.43	295.90	121.91	17.60	16.75	113.77	754.35	- 12.65	- 47.46	350.90	1,002.79	(N/A)	17.97	9.93
Apple	4.37	0.72	2.16	0.20	23.56	21.30	3.06	2.90	19.64	131.19	- 0.02	- 0.09	54.34	154.66	(N/A)	11.21	2.45
Silver maple	43.57	7.38	21.02	1.93	233.86	68.70	10.05	9.59	65.77	429.45	- 22.98	- 86.19	205.04	577.13	(N/A)	7.83	13.12
Black maple	11.93	2.03	5.55	0.53	63.49	26.96	3.93	3.75	25.72	168.27	- 3.98	- 14.93	76.42	216.82	(N/A)	4.45	8.67
Sugar maple	10.56	1.80	5.20	0.47	57.02	30.68	4.50	4.30	29.61	192.38	- 0.88	- 31.22	78.80	218.18	(N/A)	4.45	8.73
Swamp white oak	1.59	0.27	0.97	0.07	9.11	11.89	1.72	1.63	11.07	73.53	- 0.48	- 1.82	28.73	80.82	(N/A)	4.27	3.37
Littleleaf linden	2.10	0.36	1.11	0.09	11.58	9.06	1.32	1.25	8.54	56.30	- 1.08	- 4.04	22.77	63.85	(N/A)	4.09	2.78
Blue spruce	2.58	0.51	2.28	0.32	17.48	8.49	1.23	1.17	8.02	52.77	- 7.67	- 28.76	16.94	41.49	(N/A)	4.09	1.80
Northern hackberry	7.80	1.35	3.92	0.35	42.44	22.99	3.35	3.20	21.88	143.37	0.00	0.00	64.85	185.81	(N/A)	2.49	13.27
Northern red oak	1.66	0.29	0.88	0.07	9.17	6.76	0.98	0.94	6.40	42.05	- 2.31	- 8.68	15.66	42.54	(N/A)	2.31	3.27
Quaking aspen	5.84	0.94	2.70	0.26	30.86	16.68	2.42	2.30	15.71	103.61	0.00	0.00	46.87	134.47	(N/A)	1.78	13.45
White ash	5.76	0.92	2.63	0.26	30.29	12.79	1.89	1.81	12.47	80.56	0.00	0.00	38.52	110.85	(N/A)	1.60	12.32
Black walnut	7.27	1.16	3.25	0.33	38.07	15.19	2.21	2.11	14.42	94.63	0.00	0.00	45.94	132.71	(N/A)	1.42	16.59
Northern white cedar	2.52	0.50	2.02	0.31	16.44	4.57	0.67	0.64	4.37	28.57	- 11.27	- 42.27	4.32	2.73	(N/A)	1.42	0.34
Honeylocust	4.01	0.66	1.82	0.18	21.15	8.23	1.21	1.16	7.95	51.64	- 3.19	- 11.98	22.03	60.81	(N/A)	1.25	8.69
Norway spruce	0.84	0.17	0.75	0.10	5.71	2.84	0.41	0.39	2.70	17.70	- 3.02	- 11.34	5.19	12.07	(N/A)	1.25	1.72
American elm	1.46	0.25	0.72	0.06	7.89	3.99	0.58	0.55	3.79	24.86	0.00	0.00	11.41	32.75	(N/A)	1.07	5.46
Japanese tree lilac	0.53	0.09	0.25	0.02	2.82	1.86	0.26	0.25	1.67	11.34	0.00	- 0.01	4.93	14.15	(N/A)	0.71	3.54
White oak	0.51	0.08	0.29	0.02	2.84	3.88	0.57	0.54	3.75	24.33	0.00	0.00	9.64	27.18	(N/A)	0.71	6.79
Other City Trees	114.92	19.49	57.53	5.59	623.80	276.88	40.36	38.50	263.49	1,726.57	- 64.35	- 241.32	752.40	2,109.04	(N/A)	56.41	7.02
Citywide Total	256.82	42.96	124.01	11.91	1,377.98	612.45	89.03	84.86	579.58	3,810.58	- 79.71	- 298.91	1,721.90	4,889.65	(N/A)	100.00	8.70

Annual CO2 Benefits of Public Trees by Species															
Species	Sequestered		Decomposition		Maint. Release		Total Release		Avoided		Net Total		Standard		Avg. \$/tree
	(lb)	(\$)	(lb)	(\$)	(lb)	(\$)	(lb)	(\$)	(lb)	(\$)	(lb)	(\$)	Trees	Total \$	
Green ash	90,003.06	675.02	- 11,803.61	- 428.03	- 3.21	65,734.17	493.01	143,505.60	1,076.29	(N/A)	20.46	31.20	20.46	9.36	
Norway maple	27,001.32	202.51	- 4,359.53	- 280.61	- 2.10	42,066.27	315.50	64,427.46	483.21	(N/A)	17.97	14.01	17.97	4.78	
Apple	7,143.39	53.58	- 345.90	- 63.96	- 0.48	7,271.87	54.54	14,005.40	105.04	(N/A)	11.21	3.04	11.21	1.67	
Silver maple	70,656.56	529.92	- 5,139.97	- 173.36	- 0.39	24,393.32	182.95	89,736.56	673.02	(N/A)	7.83	19.51	7.83	15.30	
Black maple	10,897.97	81.73	- 619.16	- 52.46	- 0.39	9,523.44	71.43	19,749.80	148.12	(N/A)	4.45	4.29	4.45	5.92	
Sugar maple	14,820.38	111.15	- 1,529.53	- 70.01	- 0.53	10,964.15	82.23	24,185.00	181.39	(N/A)	4.45	5.26	4.45	7.26	
Swamp white oak	4,815.69	36.12	- 143.74	- 25.74	- 0.19	4,091.82	30.69	8,738.03	65.54	(N/A)	4.27	1.90	4.27	2.73	
Littleleaf linden	5,651.50	42.39	- 231.29	- 25.16	- 0.19	3,156.68	23.68	8,551.74	64.14	(N/A)	4.09	1.86	4.09	2.79	
Blue spruce	1,264.07	9.48	- 72.05	- 31.01	- 0.23	2,970.15	22.28	4,131.16	30.98	(N/A)	4.09	0.90	4.09	1.35	
Northern hackberry	5,671.28	42.53	- 593.13	- 44.46	- 0.33	8,093.87	60.70	13,127.56	98.46	(N/A)	2.49	2.85	2.49	7.03	
Northern red oak	2,225.31	16.69	- 143.22	- 16.97	- 0.13	2,368.37	17.76	4,433.51	33.25	(N/A)	2.31	0.96	2.31	2.56	
Quaking aspen	8,876.89	66.58	- 903.55	- 37.44	- 0.28	5,815.90	43.62	13,751.80	103.14	(N/A)	1.78	2.99	1.78	10.31	
White ash	6,162.29	46.22	- 447.66	- 23.99	- 0.18	4,621.21	34.66	10,311.86	77.34	(N/A)	1.60	2.24	1.60	8.59	
Black walnut	6,895.62	51.72	- 1,170.60	- 35.88	- 0.27	5,336.20	40.02	11,025.34	82.69	(N/A)	1.42	2.40	1.42	10.34	
Northern white cedar	1,012.63	7.59	- 136.13	- 19.11	- 0.14	1,619.60	12.15	2,476.99	18.58	(N/A)	1.42	0.54	1.42	2.32	
Honeylocust	1,981.42	14.86	- 249.90	- 13.26	- 0.10	2,946.71	22.10	4,664.97	34.99	(N/A)	1.25	1.01	1.25	5.00	
Norway spruce	594.34	4.46	- 31.16	- 10.73	- 0.08	1,000.41	7.50	1,552.86	11.65	(N/A)	1.25	0.34	1.25	1.66	
American elm	1,049.65	7.87	- 153.91	- 8.58	- 0.06	1,401.45	10.51	2,288.61	17.16	(N/A)	1.07	0.50	1.07	2.86	
Japanese tree lilac	265.69	1.99	- 41.93	- 6.44	- 0.05	620.27	4.65	837.59	6.28	(N/A)	0.71	0.18	0.71	1.57	
White oak	1,759.16	13.19	- 80.81	- 7.80	- 0.06	1,385.87	10.39	3,056.42	22.92	(N/A)	0.71	0.66	0.71	5.73	
Other City Trees	7,911.84	59.34	- 1,597.79	- 68.64	- 0.51	9,144.66	68.58	15,390.07	115.43	(N/A)	5.16	3.35	5.16	3.37	
Citywide Total	276,660.08	2,074.95	- 29,794.55	- 1,443.60	- 10.83	214,526.40	1,608.95	459,948.34	3,449.61	(N/A)	100.00	100.00	100.00	6.14	

