2014 Urban Forest Management Plan

Maquoketa, Iowa

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Community Tree Inventory

Maquoketa, Iowa

Summary

This plan was developed to assist the City of Maquoketa 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 13.5% of Maquoketa'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 **760 trees inventoried.**

Inventory Overview

- Maquoketa's trees provide $142,407 of benefits annually, an average of $187 a tree.
- There are over 45 species of trees.
- The top three genus are: Maple 49%, Ash 13.5% Apple 8.4%
- 54.32% of trees are in need of some type of management.
- 43 trees are recommended for removal.

General Recommendations

The following are key recommendations from the inventory:

- Of the 43 trees needing removal, 22 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. Of the 43 removals, 4 are ash trees. **City ownership of the trees recommended for removal should be verified prior to any removal.*
- After the removal of the 43 critical concern trees, ash trees in poor health should be assessed for removal.
- 11 of the 102 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 do 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 760 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. Maquoketa's trees reduce energy related costs by approximately $36,944 annually. These savings are both in Electricity (175.4 MWh) and in Natural Gas (24,110.5 Therms).

2. Annual Stormwater Benefits: Maquoketa's trees intercept about 2,193,218 gallons of rainfall or snowmelt a year. This interception provides $59,436 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 Maquoketa, it is estimated that trees remove 23,655 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $6,673

4. Annual Carbon Benefits: Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Maquoketa trees sequester about 396,770 lbs of carbon dioxide (CO2) a year with an associated value of $4,834. In addition, the trees store 9,280,479 lbs of carbon, with a yearly benefit of $69,604.

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. Maquoketa receives $34,521 in annual social benefits from trees.

Financial Summary of all Benefits: According to the USDA Forest Service i-Tree STRATUM analysis, Maquoketa's trees provide $142,407 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 760 trees in Maquoketa provide approximately $187 annually.

Table 1: Annual Benefits of Public Trees

Benefits	Per Tree	Cumulative
Energy	$48.61	$36,944
CO_2	$6.36	$4,833
Air Quality	$8.78	$6,673
Stormwater	$78.21	$59,436
Aesthetic/Other	$45.42	$34,521
Total ($)	**$187.38**	**$142,407**

Forest Structure

1. Species & Genus Distribution: Maquoketa has over 45 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

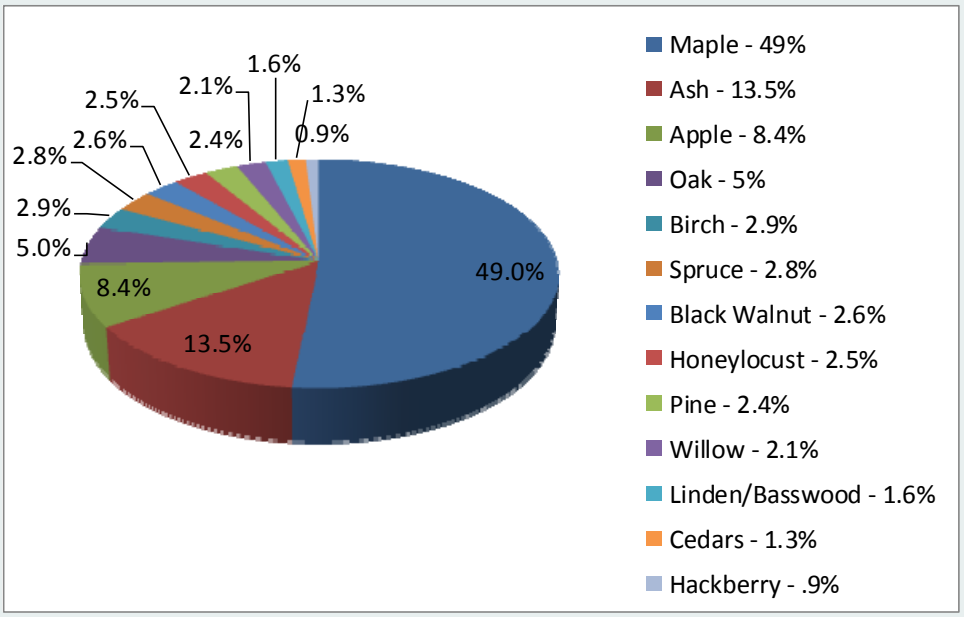

Figure 2: Common Tree Species by Percentage

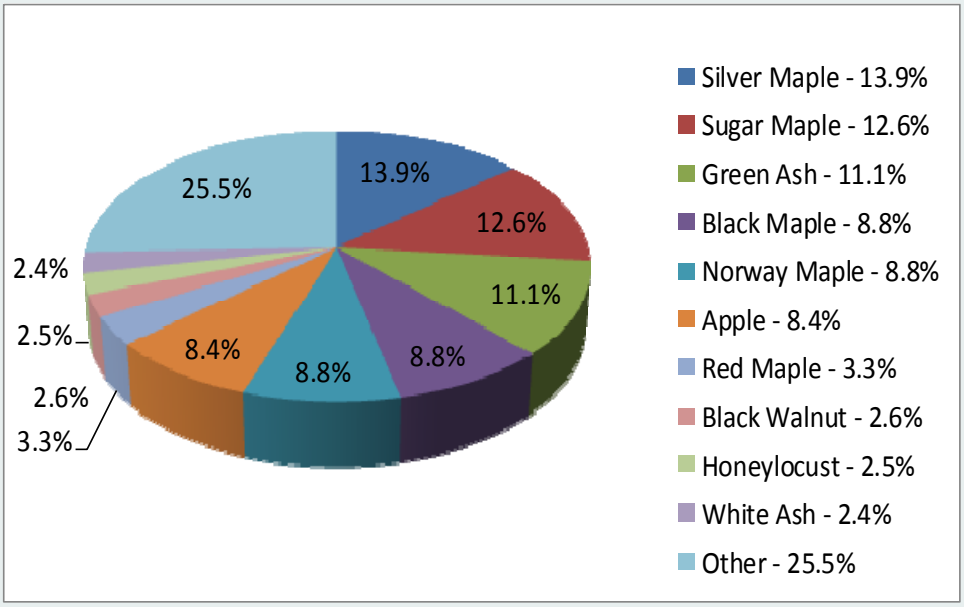

Table 2: Tree Genus

Genus	No. of Trees
Maple	373
Ash	102
Apple	64
Oak	38
Birch	22
Spruce	21
Black Walnut	20
Honey Locust	19
Pine	18
Willow	16
Linden/Basswood	12
Cedars	10
Hackberry	7

2. Age Class: Maquoketa 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. Maquoketa'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)

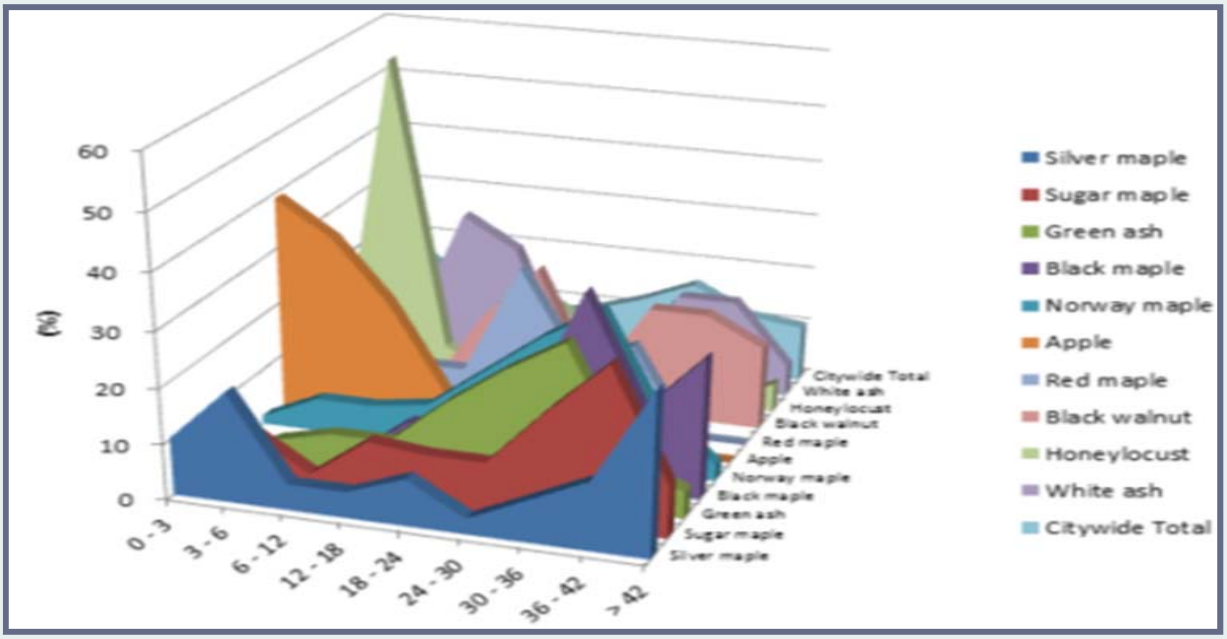

Table 3: Relative Age Distribution

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Silver maple	10.38	19.81	4.72	4.72	8.49	2.83	7.55	12.26	29.25
Sugar maple	0.00	9.38	3.13	10.42	9.38	9.38	19.79	29.17	9.38
Green ash	0.00	4.76	7.14	7.14	15.48	22.62	28.57	9.52	4.76
Black maple	0.00	0.00	0.00	7.46	5.97	11.94	34.33	14.93	25.37
Norway maple	1.49	5.97	5.97	7.46	14.93	22.39	28.36	10.45	2.99
Apple	39.06	32.81	21.88	6.25	0.00	0.00	0.00	0.00	0.00
Red maple	12.00	16.00	8.00	8.00	28.00	12.00	16.00	0.00	0.00
Black walnut	0.00	0.00	0.00	15.00	25.00	5.00	20.00	20.00	15.00
Honeylocust	0.00	57.89	5.26	0.00	15.79	10.53	5.26	0.00	5.26
White ash	0.00	5.56	27.78	22.22	0.00	5.56	16.67	16.67	5.56
Citywide Total	8.68	16.05	9.08	7.50	8.95	12.11	16.18	11.32	10.13

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 Maquoketa indicate that 97% of the trees are in fair-good health, with only 3% of the foliage in poor health, dead or dying. Similarly, 86% of Maquoketa's trees are in fair-good health for wood condition. Wood condition that is in poor health, dead or dying is about 14% of the population. This 14% is an estimate of trees that need management follow up soon.

4. Management Needs: The following management needs for Maquoketa's urban tree 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	243	32%
Crown Raising	27	3.6%
Tree Staking	19	2.5%
Tree Removal	43	5.7%
Crown Reduction	13	1.7%

Table 5: Land Use

Single Family Residential	48.42%
Park/Vacant/Other	48.42%
Industrial/Large Commercial	0%
Small Commercial	2.11%
Multifamily Residential	1.05%

Table 6: Location Type

Planting Strip	48.42%
Other Maintained Location (Park)	48.42%
Front Yard	0%
Cutout (Surrounded by Pavement)	2.11%

5. Canopy Cover: Maquoketa occupies 2,797 acres. The total public and private tree canopy cover of Maquoketa is approximately 385 acres or 14%. The tree canopy used for this inventory was 22 acres.

6. Land Use and Location: The majority of Maquoketa's city and park trees are in planting strips in single family residential neighborhoods. Table 5 &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: Maquoketa has 24 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 22 trees over 24 inches in diameter at 4.5 feet 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 2 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 24 removals, 4 are ash trees. There are a total of 102 ash trees, and 10 of those have signs and symptoms that have been associated with EAB. In addition, there are 7 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 Maquoketa.

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 (49%). 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 makes up a majority of the species (Norway, silver, sugar) 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 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: 13 largest critical concern trees (includes 4 ash) or saving for ash tree treatment
Planting and Replacement: 9 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2: Removal: 13 critical concern trees of all species or saving for ash tree treatment
Planting and Replacement: 4 trees in open locations from year one removals
Routine trimming: Delayed except critical concern branches
Visual Survey for signs and symptoms of EAB

Year 3: Removal: 13 critical concern trees of all species or saving for ash tree treatment
Planting and Replacement: 9 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4: Removal: 4 critical concern trees, new critical concern trees and/or 9 ash in poor health, or saving for ash tree treatment
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Delayed except critical concern branches
Visual Survey for signs and symptoms of EAB

Year 5: Removal: 13 trees, new critical concern trees and/or ash in poor health or saving for ash tree treatment
Planting and Replacement: 9 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6: Removal: 13 trees, new critical concern trees and/or ash in poor health or saving for ash tree treatment
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Delayed except critical concern branches
Visual Survey for signs and symptoms of EAB

Reduction of ash over 6 years: 39 ash trees removed (38% of ash). It will take approximately 11 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 years of its arrival.** To remove all ash

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/

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

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.

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 Ordinance, Title VI Physical Environment, Chapter 14 Trees, at the end of the report.

Proposed Budget

Total $63,000 over 6 years ($10,500/year)

FY 2015 Budget

Removal @ $700/tree: $9,100 or saving for ash tree treatment
Planting @ $100/tree: $900
Watering & Maintenance: $500

FY 2016 Budget

Removal: $9,100 or saving for ash tree treatment
Planting: $400
Critical concern trimming: $500
Watering & Maintenance: $500

FY 2017 Budget

Removal: $9,100 or saving for ash tree treatment
Planting: $900
Watering & Maintenance: $500

FY 2018 Budget

Removal: $9,100 or saving for ash tree treatment
Planting: $400
Critical concern trimming: $500
Watering & Maintenance: $500

FY 2019 Budget

Removal: $9,100 or saving for ash tree treatment
Planting: $900
Watering & Maintenance: $500

FY 2016 Budget

Removal: $9,100 or saving for ash tree treatment
Planting: $400
Critical concern trimming: $500
Watering & Maintenance: $500

*Reduction of ash over 6 years: 39 ash trees removed (38% of ash). **It will take approximately 11years to remove all ash with the current budget.**

Proposed Budget Increase

EAB could potentially kill all ash trees in Maquoketa within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $17,000 a year. Additionally, it is recommended that Maquoketa 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 All Trees by Species									
Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/tree
Silver maple	28.15	3,076.68	3,747.13	3,672.18	6,748.86	(N/A)	13.95	15.77	63.67
Sugar maple	30.96	3,384.23	4,081.62	3,999.99	7,384.22	(N/A)	12.63	17.25	76.92
Green ash	26.51	2,897.23	3,657.36	3,584.21	6,481.44	(N/A)	11.05	15.14	77.16
Black maple	18.91	2,067.31	2,624.04	2,571.56	4,638.87	(N/A)	8.82	10.84	69.24
Norway maple	18.19	1,987.64	2,674.98	2,621.48	4,609.12	(N/A)	8.82	10.77	68.79
Apple	2.32	253.70	373.64	366.17	619.87	(N/A)	8.42	1.45	9.69
Red maple	4.87	532.51	674.83	661.33	1,193.85	(N/A)	3.29	2.79	47.75
Black walnut	7.10	776.34	958.32	939.16	1,715.49	(N/A)	2.63	4.01	85.77
Honeylocust	3.07	336.05	420.81	412.39	748.44	(N/A)	2.50	1.75	39.39
White ash	5.68	621.22	673.84	660.37	1,281.59	(N/A)	2.37	2.99	71.20
Northern red oak	2.78	303.55	389.15	381.37	684.92	(N/A)	2.24	1.60	40.29
Willow	4.88	532.90	717.19	702.84	1,235.74	(N/A)	2.11	2.89	77.23
Eastern white pine	1.69	184.26	225.49	220.98	405.24	(N/A)	2.11	0.95	25.33
River birch	1.79	196.02	246.61	241.68	437.70	(N/A)	1.97	1.02	29.18
Norway spruce	0.67	73.31	100.43	98.42	171.74	(N/A)	1.45	0.40	15.61
Littleleaf linden	1.29	140.54	186.12	182.40	322.94	(N/A)	1.45	0.75	29.36
Blue spruce	0.21	22.92	35.60	34.89	57.81	(N/A)	1.32	0.14	5.78
Bur oak	0.70	76.85	92.99	91.14	167.99	(N/A)	1.18	0.39	18.67
Northern white cedar	0.19	21.01	25.90	25.39	46.40	(N/A)	1.05	0.11	5.80
Northern hackberry	2.42	264.79	342.54	335.69	600.48	(N/A)	0.92	1.40	85.78
Other Street Trees	13.04	1,425.58	1,861.91	1,824.68	3,250.26	(N/A)	0.36	0.28	49.88
Total	175.43	19,174.66	24,110.52	23,628.31	42,802.98	(N/A)	100.00	100.00	56.32

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of All Trees by Species						
Species	Total Rainfall Interception (Gal)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/tree
Silver maple	445,215.31	12,065.33	(N/A)	13.95	20.30	113.82
Sugar maple	436,265.96	11,822.81	(N/A)	12.63	19.89	123.15
Green ash	340,361.64	9,223.80	(N/A)	11.05	15.52	109.81
Black maple	185,772.09	5,034.42	(N/A)	8.82	8.47	75.14
Norway maple	196,712.01	5,330.90	(N/A)	8.82	8.97	79.57
Apple	7,997.04	216.72	(N/A)	8.42	0.36	3.39
Red maple	45,180.13	1,224.38	(N/A)	3.29	2.06	48.98
Black walnut	93,927.55	2,545.44	(N/A)	2.63	4.28	127.27
Honeylocust	30,070.12	814.90	(N/A)	2.50	1.37	42.89
White ash	70,359.05	1,906.73	(N/A)	2.37	3.21	105.93
Northern red oak	29,702.61	804.94	(N/A)	2.24	1.35	47.35
Willow	54,019.09	1,463.92	(N/A)	2.11	2.46	91.49
Eastern white pine	35,437.12	960.35	(N/A)	2.11	1.62	60.02
River birch	10,215.03	276.83	(N/A)	1.97	0.47	18.46
Norway spruce	12,327.17	334.07	(N/A)	1.45	0.56	30.37
Littleleaf linden	12,503.13	338.83	(N/A)	1.45	0.57	30.80
Blue spruce	1,971.97	53.44	(N/A)	1.32	0.09	5.34
Bur oak	8,586.96	232.71	(N/A)	1.18	0.39	25.86
Northern white cedar	2,207.84	59.83	(N/A)	1.05	0.10	7.48
Northern hackberry	26,443.70	716.62	(N/A)	0.92	1.21	102.37
Other City Trees	147,942.24	4,009.23	(N/A)	9.74	6.75	66.47
Citywide total	2,193,217.76	59,436.20	(N/A)	100.00	100.00	78.21