Table 5: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species						
Species	Total stored CO2 (lbs)	Total (\$)	Stand. Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	2,459,085.03	18,443.14	(N/A)	20.46	39.64	160.38
Norway maple	907,305.09	6,804.79	(N/A)	17.97	14.63	67.37
Apple	71,988.32	539.91	(N/A)	11.21	1.16	8.57
Silver maple	1,070,367.32	8,027.75	(N/A)	7.83	17.26	182.45
Black maple	128,991.09	967.43	(N/A)	4.45	2.08	38.70
Sugar maple	318,506.63	2,388.80	(N/A)	4.45	5.13	95.55
Swamp white oak	29,049.14	217.87	(N/A)	4.27	0.47	9.08
Littleleaf linden	46,784.21	350.88	(N/A)	4.09	0.75	15.26
Blue spruce	15,006.79	112.55	(N/A)	4.09	0.24	4.89
Northern hackberry	123,568.98	926.77	(N/A)	2.49	1.99	66.20
Northern red oak	29,811.46	223.59	(N/A)	2.31	0.48	17.20
Quaking aspen	188,238.80	1,411.79	(N/A)	1.78	3.03	141.18
White ash	93,138.09	698.54	(N/A)	1.60	1.50	77.62
Black walnut	243,874.01	1,829.06	(N/A)	1.42	3.93	228.63
Northern white cedar	28,356.52	212.67	(N/A)	1.42	0.46	26.58
Honeylocust	52,044.09	390.33	(N/A)	1.25	0.84	55.76
Norway spruce	6,491.46	48.69	(N/A)	1.25	0.10	6.96
American elm	32,027.95	240.21	(N/A)	1.07	0.52	40.03
Japanese tree lilac	8,736.32	65.52	(N/A)	0.71	0.14	16.38
White oak	16,835.88	126.27	(N/A)	0.71	0.27	31.57
Other City Trees	332,689.64	2,495.17	(N/A)	5.16	5.36	60.50
Citywide total	6,202,896.83	46,521.73	(N/A)	100.00	100.00	82.78

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefit of Public Trees by Species					
Species	Total (\$)	Stand. Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	6,716.10	(N/A)	20.46	27.96	58.40
Norway maple	2,544.02	(N/A)	17.97	10.59	25.19
Apple	406.52	(N/A)	11.21	1.69	6.45
Silver maple	5,134.80	(N/A)	7.83	21.38	116.70
Black maple	1,379.30	(N/A)	4.45	5.74	55.17
Sugar maple	1,516.88	(N/A)	4.45	6.31	60.68
Swamp white oak	554.09	(N/A)	4.27	2.31	23.09
Littleleaf linden	649.11	(N/A)	4.09	2.70	28.22
Blue spruce	449.15	(N/A)	4.09	1.87	19.53
Northern hackberry	772.21	(N/A)	2.49	3.21	55.16
Northern red oak	205.16	(N/A)	2.31	0.85	15.78
Quaking aspen	658.94	(N/A)	1.78	2.74	65.89
White ash	687.33	(N/A)	1.60	2.86	76.37
Black walnut	476.23	(N/A)	1.42	1.98	59.53
Northern white cedar	226.10	(N/A)	1.42	0.94	28.26
Honeylocust	492.38	(N/A)	1.25	2.05	70.34
Norway spruce	164.81	(N/A)	1.25	0.69	23.54
American elm	146.49	(N/A)	1.07	0.61	24.42
Japanese tree lilac	14.86	(N/A)	0.71	0.06	3.72
White oak	177.96	(N/A)	0.71	0.74	44.49
Other City Trees	648.01	(N/A)	5.16	2.70	20.16
Citywide Total	24,020.44	(N/A)	100.00	100.00	42.74

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of Public Trees by Species (\$/tree)						
Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total
Green ash	71.76	9.36	13.54	121.56	58.40	274.62
Norway maple	54.30	4.78	9.93	68.67	25.19	162.87
Apple	15.53	1.67	2.45	7.17	6.45	33.27
Silver maple	68.08	15.30	13.12	141.10	116.70	354.29
Black maple	47.19	5.92	8.67	53.31	55.17	170.28
Sugar maple	52.74	7.26	8.73	76.04	60.68	205.44
Swamp white oak	22.37	2.73	3.37	15.43	23.09	66.99
Littleleaf linden	17.48	2.79	2.78	17.39	28.22	68.66
Blue spruce	16.46	1.35	1.80	26.26	19.53	65.40
Northern hackberry	71.70	7.03	13.27	88.78	55.16	235.94
Northern red oak	23.05	2.56	3.27	20.21	15.78	64.87
Quaking aspen	74.24	10.31	13.45	119.44	65.89	283.33
White ash	60.16	8.59	12.32	95.20	76.37	252.64
Black walnut	83.57	10.34	16.59	156.08	59.53	326.10
Northern white cedar	25.01	2.32	0.34	71.76	28.26	127.70
Honeylocust	50.60	5.00	8.69	78.73	70.34	213.35
Norway spruce	17.87	1.66	1.72	31.15	23.54	75.95
American elm	29.27	2.86	5.46	41.17	24.42	103.18
Japanese tree lilac	21.98	1.57	3.54	12.00	3.72	42.81
White oak	41.60	5.73	6.79	41.53	44.49	140.15
Other City Trees	631.06	60.67	115.84	803.41	362.96	1,973.96
Citywide Total	48.17	6.14	8.70	71.97	42.74	177.71