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

Annual Air Quality Benefits of All Trees by Species

Species	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Total Deposition	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Total Avoided	BVOC Emission	BVOC Emission	Total (lb)	Total ($)	Stand.Error	% of Total Trees	Avg. $/tree
Silver maple	86.18	14.60	41.53	3.82	462.44	133.11	19.46	18.57	127.32	831.74	- 46.82	- 175.59	397.76	1,118.58	(N/A)	13.95	10.55
Sugar maple	68.04	11.60	32.24	3.01	363.76	146.25	21.40	20.43	140.21	914.70	- 52.47	- 196.77	390.71	1,081.69	(N/A)	12.63	11.27
Green ash	48.32	7.73	22.19	2.16	254.66	126.82	18.45	17.58	120.12	789.36	0.00	0.00	363.37	1,044.02	(N/A)	11.05	12.43
Black maple	48.05	8.19	22.03	2.13	254.82	90.49	13.16	12.54	85.66	563.09	- 15.64	- 58.65	266.62	759.26	(N/A)	8.82	11.33
Norway maple	43.41	7.49	20.92	1.92	233.35	88.62	12.78	12.15	82.49	547.81	- 9.90	- 37.13	259.88	744.02	(N/A)	8.82	11.10
Apple	1.55	0.26	0.86	0.07	8.62	11.57	1.65	1.56	10.52	70.86	- 0.01	- 0.04	28.03	79.45	(N/A)	8.42	1.24
Red maple	11.32	1.93	5.24	0.50	60.16	23.30	3.39	3.23	22.07	145.00	- 3.72	- 13.94	67.25	191.22	(N/A)	3.29	7.65
Black walnut	14.72	2.35	6.66	0.66	77.27	33.79	4.93	4.70	32.19	210.81	0.00	0.00	100.00	288.08	(N/A)	2.63	14.40
Honeylocust	5.57	0.92	2.60	0.25	29.57	14.64	2.13	2.03	13.92	91.27	- 4.28	- 16.04	37.79	104.80	(N/A)	2.50	5.52
White ash	14.98	2.39	6.66	0.67	78.32	26.16	3.88	3.71	25.73	165.33	0.00	0.00	84.19	243.65	(N/A)	2.37	13.54
Northern red oak	6.38	1.10	3.08	0.28	34.31	13.32	1.93	1.84	12.58	82.80	- 9.22	- 34.58	31.29	82.52	(N/A)	2.24	4.85
Willow	12.06	2.08	5.79	0.53	64.77	23.76	3.43	3.26	22.12	146.87	- 2.74	- 10.27	70.29	201.37	(N/A)	2.11	12.59
Eastern white pine	4.21	0.83	3.40	0.52	27.55	7.98	1.17	1.11	7.64	49.89	- 20.16	- 75.58	6.70	1.85	(N/A)	2.11	0.12
River birch	1.35	0.23	0.77	0.06	7.61	8.59	1.25	1.19	8.14	53.49	- 0.38	- 1.44	21.21	59.65	(N/A)	1.97	3.98
Norway spruce	1.36	0.27	1.15	0.17	9.07	3.27	0.47	0.45	3.04	20.21	- 6.60	- 24.75	3.58	4.53	(N/A)	1.45	0.41
Littleleaf linden	2.08	0.36	1.04	0.09	11.31	6.24	0.90	0.86	5.84	38.64	- 1.01	- 3.78	16.41	46.17	(N/A)	1.45	4.20
Blue spruce	0.13	0.03	0.16	0.02	0.99	1.06	0.15	0.14	0.95	6.46	- 0.54	- 2.01	2.09	5.43	(N/A)	1.32	0.54
Bur oak	1.62	0.26	0.73	0.07	8.49	3.32	0.49	0.46	3.18	20.78	0.00	0.00	10.14	29.27	(N/A)	1.18	3.25
Northern white cedar	0.19	0.04	0.18	0.02	1.29	0.91	0.13	0.13	0.87	5.70	- 0.75	- 2.81	1.72	4.18	(N/A)	1.05	0.52
Northern hackberry	4.93	0.85	2.42	0.22	26.65	11.68	1.69	1.61	10.99	72.51	0.00	0.00	34.40	99.16	(N/A)	0.92	14.17
Other Street Trees	26.49	4.48	13.22	1.37	143.81	62.94	9.11	8.68	59.11	390.40	- 13.32	- 49.95	172.08	484.25	(N/A)	9.74	7.35
Citywide Total	402.94	67.98	192.87	18.55	2,158.83	837.84	121.94	116.25	794.69	5,217.68	- 187.56	- 703.34	2,365.50	6,673.17	(N/A)	100.00	8.78

Annual CO2 Benefits of All Trees by Species

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release(lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	141,814.95	1,063.61	- 10,674.06	- 346.71	- 2.60	47,216.15	354.12	178,010.32	1,335.08	(N/A)	13.95	27.62	12.60
Sugar maple	84,615.86	634.62	- 9,802.66	- 360.56	- 2.70	51,936.04	389.52	126,388.69	947.92	(N/A)	12.63	19.61	9.87
Green ash	61,320.67	459.91	- 7,676.37	- 290.16	- 2.18	44,462.24	333.47	97,816.38	733.62	(N/A)	11.05	15.18	8.73
Black maple	6,109.39	45.82	- 2,451.50	- 179.01	- 1.34	31,725.96	237.94	35,204.84	264.04	(N/A)	8.82	5.46	3.94
Norway maple	13,463.23	100.97	- 3,444.03	- 217.04	- 1.63	30,503.26	228.77	40,305.42	302.29	(N/A)	8.82	6.25	4.51
Apple	3,678.60	27.59	- 140.00	- 41.34	- 0.31	3,893.43	29.20	7,390.69	55.43	(N/A)	8.42	1.15	0.87
Red maple	7,923.74	59.43	- 583.88	- 47.39	- 0.36	8,172.22	61.29	15,464.69	115.99	(N/A)	3.29	2.40	4.64
Black walnut	14,414.77	108.11	- 2,389.58	- 78.00	- 0.59	11,914.03	89.36	23,861.22	178.96	(N/A)	2.63	3.70	8.95
Honeylocust	6,474.78	48.56	- 352.20	- 26.72	- 0.20	5,157.18	38.68	11,253.04	84.40	(N/A)	2.50	1.75	4.44
White ash	10,033.06	75.25	- 1,044.21	- 50.90	- 0.38	9,533.53	71.50	18,471.48	138.54	(N/A)	2.37	2.87	7.70
Northern red oak	1,768.65	13.26	- 684.28	- 37.44	- 0.28	4,658.50	34.94	5,705.43	42.79	(N/A)	2.24	0.89	2.52
Willow	5,496.15	41.22	- 954.34	- 53.82	- 0.40	8,178.13	61.34	12,666.12	95.00	(N/A)	2.11	1.97	5.94
Eastern white pine	1,338.46	10.04	- 245.89	- 35.69	- 0.27	2,827.76	21.21	3,884.65	29.13	(N/A)	2.11	0.60	1.82
River birch	3,309.02	24.82	- 116.99	- 17.55	- 0.13	3,008.26	22.56	6,182.75	46.37	(N/A)	1.97	0.96	3.09
Norway spruce	783.66	5.88	- 77.42	- 13.85	- 0.10	1,125.12	8.44	1,817.51	13.63	(N/A)	1.45	0.28	1.24
Littleleaf linden	3,166.39	23.75	- 220.30	- 17.75	- 0.13	2,156.81	16.18	5,085.16	38.14	(N/A)	1.45	0.79	3.47
Blue spruce	95.43	0.72	- 2.28	- 4.49	- 0.03	351.71	2.64	440.38	3.30	(N/A)	1.32	0.07	0.33
Bur oak	992.16	7.44	- 277.53	- 9.95	- 0.07	1,179.44	8.85	1,884.13	14.13	(N/A)	1.18	0.29	1.57
Northern white cedar	169.21	1.27	- 6.08	- 4.10	- 0.03	322.48	2.42	481.51	3.61	(N/A)	1.05	0.07	0.45
Northern hackberry	3,226.19	24.20	- 383.51	- 24.57	- 0.18	4,063.65	30.48	6,881.76	51.61	(N/A)	0.92	1.07	7.37
Other City Trees	26,575.30	199.31	- 3,062.73	- 173.36	- 1.30	21,877.62	164.08	45,216.83	339.13		9.74	7.02	5.25
Citywide Total	396,769.67	2,975.77	- 44,589.85	- 2,030.36	- 15.23	294,263.51	2,206.98	644,412.97	4,833.10	(N/A)	100.00	100.00	6.36

Table 5: Annual Carbon Stored

Stored CO2 Benefits of All Trees by Species						
Species	Total stored CO2 (lbs)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	2,220,581.01	16,654.36	(N/A)	13.95	23.93	157.12
Sugar maple	2,040,910.70	15,306.83	(N/A)	12.63	21.99	159.45
Green ash	1,599,244.13	11,994.33	(N/A)	11.05	17.23	142.79
Black maple	510,728.54	3,830.46	(N/A)	8.82	5.50	57.17
Norway maple	716,913.35	5,376.85	(N/A)	8.82	7.72	80.25
Apple	28,937.55	217.03	(N/A)	8.42	0.31	3.39
Red maple	121,608.04	912.06	(N/A)	3.29	1.31	36.48
Black walnut	497,829.31	3,733.72	(N/A)	2.63	5.36	186.69
Honeylocust	72,071.12	540.53	(N/A)	2.50	0.78	28.45
White ash	217,420.27	1,630.65	(N/A)	2.37	2.34	90.59
Northern red oak	142,541.58	1,069.06	(N/A)	2.24	1.54	62.89
Willow	198,821.78	1,491.16	(N/A)	2.11	2.14	93.20
Eastern white pine	51,222.15	384.17	(N/A)	2.11	0.55	24.01
River birch	23,632.65	177.24	(N/A)	1.97	0.25	11.82
Norway spruce	16,126.83	120.95	(N/A)	1.45	0.17	11.00
Littleleaf linden	45,273.09	339.55	(N/A)	1.45	0.49	30.87
Blue spruce	466.93	3.50	(N/A)	1.32	0.01	0.35
Bur oak	57,794.84	433.46	(N/A)	1.18	0.62	48.16
Northern white cedar	1,258.95	9.44	(N/A)	1.05	0.01	1.18
Northern hackberry	79,897.77	599.23	(N/A)	0.92	0.86	85.60
Other City Trees	637,198.84	4,778.99	(N/A)	9.74	6.87	79.49
Citywide total	9,280,479.44	69,603.60	(N/A)	100.00	100.00	91.58

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefit of All Trees by Species					
Species	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	3,820.85	(N/A)	13.95	30.23	36.05
Sugar maple	2,953.47	(N/A)	12.63	23.37	30.77
Green ash	1,713.74	(N/A)	11.05	13.56	20.40
Black maple	280.40	(N/A)	8.82	2.22	4.19
Norway maple	460.36	(N/A)	8.82	3.64	6.87
Apple	71.62	(N/A)	8.42	0.57	1.12
Red maple	360.34	(N/A)	3.29	2.85	14.41
Black walnut	394.32	(N/A)	2.63	3.12	19.72
Honeylocust	540.71	(N/A)	2.50	4.28	28.46
White ash	408.20	(N/A)	2.37	3.23	22.68
Northern red oak	52.64	(N/A)	2.24	0.42	3.10
Willow	176.80	(N/A)	2.11	1.40	11.05
Eastern white pine	92.36	(N/A)	2.11	0.73	5.77
River birch	134.67	(N/A)	1.97	1.07	8.98
Norway spruce	53.53	(N/A)	1.45	0.42	4.87
Littleleaf linden	130.93	(N/A)	1.45	1.04	11.90
Blue spruce	34.96	(N/A)	1.32	0.28	3.50
Bur oak	48.27	(N/A)	1.18	0.38	5.36
Northern white cedar	27.38	(N/A)	1.05	0.22	3.42
Other City Trees	733.73	(N/A)	9.74	5.81	11.52
Citywide Total	12,638.65	(N/A)	100.00	100.00	16.63