Figure 1: Species Distribution

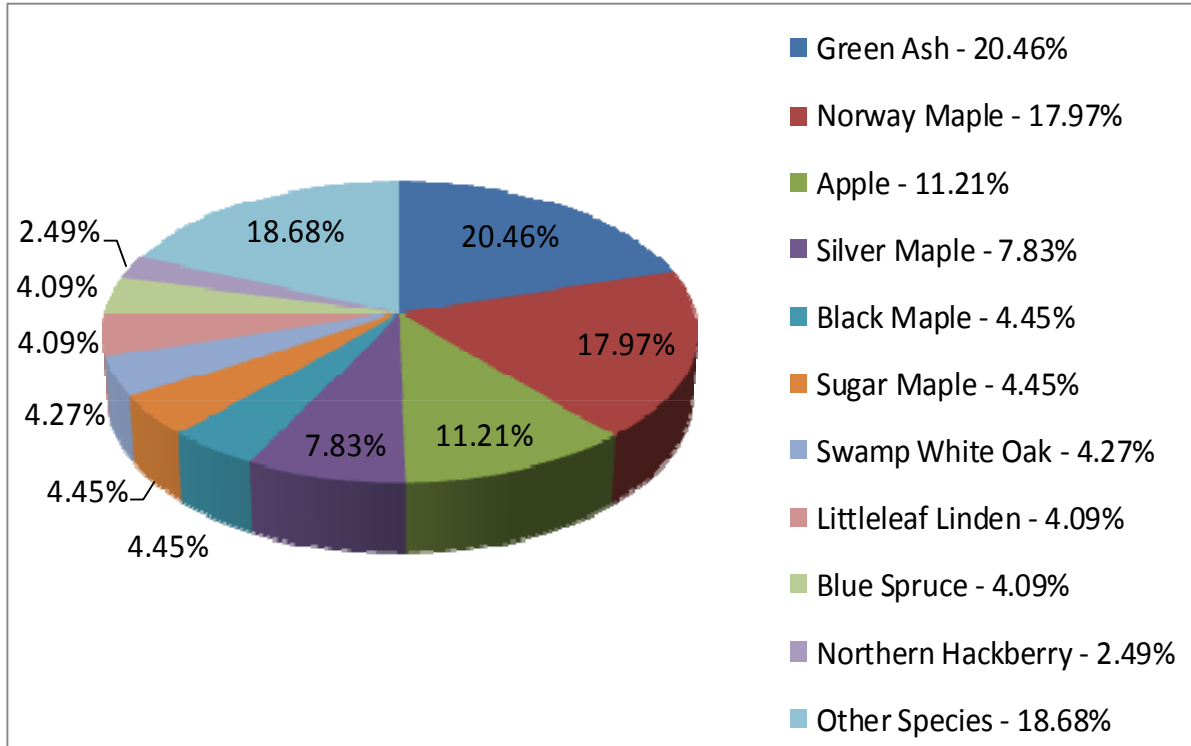


Figure 2: Relative Age Class

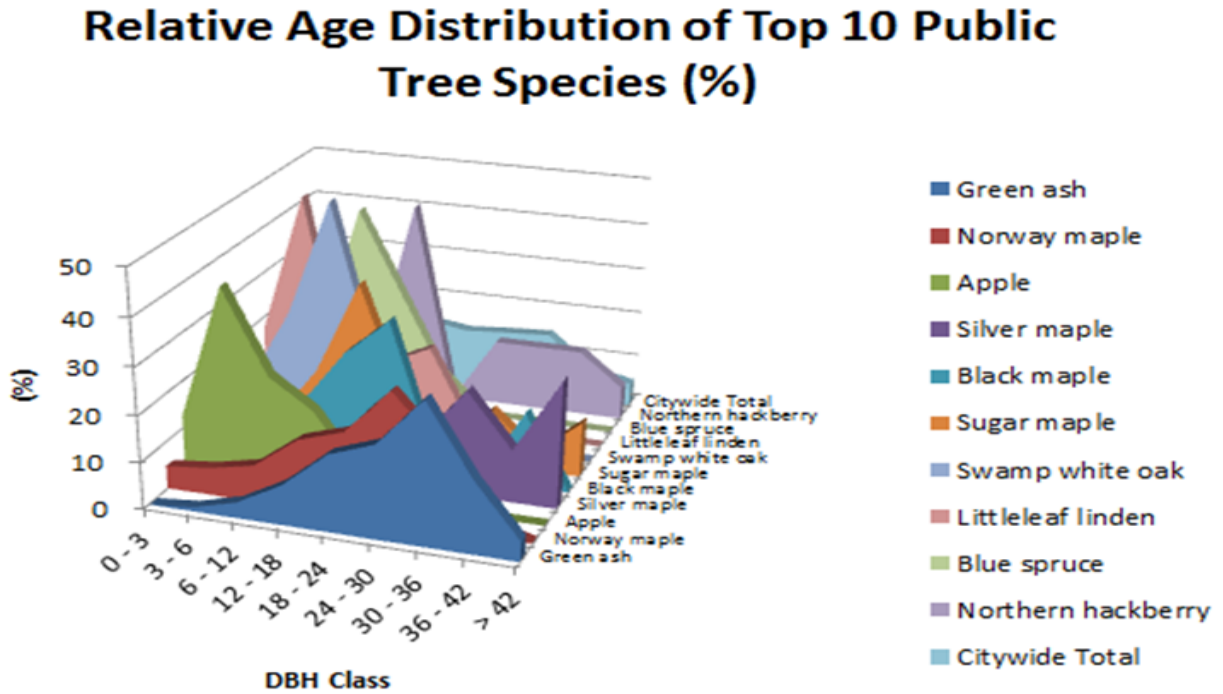


Table 8: Relative Age Class

Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	> 42
Green ash	0.00	0.87	3.48	8.70	16.52	20.00	30.43	15.65	4.35
Norway maple	4.95	5.94	7.92	14.85	17.82	27.72	17.82	2.97	0.00
Apple	12.70	41.27	23.81	17.46	4.76	0.00	0.00	0.00	0.00
Silver maple	4.55	6.82	4.55	2.27	9.09	11.36	22.73	11.36	27.27
Black maple	0.00	12.00	12.00	24.00	32.00	4.00	0.00	16.00	0.00
Sugar maple	0.00	4.00	16.00	36.00	12.00	4.00	12.00	4.00	12.00
Swamp white oak	8.33	25.00	50.00	16.67	0.00	0.00	0.00	0.00	0.00
Littleleaf linden	17.39	47.83	4.35	13.04	17.39	0.00	0.00	0.00	0.00
Blue spruce	8.70	13.04	43.48	26.09	8.70	0.00	0.00	0.00	0.00
Northern hackberry	0.00	0.00	7.14	42.86	0.00	14.29	14.29	14.29	7.14
Citywide Total	6.76	12.28	13.70	14.41	12.99	13.70	14.23	6.94	4.98

Figure 3: Foliage Condition

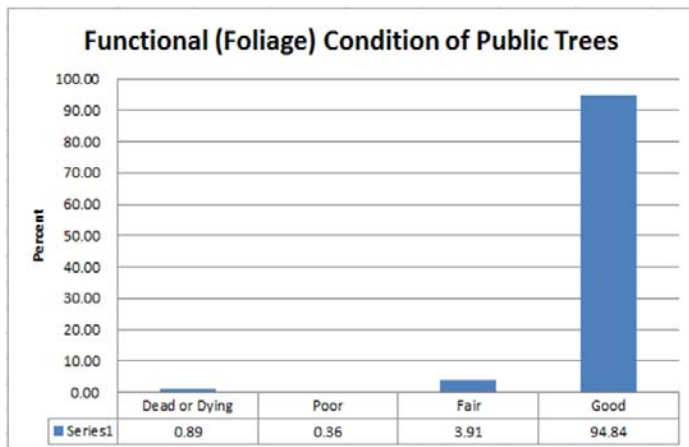


Figure 4: Wood Condition

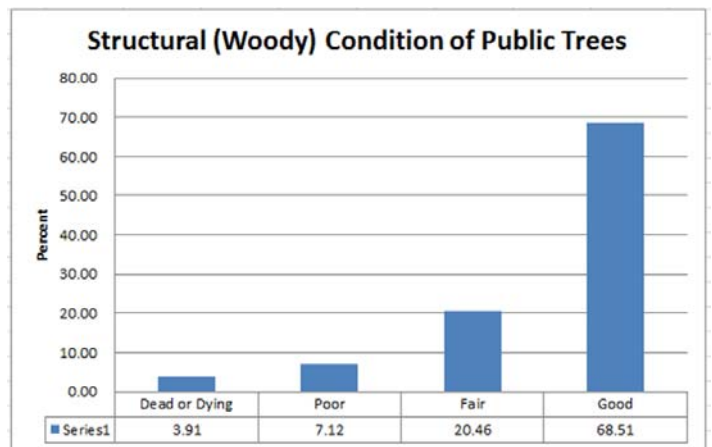


Figure 5: Land Use of City/Park Trees

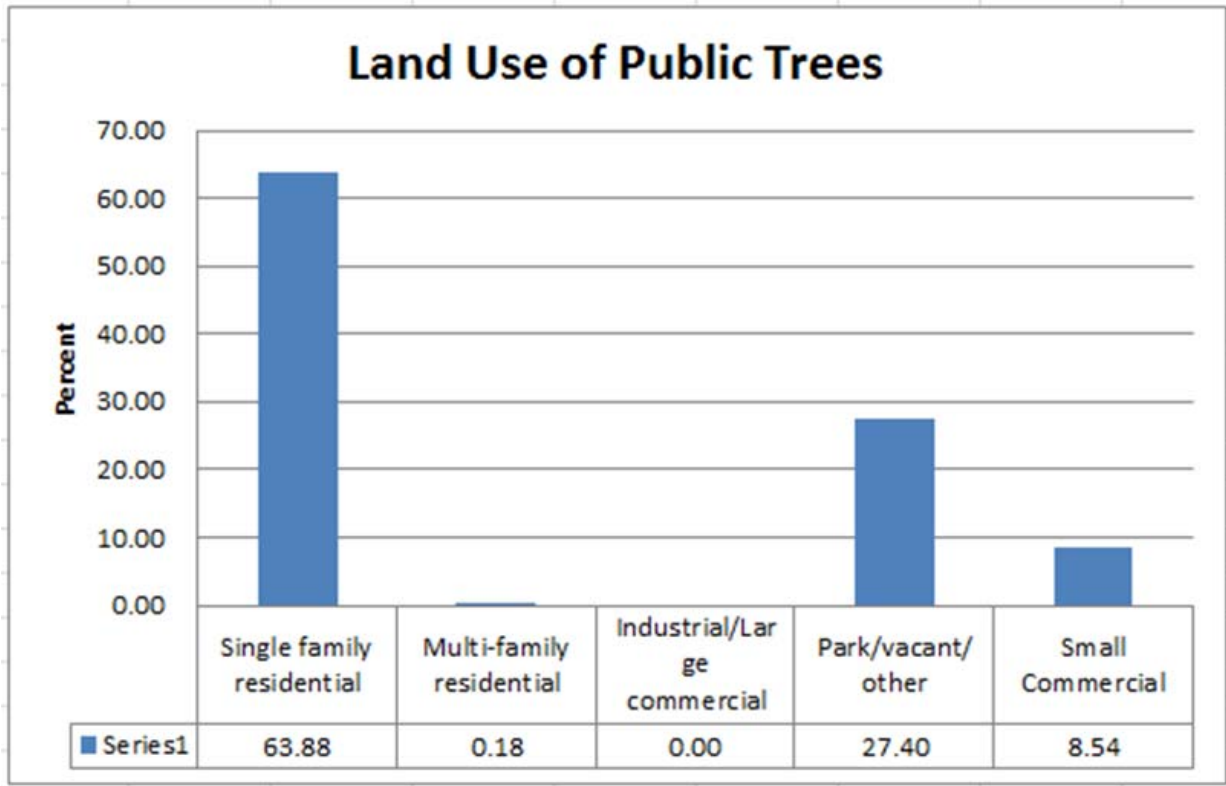
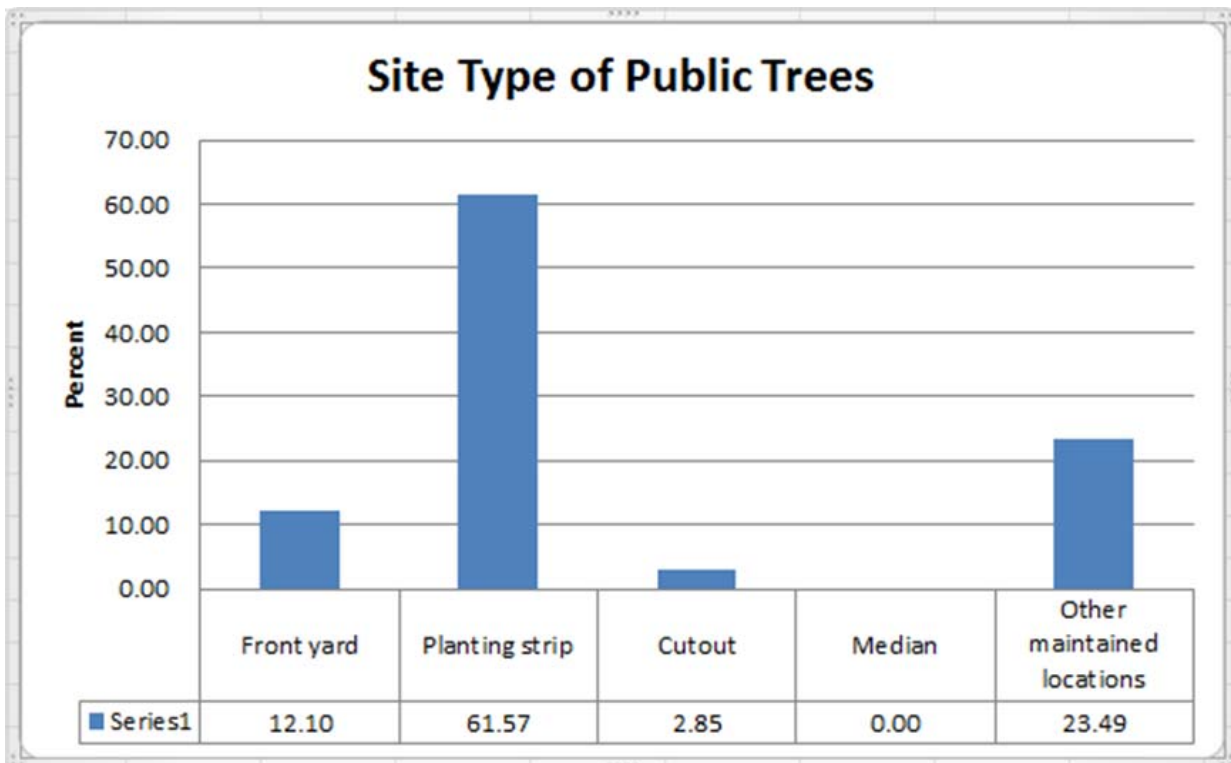