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of All Tree by Species ($/tree)							
Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total	Stand. Error
Silver maple	63.67	12.60	10.55	113.82	36.05	236.69	(N/A)
Sugar maple	76.92	9.87	11.27	123.15	30.77	251.98	(N/A)
Green ash	77.16	8.73	12.43	109.81	20.40	228.53	(N/A)
Black maple	69.24	3.94	11.33	75.14	4.19	163.84	(N/A)
Norway maple	68.79	4.51	11.10	79.57	6.87	170.85	(N/A)
Apple	9.69	0.87	1.24	3.39	1.12	16.30	(N/A)
Red maple	47.75	4.64	7.65	48.98	14.41	123.43	(N/A)
Black walnut	85.77	8.95	14.40	127.27	19.72	256.11	(N/A)
Honeylocust	39.39	4.44	5.52	42.89	28.46	120.70	(N/A)
White ash	71.20	7.70	13.54	105.93	22.68	221.04	(N/A)
Northern red oak	40.29	2.52	4.85	47.35	3.10	98.11	(N/A)
Willow	77.23	5.94	12.59	91.49	11.05	198.30	(N/A)
Eastern white pine	25.33	1.82	0.12	60.02	5.77	93.06	(N/A)
River birch	29.18	3.09	3.98	18.46	8.98	63.68	(N/A)
Norway spruce	15.61	1.24	0.41	30.37	4.87	52.50	(N/A)
Littleleaf linden	29.36	3.47	4.20	30.80	11.90	79.73	(N/A)
Blue spruce	5.78	0.33	0.54	5.34	3.50	15.49	(N/A)
Bur oak	18.67	1.57	3.25	25.86	5.36	54.71	(N/A)
Northern white cedar	5.80	0.45	0.52	7.48	3.42	17.68	(N/A)
Northern hackberry	85.78	7.37	14.17	102.37	21.34	231.03	(N/A)

Figure 1: Species Distribution

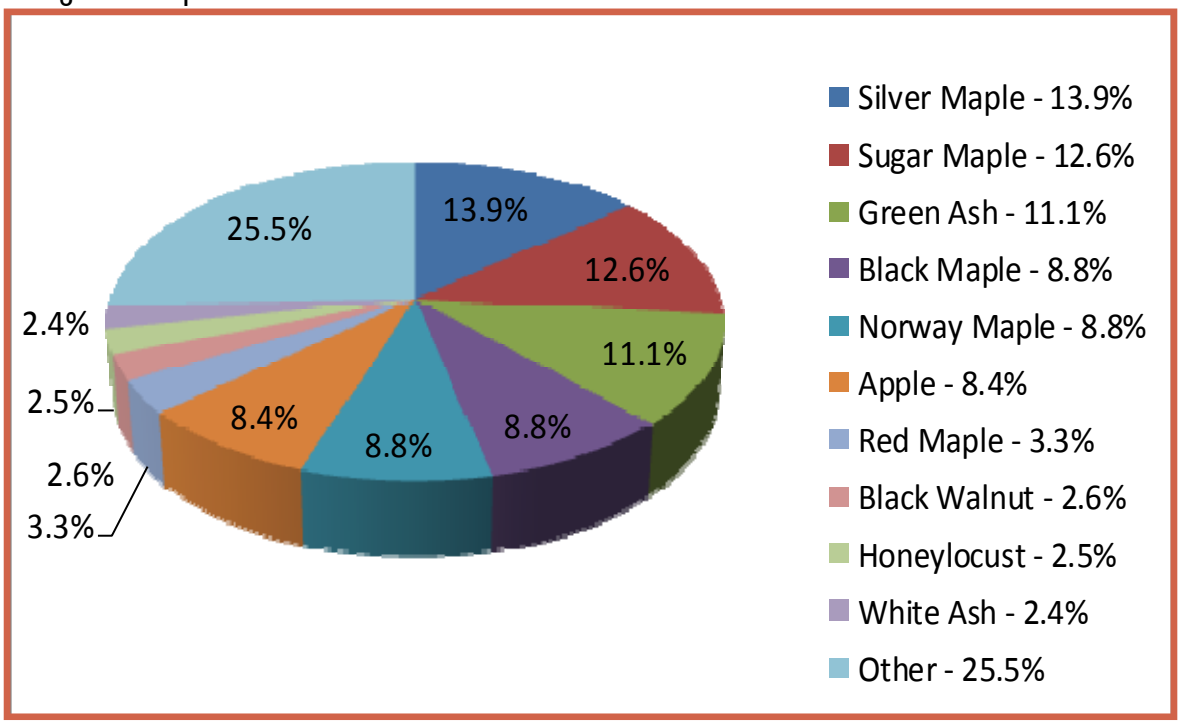


Figure 2: Relative Age Class

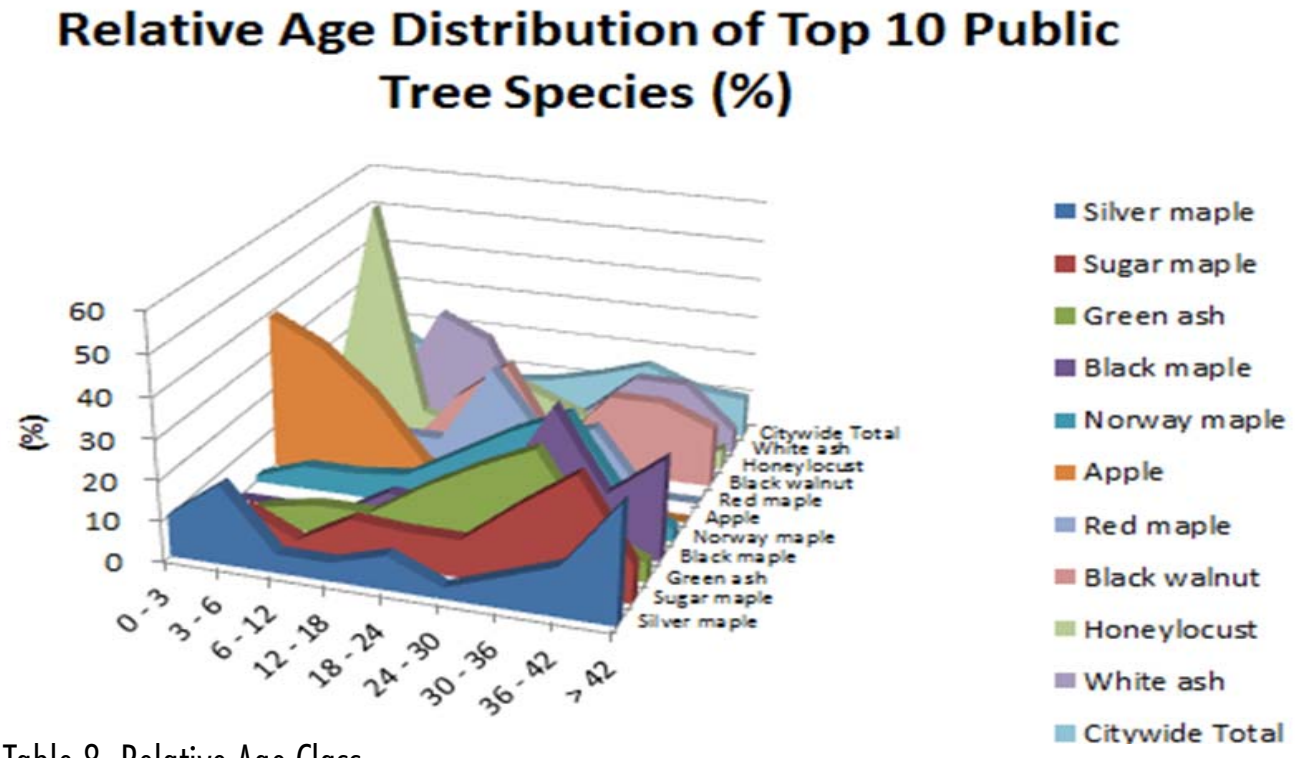


Table 8: Relative Age Class

Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	>42
Silver maple	10.38	19.81	4.72	4.72	8.49	2.83	7.55	12.26	29.25
Sugar maple	0.00	9.38	3.13	10.42	9.38	9.38	19.79	29.17	9.38
Green ash	0.00	4.76	7.14	7.14	15.48	22.62	28.57	9.52	4.76
Black maple	0.00	0.00	0.00	7.46	5.97	11.94	34.33	14.93	25.37
Norway maple	1.49	5.97	5.97	7.46	14.93	22.39	28.36	10.45	2.99
Apple	39.06	32.81	21.88	6.25	0.00	0.00	0.00	0.00	0.00
Red maple	12.00	16.00	8.00	8.00	28.00	12.00	16.00	0.00	0.00
Black walnut	0.00	0.00	0.00	15.00	25.00	5.00	20.00	20.00	15.00
Honeylocust	0.00	57.89	5.26	0.00	15.79	10.53	5.26	0.00	5.26
White ash	0.00	5.56	27.78	22.22	0.00	5.56	16.67	16.67	5.56
Citywide Total	8.68	16.05	9.08	7.50	8.95	12.11	16.18	11.32	10.13