Figure 6: Location of City/Park Trees



Appendix B: ArcGIS Mapping

Image 1: Location of Ash Trees

Image 2: Location of EAB symptoms

Image 3: Location of Poor Condition Ash Trees

Image 4: Location of Trees with Recommended Maintenance

Image 5: Maintenance Tasks * *City ownership of the trees recommended for removal should be verified prior to any removal*



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, and Northeast Iowa RC&D

Image 1. Location of Ash Trees

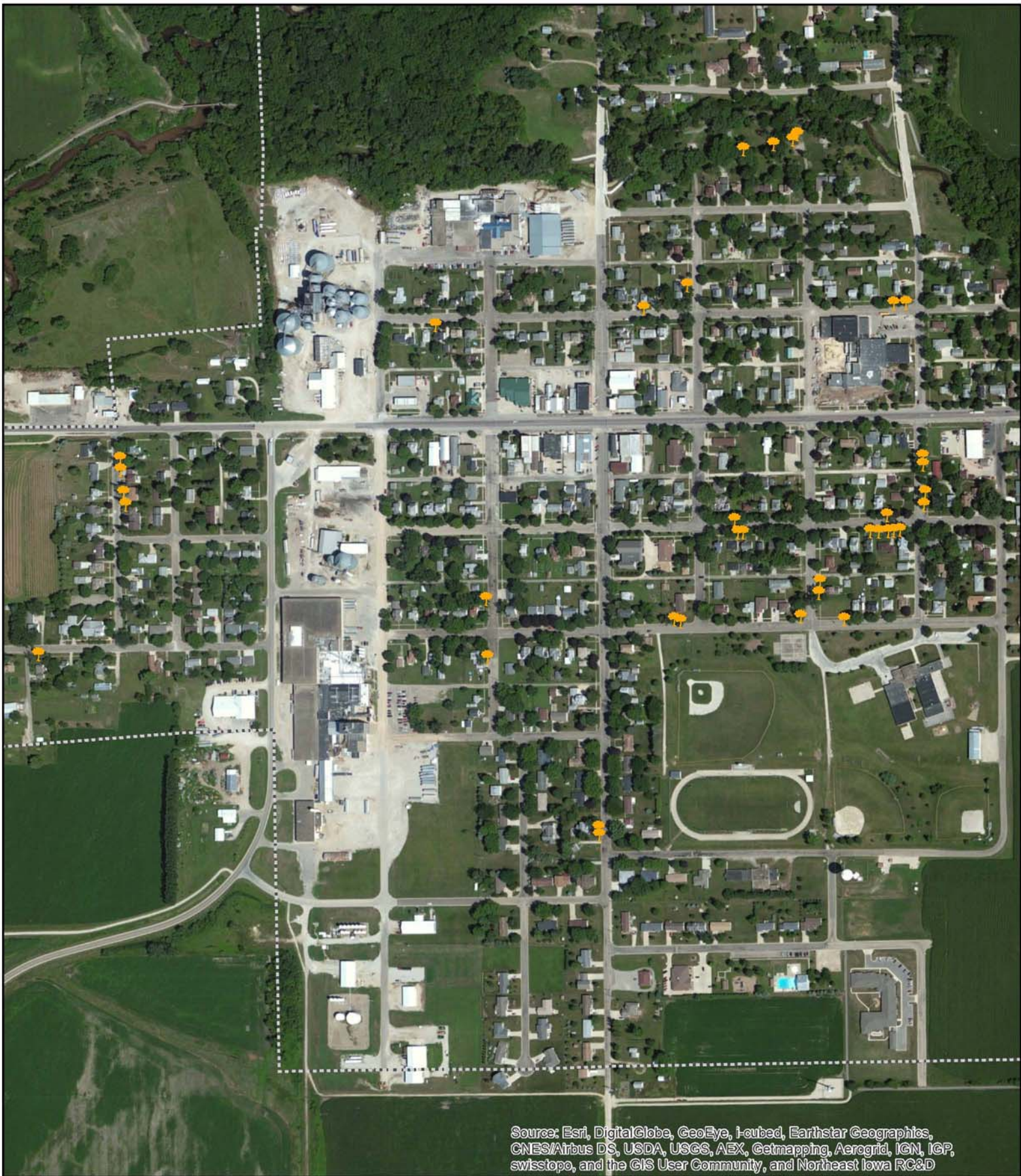
Legend	
	Green ash
	Ash
	White ash
	Black ash

Fredericksburg, Iowa

0 0.05 0.1 0.2
Miles

N
▲


Map created by Northeast Iowa RC&D
11/13/2014



Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, and Northeast Iowa RC&D

Image 2. Location of Trees with One or More Symptoms of EAB
(Canopy Dieback, Epicormic Shoots, Woodpecker Damage, Bark Splitting, or D-Shaped Exit Holes)

Legend

 EAB Symptoms

 City Limits

Fredericksburg, Iowa



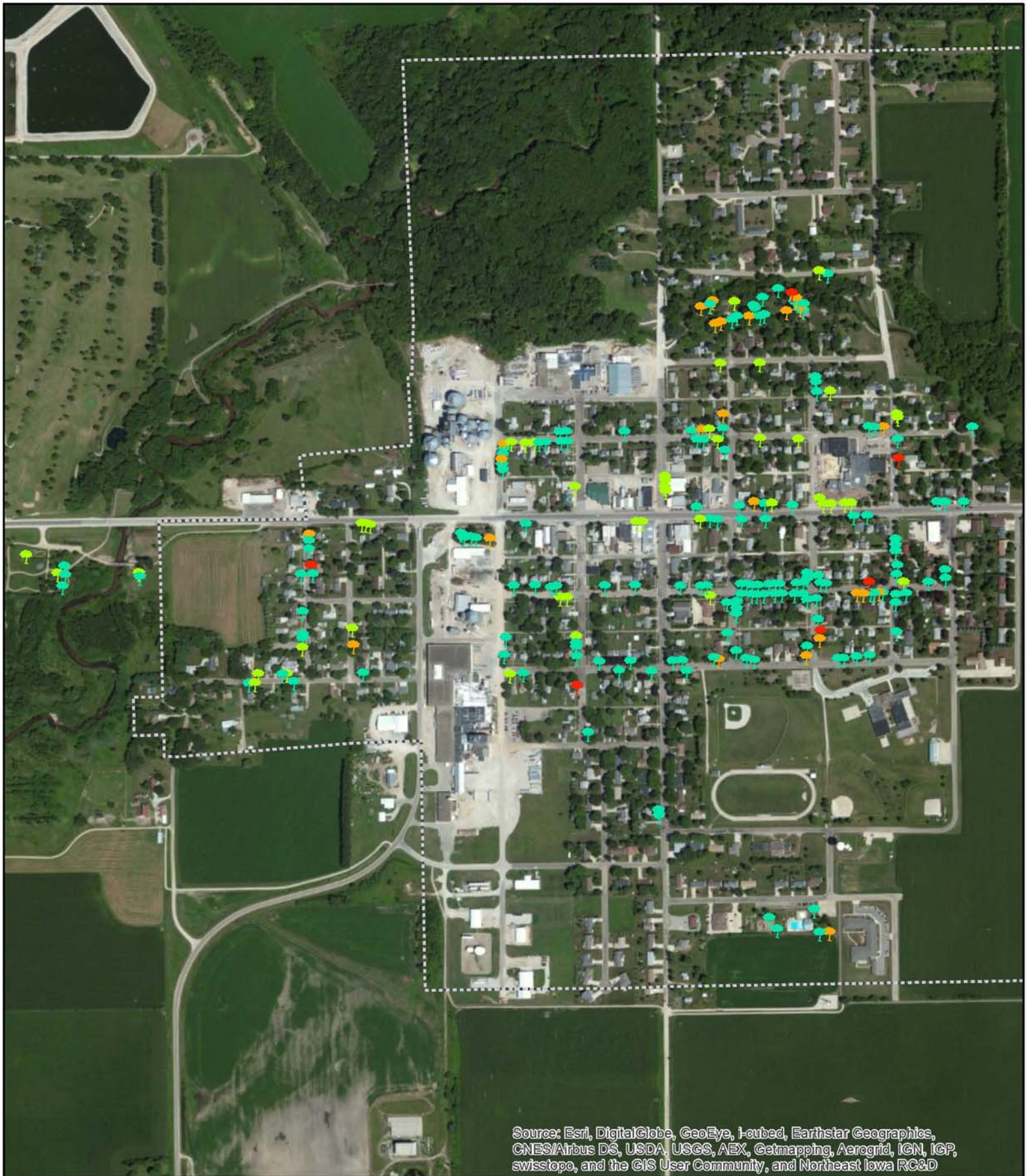
Map created by Northeast Iowa RC&D
11/13/2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, and Northeast Iowa RC&D

Image 3. Location of Poor Condition Ash Trees
(Wood and/or Leaves are Dead/Dying or in Poor Condition)

<p>Legend</p> <p> Dead or Dying  Poor</p>	<p>Fredericksburg, Iowa</p> <p>0 0.05 0.1 0.2 Miles</p> 	<p>N</p>  <p>Map created by Northeast Iowa RC&D 11/13/2014</p>
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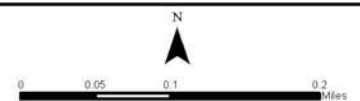
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, and Northeast Iowa RC&D

Image 4. Location of Trees with Recommended Maintenance

Fredericksburg, Iowa

Legend

-  Critical Concern
-  Mature Tree Immediate
-  Mature Tree Routine
-  Young Tree Immediate
-  Young Tree Routine




Map created by Northeast Iowa RC&D
11/13/2014

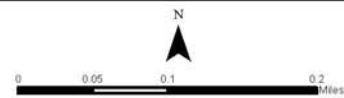


Image 5. Location of Maintenance Tasks

Fredericksburg, Iowa

Legend

-  Clean
-  Raise
-  Reduce
-  Remove*
-  Stake/Train
-  Treat pest/disease



Map created by Northeast Iowa RC&D
11/20/2014

*City owned trees recommended for removal should be verified prior to any removal

Appendix C: Fredericksburg Tree Ordinances

151.01 Definition	151.05 Disease Control
151.02 Planting Restrictions	151.06 Inspection and Removal
151.03 Duty to Trim Trees	151.07 Tree Topping to be Regulated
151.04 Trimming Trees to be Supervised	

151.01 DEFINITION. For use in this chapter, “parking” means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.
3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The City shall keep the trees on or overhanging the street trimmed so that all branches are at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks.

151.04 TRIMMING TREES TO BE SUPERVISED. It is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

(Code of Iowa, Sec. 364.12[3b & h])

151.07 TREE TOPPING TO BE REGULATED. It is unlawful as a normal practice for any person or City department to top any street tree, park tree or other tree on public property. "Topping" is defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree as to remove the normal canopy and disfigure the tree. Trees severely damaged to storms or other causes, or certain trees under utility wires or other obstructions where other pruning practices are impractical, may be exempted from the requirements of this section at the determination of the City Tree Board.

Appendix D: Suitable Shade Tree Lists

Shade Trees for Iowa

This document lists several shade tree selections suitable for the Iowa landscape. Nursery and landscape professionals have eliminated green, white, black, pumpkin, and blue ash from their inventories and designs since they are susceptible to the emerald ash borer, which kills ash trees. This destructive pest has been found in several states in the upper Midwest.

While not all-inclusive, this list does describe many useful species, many which are also pest-resistant. Not all trees appearing on this list will “work” in every landscape situation. Great care must be taken to carefully match trees to sites (including above- and below-ground spatial and environmental constraints) and to complement species existing nearby so that a diverse tree canopy will be maintained. *A healthy and diverse tree population is the best defense against current and future tree pests.*

<u>Deciduous Shade Trees</u>	<u>Height/Width</u>	<u>Growth Habit</u>
Alder		
<u>Manchurian alder</u> – <i>Alnus hirsuta</i> 'Harbin' (Prairie Horizon [®])	40'/30'	Upright
Amur maackia – <i>Maackia amurensis</i>	25'/25'	Upright-spreading
Baldcypresses		
<u>Baldcypress</u> – <i>Taxodium distichum</i> 'Mickelson' (Shawnee Brave [®]) 'JFS-SGPN' (Green Whisper [™])	55'/20' 55'/30'	Narrow-pyramid Pyramidal
Birches		
<u>Asian white birch</u> – <i>Betula platyphylla</i> 'VerDale' (Prairie Vision [®])	35'/30'	Upright-oval
<u>Gray birch</u> – <i>Betula populifolia</i> 'Whitespire Sr.'	40'/25'	Pyramidal-oval
<u>Hybrid birch</u> – <i>Betula</i> × 'Penci-2' (Royal Frost [®])	40'/25'	Pyramidal
<u>River birch</u> – <i>Betula nigra</i> 'Cully' (Heritage [®])	45'/30'	Oval
<u>Whitebarked Himalayan birch</u> – <i>Betula utilis</i> 'Madison' (White Satin [™])	35'/20'	Broadly-pyramidal