Figure 3: Foliage Condition

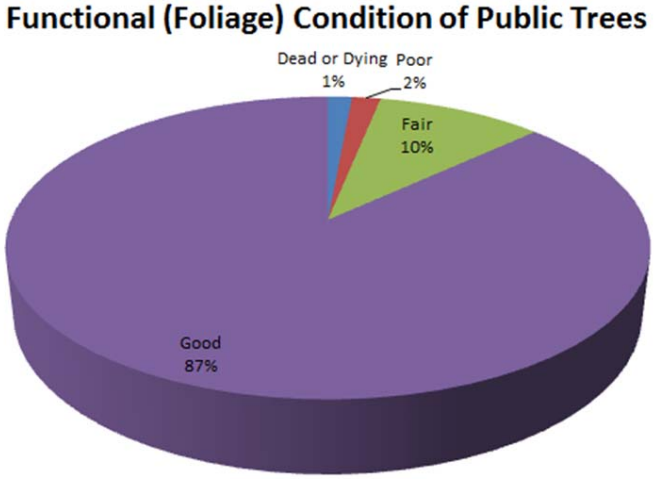


Figure 4: Wood Condition

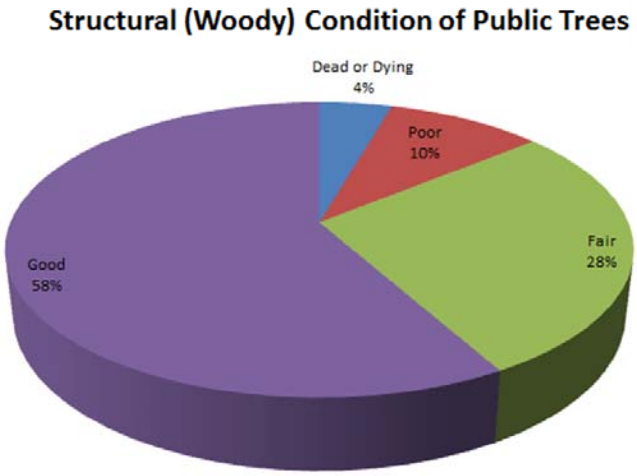


Figure 5: Land Use of City/Park Trees

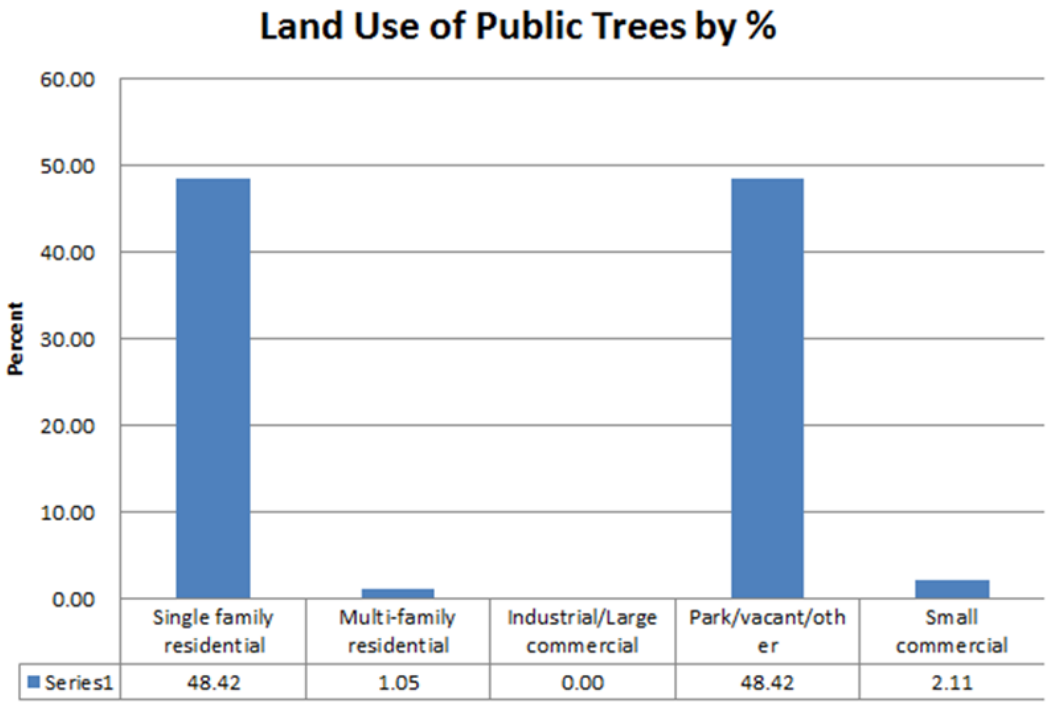
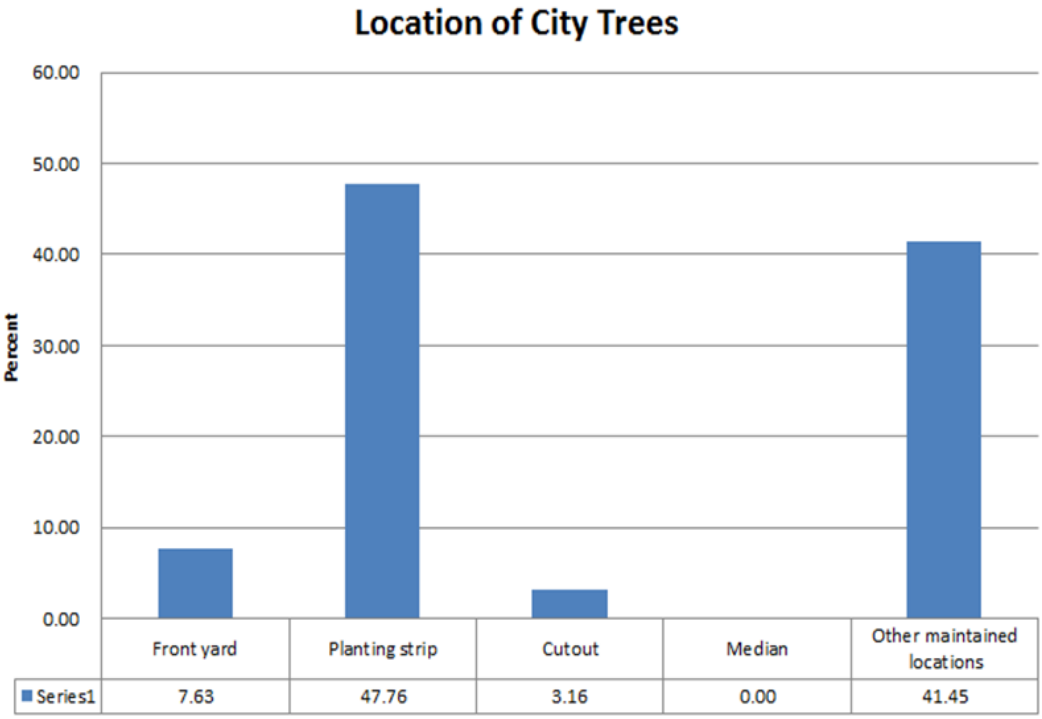