	<u>Height/Width</u>	<u>Growth Habit</u>
Coffeetree		
<u>Kentucky coffeetree</u> – <i>Gymnocladus dioica</i>		
'Espresso'	50'/35'	Oval
Cork trees		
<u>Cork tree</u> – <i>Phellodendron</i> species		
'Longenecker' (Eye Stopper™)	40'/35'	Rounded
'His Majesty'	40'/35'	Vase-shaped
Elms		
<u>American elm</u> – <i>Ulmus americana</i>		
'Jefferson'	70'/50'	Vase-shaped
'Princeton'	60'/40'	Vase-shaped
'Lewis & Clark' (Prairie Expedition™)	60'/50'	Umbrella-shaped
'New Harmony'	70'/70'	Vase-shaped
'Valley Forge'	70'/70'	Vase-shaped
<u>Asian Elm Cultivars and Hybrids</u>		
'Morton' (Accolade™)	70'/60'	Vase-shaped
'Morton Glossy' (Triumph™)	55'/45'	Vase-shaped
'New Horizon'	55'/40'	Upright-oval
'Prospector'	40'/30'	Vase-shaped
'Discovery'	50'/40'	Vase-shaped
<u>European and Eurasian Hybrid Elm Cultivars</u>		
'Patriot'	50'/40'	Stiff vase-shaped
Filbert		
Turkish filbert – <i>Corylus colurna</i>	40'/30'	Pyramidal
Gingkoes		
<u>Ginkgo</u> – <i>Ginkgo biloba</i>		
'Autumn Gold'	45'/35'	Broadly-pyramidal
'Halka'	45'/40'	Oval
'Magyar'	60'/40'	Upright-oval
'PNI 2720' (Princeton Sentry®)	40'/15'	Narrow-pyramidal
'JFS-UGA2' (Golden Colonnade®)	45'/25'	Narrow-oval
'The President' (Presidential Gold®)	50'/40'	Broadly-pyramidal

	<u>Height/Width</u>	<u>Growth Habit</u>
Hackberries		
<u>Hackberry</u> – <i>Celtis occidentalis</i>		
'JFS-KSU1' (Prairie Sentinel [™])	45'/12'	Columnar
'Chicagoland'	50'/40'	Broadly-pyramidal
'Prairie Pride'	50'/40'	Oval
Honeylocusts		
<u>Honeylocust</u> – <i>Gleditsia triacanthos</i> var. <i>inermis</i>		
'Draves' (Street Keeper [™])	45'/20'	Narrow-upright
'Harve' (Northern Acclaim [™])	45'/35'	Upright-spreading
'Skycole' (Skyline [®])	50'/35'	Pyramidal
Hornbeams		
<u>European hornbeam</u> – <i>Carpinus betulus</i>		
'JFS-KW1CB' (Emerald Avenue [®])	40'/30'	Broadly-pyramidal
'Windy City'	45'/40'	Upright-spreading
Hophornbeam		
American hophornbeam – <i>Ostrya virginiana</i>		
	40'/25'	Upright-oval
Horsechestnuts		
<u>Common horsechestnut</u> – <i>Aesculus hippocastanum</i>		
'Baumannii'	50'/40'	Broadly-oval
<u>Red horsechestnut</u> – <i>Aesculus</i> × <i>carnea</i>		
'Briotii'	30'/35'	Round
'Fort McNair'	30'/30'	Round
Lindens		
<u>American linden</u> – <i>Tilia americana</i>		
'Boulevard'	60'/30'	Pyramidal
'Continental Appeal'	50'/30'	Narrow-oval
'Wandell' (Legend [®])	40'/30'	Broad-pyramidal
'McKSentry' (American Sentry [®])	45'/30'	Pyramidal
'Lincoln'	35'/25'	Pyramidal
'Redmond'	50'/35'	Pyramidal
<u>Hybrid Linden</u> – <i>Tilia</i> × <i>flavescens</i> (<i>americana</i> × <i>cordata</i>)		
'Glenleven'	50'/30'	Pyramidal

	<u>Height/Width</u>	<u>Growth Habit</u>
<u>Littleleaf linden</u> – <i>Tilia cordata</i>		
'Bailey' (Shamrock [®])	40'/30'	Pyramidal
'Corzam' (Corinthian [®])	45'/15'	Narrow-pyramid
'Ronald' (Norlin [™])	40'/30'	Pyramidal
<u>Mongolian linden</u> – <i>Tilia mongolica</i>		
'Harvest Gold'	30-40'/25-30'	Upright-oval
<u>Silver linden</u> – <i>Tilia tomentosa</i>		
'PNI 6051' (Green Mountain [®])	45'/35'	Broad-pyramidal
'Sterling'	45'/35'	Broad-pyramidal
Magnolias		
Cucumbertree – <i>Magnolia acuminata</i>	50-80'/40-60'	Upright-oval
Maples		
<u>Black maple</u> – <i>Acer nigrum</i>		
	60'/60'	Round-spreading
<u>Freeman maple</u> – <i>Acer × freemanii</i>		
'Jeffersred' (Autumn Blaze [®])	50'/45'	Broadly-oval
'DTR 102' (Autumn Fantasy [®])	40'/30'	Broadly-oval
'Marmo'	50'/30'	Upright-oval
'Bailston' (Matador [™])	40'/30'	Upright-oval
'Morgan' ('Indian Summer')	45'/40'	Rounded
'Sienna' (Sienna Glen [®])	45'/35'	Pyramidal
'UMNAF#1' (Firefall [™])	50'/30'	Upright-oval
<u>Hybrid maple</u> – <i>Acer truncatum</i> × <i>platanoides</i>		
'Warrenred' (Pacific Sunset [®])	30'/25'	Upright-spreading
'JFS-KW202' (Crimson Sunset [™])	35'/25'	Upright-oval
<u>Miyabe maple</u> – <i>Acer miyabei</i>		
'Morton' (State Street [™])	45'/30'	Upright-oval
'JFS-KW3AMI' (Rugged Ridge [™])	55'/40'	Upright-oval
<u>Norway maple</u> – <i>Acer platanoides</i>		
'Columnarbroad' (Parkway [®])	40'/25'	Oval
'Deborah'	45'/40'	Rounded
'Emerald Queen'	50'/40'	Oval-upright
'Ezestre' (Easy Street [™])	40'/20'	Narrow-pyramidal
'Fairview'	45'/35'	Upright-oval