Figure 6: Location of City/Park Trees



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

Image 6: Good Condition Ash

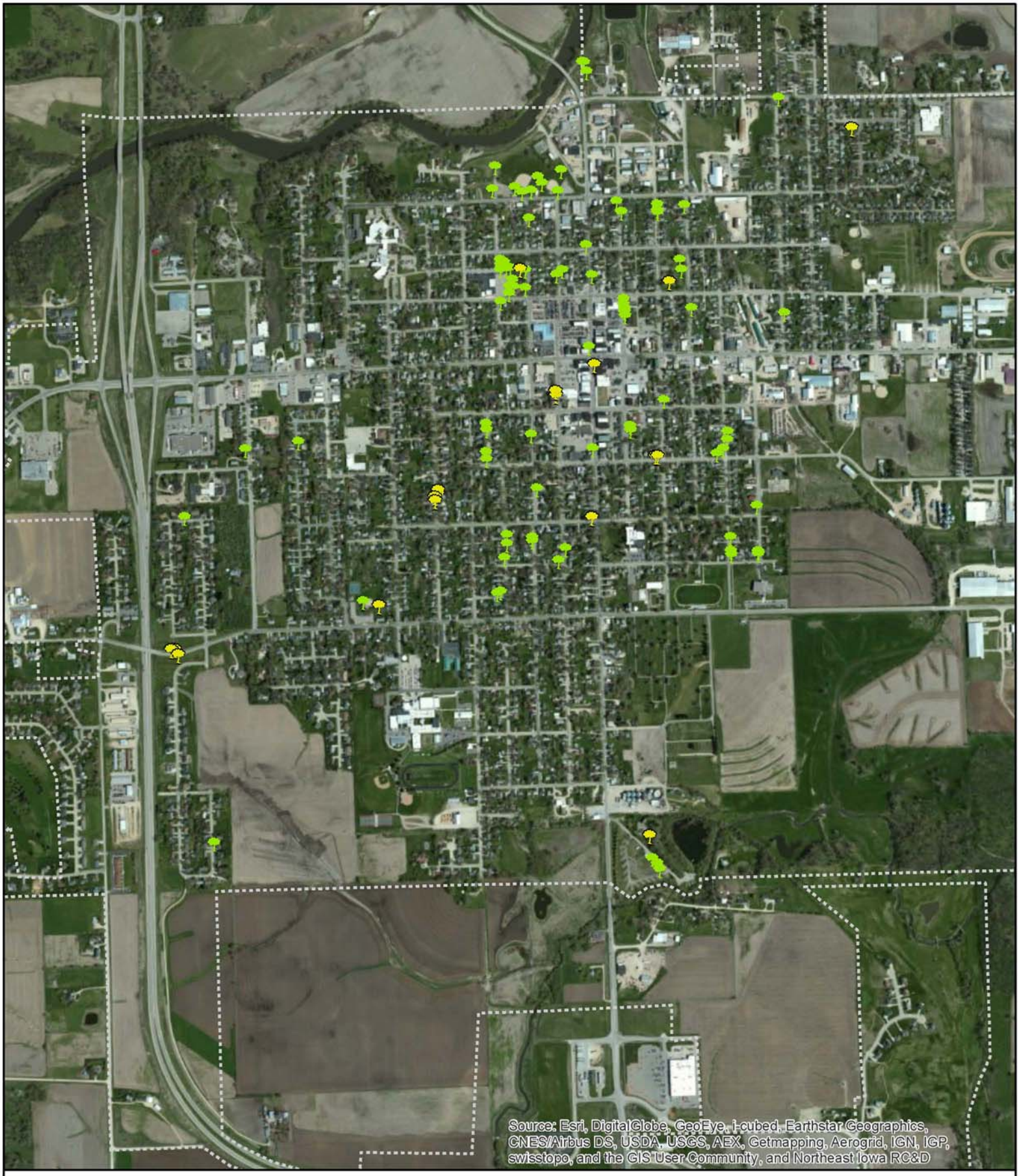


Image 1. Location of Ash Trees

Legend

- Green ash
- White ash
- Ash
- Black ash

Maquoketa, Iowa

0 0.125 0.25 0.5 Miles

N

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

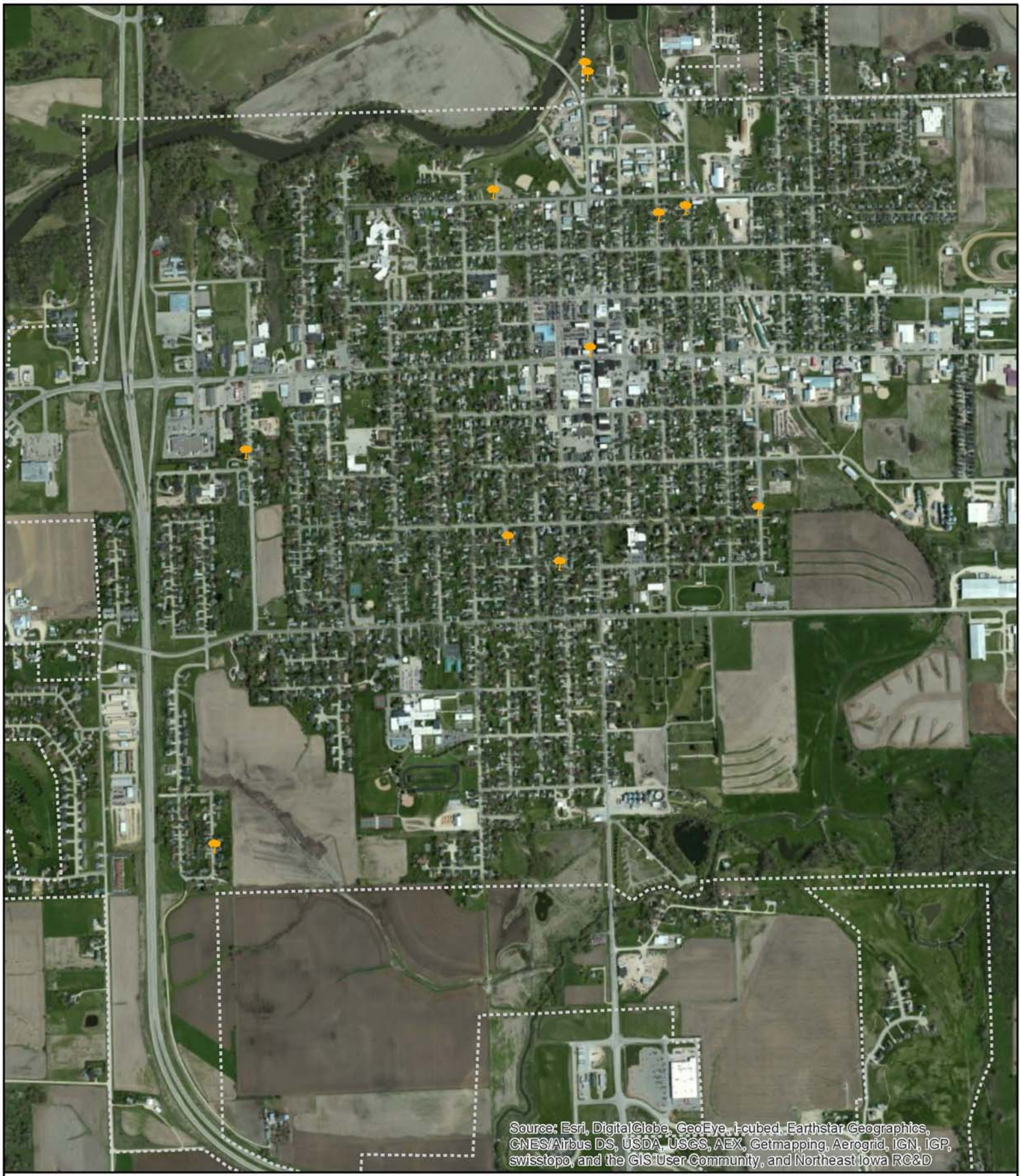


Image 2. Location of Trees with One or More Symptoms of EAB
(Canopy Dieback, Epicormic Shoots, Woodpecker Damage, Bark Splitting, or D-Shaped Exit Holes)

Legend

EAB Symptoms

City Limits

Maquoketa, Iowa

0 0.125 0.25 0.5 Miles

N

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

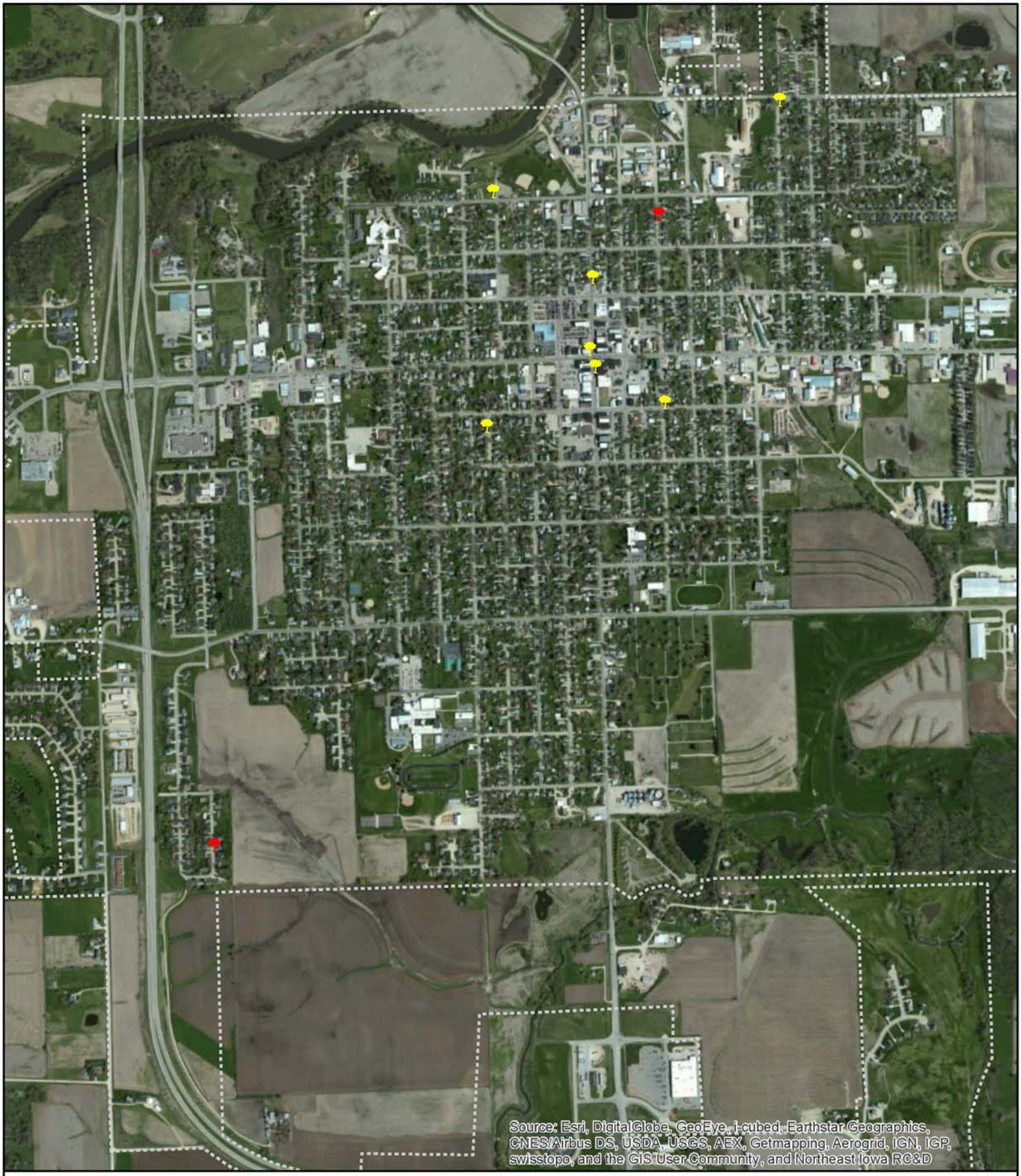


Image 3. Location of Poor Condition Ash Trees
(Wood and/or Leaves are Dead/Dying or in Poor Condition)