	<u>Height/Width</u>	<u>Growth Habit</u>
'Pond' (Emerald Lustre [™])	45'/40'	Rounded
'Princeton Gold'	35'/30'	Oval
<u>Red maple – <i>Acer rubrum</i></u>		
'Bailcraig' (Scarlet Jewell [™])	50'/30'	Upright
'Franksred' (Red Sunset [®])	45'/35'	Upright-oval
'Magnificent Magenta' (Burgundy Belle [®])	50'/40'	Oval
'Frank Jr.' (Redpointe [™])	45'/30'	Pyramidal
'New World'	40'/20'	Narrow-oval
'Polara' (Rubyfrost [™])	45'/40'	Broadly-oval
'Somerset'	45'/35'	Broadly-oval
<u>Sugar maple – <i>Acer saccharum</i></u>		
'Autumn Splendor'	45'/40'	Broadly-oval
'JFS-KW8' (Autumn Fest [™])	50'/35'	Upright-oval
'JFS-Caddo2' (Flashfire [™])	45'/40'	Broadly-oval
'Bailsta' (Fall Fiesta [™])	50'/50'	Upright-rounded
'Commemoration'	50'/35'	Oval-rounded
'Endowment'	50'/20'	Columnar
'Legacy'	50'/35'	Oval
'Morton' (Crescendo [™])	40'/30'	Broadly-oval
'Green Mountain'	45'/35'	Broadly-oval
Planetrees		
<u>London planetree – <i>Platanus × acerifolia</i></u>		
'Bloodgood'	50'/40'	Broadly-pyramidal
'Morton Circle' (Exclamation [™])	55'/35'	Upright-pyramidal
Oaks		
<u>Bur oak – <i>Quercus macrocarpa</i></u>		
'JFS-KW3' (Urban Pinnacle [™])	50-80'/40-80'	Spreading
	55'/25'	Narrow-pyramidal
<u>Chinkapin oak – <i>Quercus muehlenbergii</i></u>		
	45'/45'	Round
<u>English/white oak – <i>Quercus bimundorum</i></u>		
'Crimschmidt' (Crimson Spire [™])	45'/15'	Columnar
'Midwest' (Prairie Stature [™])	50'/40'	Broadly-pyramidal
<u>Hybrid oak – <i>Quercus</i> ×</u>		
'Clemons' (Heritage [®])	40-50'/40-50'	Broadly-pyramidal
'Long' (Regal Prince [®])	45'/18'	Narrow-oval

	<u>Height/Width</u>	<u>Growth Habit</u>
Red oak – <i>Quercus rubra</i>	60-75'/60'	Spreading
Shingle oak – <i>Quercus imbricaria</i>	50'/40'	Broadly-oval
Swamp white oak – <i>Quercus bicolor</i>	60'/60'	Round
White oak – <i>Quercus alba</i>	50-70'/40-80'	Spreading
Sweetgums		
<u>Sweetgum – <i>Liquidambar styraciflua</i></u>		
'Clydesform' (Emerald Sentinel®)	30'/12'	Narrow-pyramid
'Moraine'	40'/25'	Pyramidal

Compiled by Jeff Iles, Department of Horticulture, Iowa State University
10-January-2013

Small-stature Trees for Iowa

This document lists several small-stature tree selections suitable for the Iowa landscape. Nursery and landscape professionals have eliminated green, white, black, pumpkin, and blue ash from their inventories and designs since they are susceptible to the emerald ash borer, which kills ash trees. This destructive pest has been found in several states in the upper Midwest.

While not all-inclusive, this list does describe many useful species, many which are also pest-resistant. Not all trees appearing on this list will “work” in every landscape situation. Great care must be taken to carefully match trees to sites (including above- and below-ground spatial and environmental constraints) and to complement species existing nearby so that a diverse tree canopy will be maintained. *A healthy and diverse tree population is the best defense against current and future tree pests.*

<u>Deciduous Small-stature Trees</u>	<u>Height/Width</u>	<u>Growth Habit</u>
Amur maackia – <i>Maackia amurensis</i>	20'/20'	Upright-spreading
Cherries		
<u>Sargent cherry</u> – <i>Prunus sargentii</i>		
'JFS-KW58' (Pink Flair [®])	25'/15'	Upright
'Hokkaido Normandale' (Spring Wonder [™])	25'/20'	Upright-spreading
Crabapples – <i>Malus</i> species		
'Adirondack'	18'/12'	Vase-shaped
'Beeson' (May's Delight [®])	8'/8'	Upright-spreading
'Hub Tures' (Spring Sensation [™])	10'/12'	Wide-spreading
'JFS-KW5' (Royal Raindrops [®])	20'/15'	Upright-spreading
'Malusquest' (Pink Sparkles [®])	15'/12'	Upright
'Orange Crush'	15'/15'	Round-spreading
Dogwoods		
Corneliancherry dogwood – <i>Cornus mas</i>	20'/20'	Round-spreading
<u>Gray dogwood</u> – <i>Cornus racemosa</i>		
'Jade' (Snow Mantle [™])	15'/8'	Upright-spreading
Pagoda dogwood – <i>Cornus alternifolia</i>	20'/20'	Spreading

	<u>Height/Width</u>	<u>Growth Habit</u>
Hophornbeams		
American hophornbeam – <i>Ostrya virginiana</i>	25'/20'	Upright-spreading
Hornbeams		
<u>American hornbeam</u> – <i>Carpinus caroliniana</i>		
'J.N. Strain'	25'/25'	Spreading
'J.N. Upright' (Firespire™)	20'/10'	Upright
Lilacs		
<u>Japanese tree lilac</u> – <i>Syringa reticulata</i>		
'Bailnce' (Snowdance™)	18'/20'	Round-spreading
'Ivory Silk'	25'/15'	Upright
<u>Pekin lilac</u> – <i>Syringa reticulata</i> subsp. <i>pekinensis</i>		
'Morton' (China Snow®)	20'/20'	Upright-spreading
'SunDak' (Copper Curls®)	20'/15'	Upright-spreading
Magnolias		
<u>Loebner magnolia</u> – <i>Magnolia × loebneri</i>		
'Merrill'	25'/25'	Upright-spreading
'Ruth' (Spring Welcome®)	20'/20'	Round-spreading
Maples		
<u>Tatarian maple</u> – <i>Acer tataricum</i>		
'GarAnn' (Hot Wings®)	20'/25'	Round-spreading
Three-flower maple – <i>Acer triflorum</i>	25'/25'	Upright-spreading
Pears		
<u>Callery pear</u> – <i>Pyrus calleryana</i>		
'Glen's Form' (Chanticleer®)	40'/15'	Narrow-pyramid
<u>Ussurian pear</u> – <i>Pyrus ussuriensis</i>		
'MorDak' (Prairie Gem®)	25'/20'	Oval
'Bailfrost' (Mountain Frost®)	20'/15'	Upright-oval
Redbud		
<u>American redbud</u> – <i>Cercis canadensis</i>		
'Pink Trim' (Northern Herald™)	25'/25'	Spreading

Serviceberries

Allegheny serviceberry – *Amelanchier laevis*

'Cumulus'

20'/15'

Upright-spreading

'JFS-Arb' (**Spring Flurry**[®])

28'/20'

Upright-oval

Apple serviceberry – *Amelanchier* × *grandiflora*

'Autumn Brilliance'

20'/15'

Upright-spreading

'Strata'

20'/20'

Horizontal

Compiled by Jeff Iles, Department of Horticulture, Iowa State University
10-January-2013

The inventory was funded in part through a grant from the Iowa Department of Natural Resources to assist communities in Eastern Iowa with planning and managing their urban tree resources and development of response to the presence of EAB and other tree pests and problems.

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