Legend

Dead or Dying

Poor

Maquoketa, Iowa

0 0.1 0.2 0.4 Miles

N

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

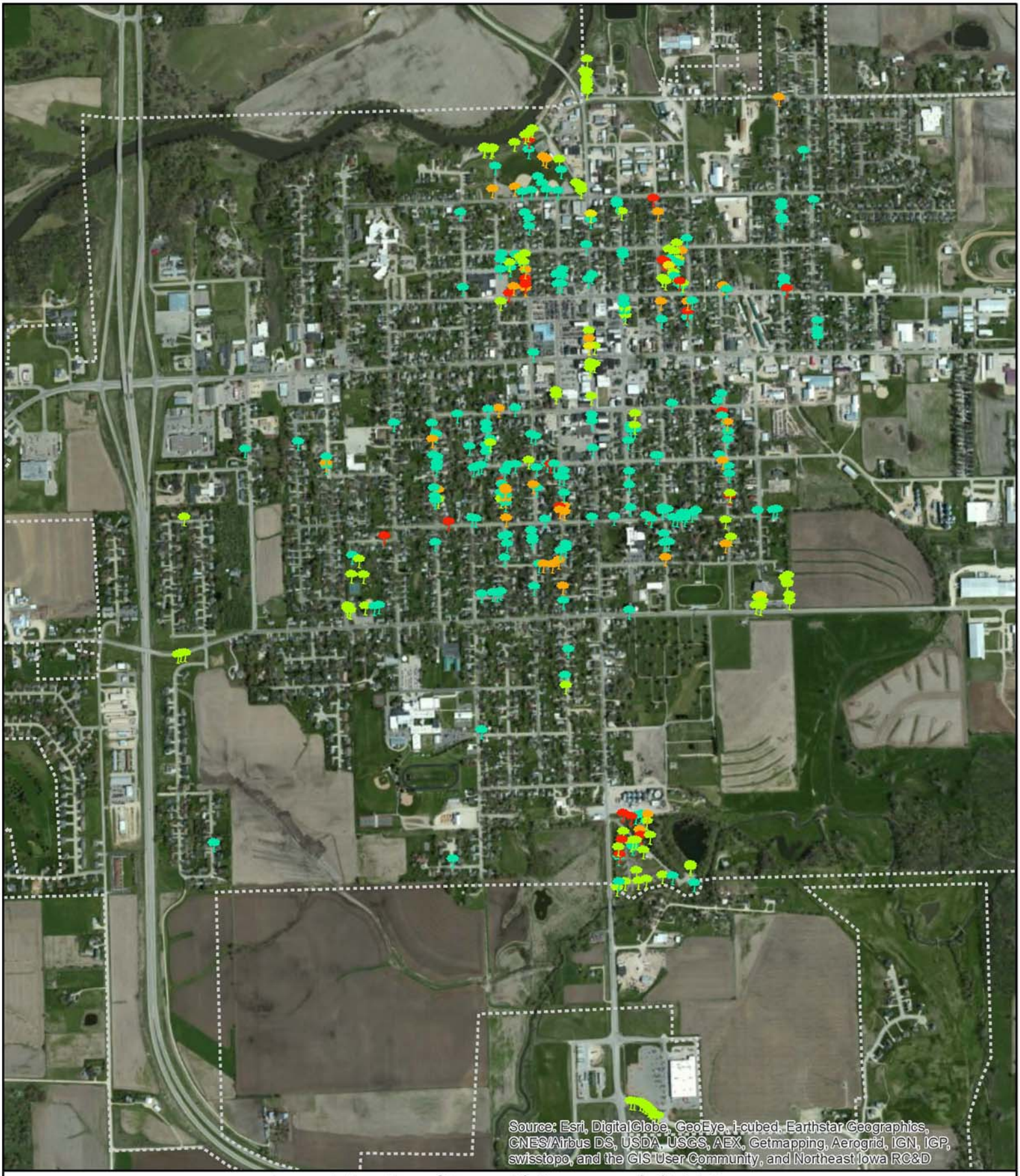


Image 4. Location of Trees with Recommended Maintenance

Maquoketa, Iowa

Legend

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

N

0 0.1 0.2 0.4 Miles

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

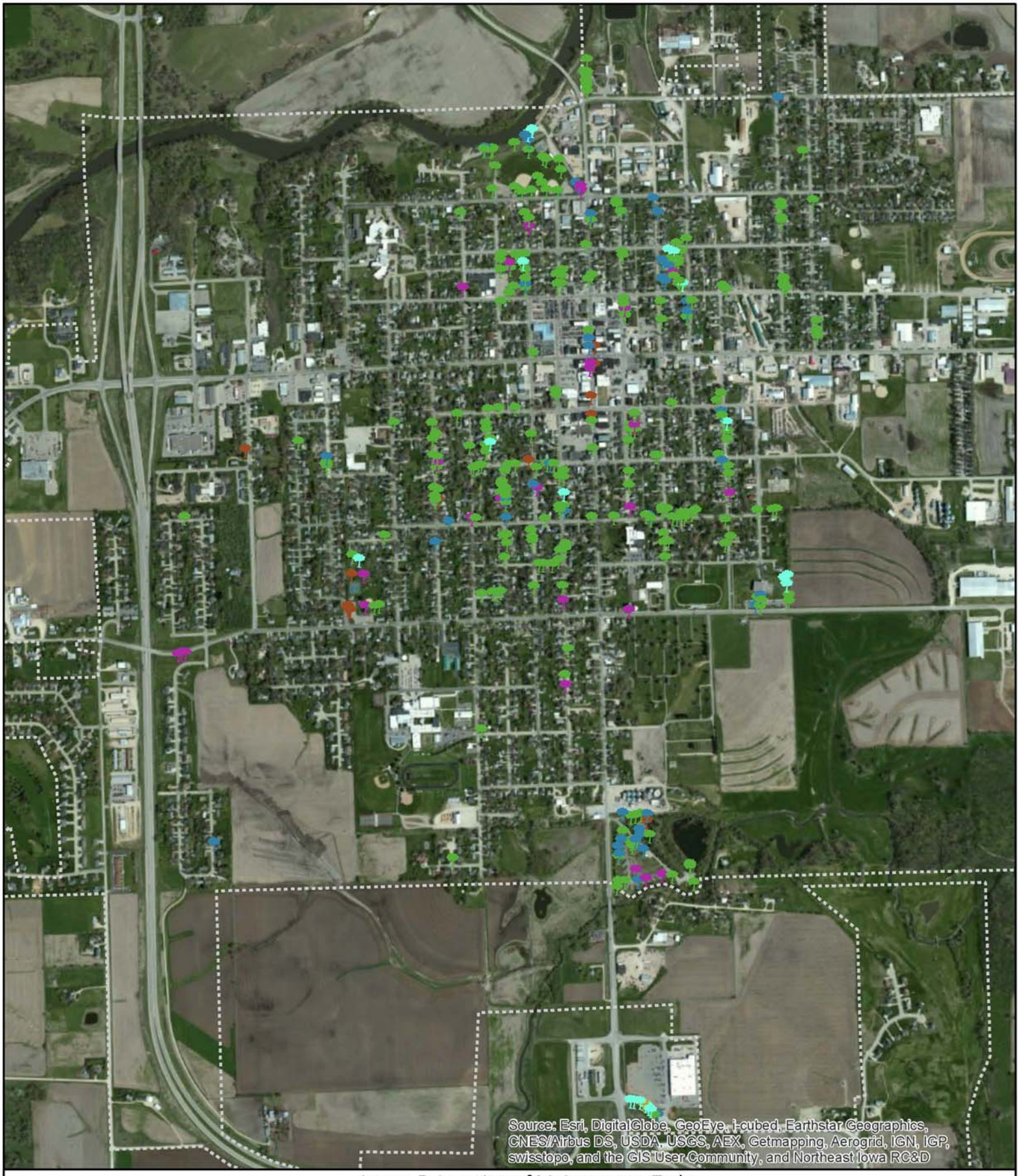


Image 5. Location of Maintenance Tasks

Maquoketa, Iowa

Legend

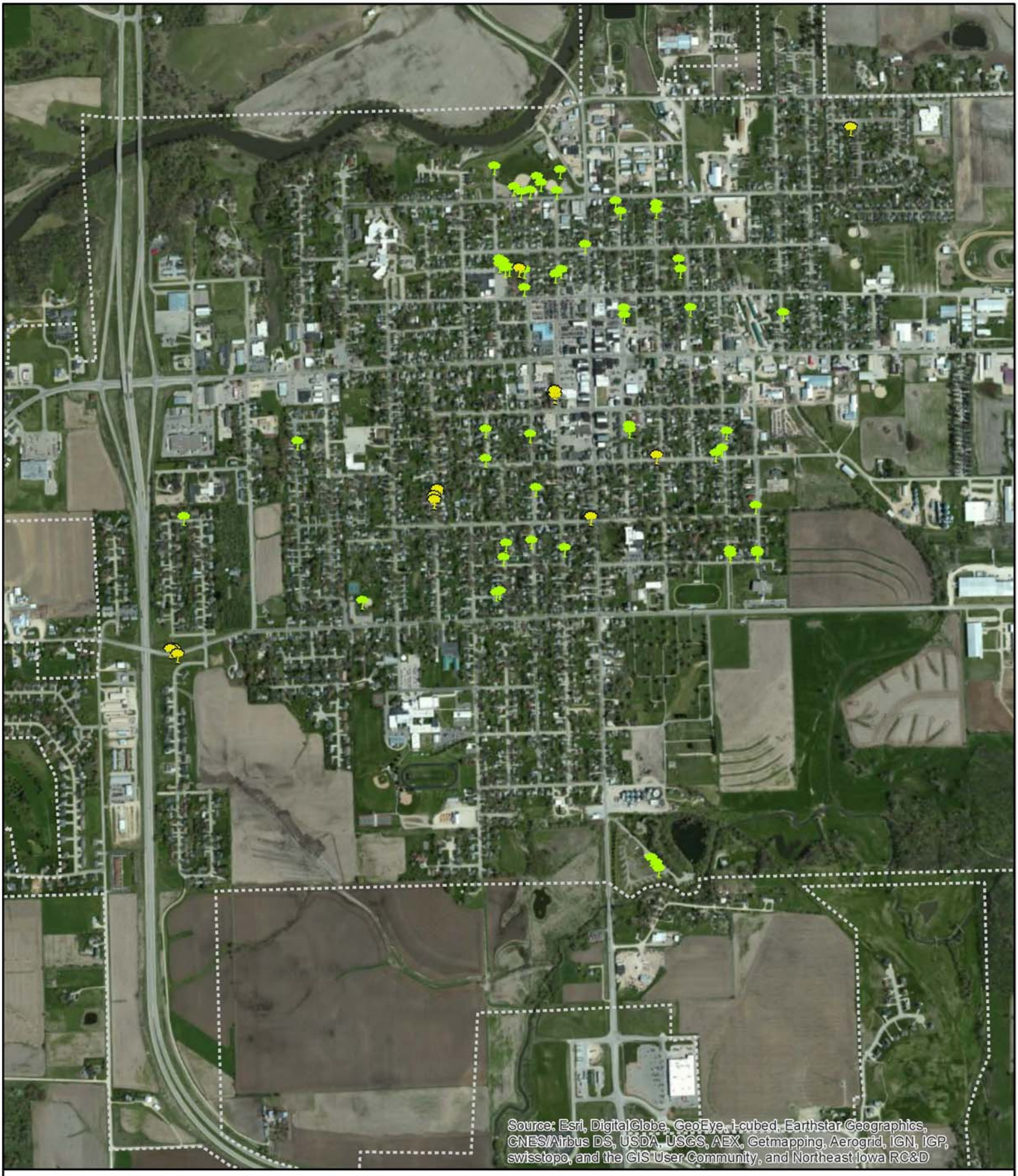
Clean | Raise | Reduce | Remove* | Stake/Train | Treat pest/disease

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

N

0 0.1 0.2 0.4 Miles

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



Location of Good Condition Ash Trees
(Wood and Leaves are in Good Condition, Trees Show No Symptoms of EAB, and No Wires are Conflicting)

Legend

- Green ash
- Ash
- White ash
- Black ash

Maquoketa, Iowa

0 0.1 0.2 0.4 Miles

N

Map created by Northeast Iowa RC&D
12/3/2014

Appendix C: Maquoketa Tree Ordinances

TITLE VI PHYSICAL ENVIRONMENT

CHAPTER 14 TREES

6-14-1 DEFINITIONS

1. Street trees "Street trees" are herein defined as trees, shrubs, bushes, and all other woody vegetation on land lying between property lines on either side of all streets, avenues, or ways within the City.

2. Park trees "Park trees" are herein defined as trees, shrubs, bushes and all other woody vegetation in public parks having individual names, and all areas owned by the City or to which the public has free access as a park.

6-14-2 CREATION AND ESTABLISHMENT OF A CITY TREE BOARD There is hereby created and established a City Tree Board for the City of Maquoketa, Iowa, which shall consist of five members, citizens and residents of this City, who shall be appointed by the Mayor with the approval of the Council.

6-14-3 TERM OF OFFICE The term of the five persons to be appointed by the Mayor shall be three years except that the term of two of the members appointed to the first board shall be for only one year and the term of two members of the first board shall be

for two years. In the event that a vacancy shall occur during the term of any member, his/her successor shall be appointed for the unexpired portion of the term.

6-14-4 COMPENSATION Members of the Board shall serve without compensation.

6-14-5 DUTIES AND RESPONSIBILITIES It shall be the responsibility of the Board to study, investigate, counsel and develop and/or annually administer a written plan for the care, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs in parks, along streets and in other public areas. Such plan will be presented annually to the City Council and upon their acceptance and approval shall constitute the official comprehensive City tree plan for the City of Maquoketa, Iowa. The Board, when requested by the City, shall consider, investigate, make finding, report, and recommend upon any special matter of question coming within the scope of its work. Variations from Section 7,8, and 9 of this ordinance may be made on an individual basis by action of the City Tree Board.

6-14-6 OPERATION The Board shall choose its own officers, make its own rules and regulations and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business.

6-14-7 STREET TREE SPECIES The following list constitutes the Official Street Tree species for Maquoketa, Iowa. No species other than those included in this list may be planted as Street Trees without written permission of the City Tree Board.

Small Trees:	Crabapple
	Flowering Pear
	Bradford Redbud
Medium Trees:	Ash
	Hackberry
	Honeylocust (thornless)
	Linden
	Oak
	Maple
Large Trees:	Maple
	Sugar Oak
	Burr

6-14-8 SPACING The spacing of Street Trees will be in accordance with the tree species size classes listed in Section 7 of this ordinance, and no trees may be planted closer together than the following: Small Trees, 30 feet; Medium Trees, 40 feet; Large Trees, 60 feet; except in special plantings designed or approved by a landscape architect.

6-14-9 DISTANCE FROM CURB AND SIDEWALK No trees may be planted closer to any curb than ten feet (10') without the approval of the City Tree Board and completion of application being filled out by property owner and Iowa One Call finished. This section shall not apply to the Central Business District as defined in Section 6-7-1 of this Code.

No tree shall be planted within the City's right-of-way, unless such tree is planted to replace a tree that has been removed within the last two years and unless advance approval is given by the Tree Board. The Tree Board shall meet during the months of March and August of each year or as necessary and shall review applications to plant such trees in the City right-of-way.

(Ord. 955 8-6-01)

6-14-10 DISTANCE FROM STREET CORNERS AND FIREPLUGS No Street Tree shall be planted closer than thirty-five feet (35') of any street corner, measured from the point of nearest intersection curbs or curb lines. No Street Tree shall be planted closer than 10 feet of any fireplug.

6-14-11 UTILITIES No Street Trees other than those species listed as Small Trees in Section 7 of this Ordinance may be planted under or within ten lateral feet (10') of any overhead utility wire, or over, or within five lateral feet (5') of any underground water line, sewer, transmission line or other utility.

6-14-12 PUBLIC TREE CARE The City and the Maquoketa Municipal Electric Utility shall have the right to plant, prune, maintain, and remove trees, plants, and shrubs within the lines of all streets, alleys, avenues, lanes, squares, and public grounds, as may be necessary to insure public safety or to preserve or enhance the symmetry and beauty of such public grounds.

The City Tree Board may remove or cause or order to be removed, any tree or part thereof, which is in an unsafe condition or which by reason of its nature is injurious to sewers, gas lines, water lines, or other public improvements, or is affected with any injurious fungus, insect or other pest This Section does not prohibit the planting of Street Trees by adjacent property owners providing that the selection and location of said trees is in accordance with Sections 7 through 11 of this ordinance.

6-14-13 TREE TOPPING It shall be unlawful as a normal practice for any person, firm, 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 (3") in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes, or certain trees under utility wires or other obstructions where other pruning practices are impractical may be exempted from this ordinance at the determination of the City Tree Board. The tree trimming and tree topping conducted by the Employees of the Maquoketa Municipal Electric Utility shall be exempt from this section.

6-14-14 PRUNING, CORNER CLEARANCE Every owner of any tree overhanging any street or right-of-way within the City shall prune the branches so that such branches shall not obstruct the light from any street lamp or obstruct the view of any street intersection and so that there shall be a clear space of eight feet (8') above the surface of the street or sidewalk. Said owners shall remove all dead, diseased or dangerous trees, or broken or decayed limbs which constitute a menace to the safety of the public. The City shall have the right to prune any tree or shrub on private property when it interferes with the proper spread of light along the street from a street light or interferes with visibility of any traffic control device or sign.

6-14-15 DEAD OR DISEASED TREE REMOVAL ON PRIVATE PROPERTY The City shall have the right to cause the removal of any dead or diseased trees on private property within the City, when such trees constitute a hazard to life and property, or harbor insects of disease which constitute a potential threat to other trees within the City. The City Tree Board will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within sixty (60) days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owner's property tax notice.

6-14-16 REMOVAL OF STUMPS All stumps of street and park trees shall be removed below the surface of the ground so that the top of the stump shall not project above the surface of the ground.

6-14-17 INTERFERENCE WITH CITY TREE BOARD It shall be unlawful for any person to prevent, deny or interfere with the City Tree Board, or any of its agents, while engaging in and about the planting, cultivating, mulching, pruning, spraying, or removing of any street trees, park trees, or trees on private grounds, as authorized in this ordinance.

6-14-18 LICENSE FEE AND INSURANCE REQUIREMENTS It shall be unlawful for any person or firm to engage in the business or occupation of pruning, treating, or removing trees within the City without first applying for and procuring a license.

The license fee shall be seventy-five dollars ($75.00) annually in advance.

No license shall be required of:

1. Any public service company, or City employee, doing such work in the pursuit of their public service endeavors.

2. Any person with reference to tree or trees on his/her own premises.

3. Any individual performing labor or services on or in connection with trees at the direction and under the personal supervision of a licensed tree trimmer while in the performance of such function.

4. Any public utility, including its authorized employees and agents, when engaged in the tree trimming and/or tree removal for the purpose of line clearance, and in order to insure the continuity of utility service to the public.

Before any license shall be issued, each application shall first file evidence of possession of liability insurance with an insurance company of good standing and authorized to do business in the State of Iowa, in the minimum amounts as follows:

General Aggregate	$1,000,000
Products and Completed Operations Aggregate	$1,000,000
Personal and Advertising Injury	$500,000
Each Occurrence	$500,000
Fire Damage (any one fire)	$50,000
Medical Expense(any one person)	$5,000

(Ord 856, 04-17-95)
(Ord. 861, 11-20-95)
(Ord. No. 958 10-15-01)

REVIEW BY CITY COUNCIL The City Council shall have the right to review the conduct, acts, and decisions of the City Tree Board. Any person may appeal from any ruling, or order of the City Tree Board to the City Council who may hear the matter and make final decision.

6-14-20 PENALTY Any person violating any provision of this ordinance shall be, upon conviction or a plea of guilty, subject to a fine not to exceed one hundred thousand dollars ($100,000).

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.*

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

	Height/Width	Growth Habit
Coffeetree		
Kentucky coffeetree – *Gymnocladus dioicus*		
'Espresso'	50'/35'	Oval
Cork trees		
Cork tree – *Phellodendron* species		
'Longenecker' (**Eye Stopper™**)	40'/35'	Rounded
'His Majesty'	40'/35'	Vase-shaped
Elms		
American elm – *Ulmus americana*		
'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
Asian Elm Cultivars and Hybrids		
'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
European and Eurasian Hybrid Elm Cultivars		
'Patriot'	50'/40'	Stiff vase-shaped
Filbert		
Turkish filbert – *Corylus colurna*	40'/30'	Pyramidal
Gingkoes		
Ginkgo – *Ginkgo biloba*		
'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

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

	Height/Width	Growth Habit
Littleleaf linden – *Tilia cordata*		
'Baileyi' (**Shamrock®**)	40'/30'	Pyramidal
'Corzam' (**Corinthian®**)	45'/15'	Narrow-pyramid
'Ronald' (**Norlin™**)	40'/30'	Pyramidal
Mongolian linden – *Tilia mongolica*		
'Harvest Gold'	30-40'/25-30'	Upright-oval
Silver linden – *Tilia tomentosa*		
'PNI 6051' (**Green Mountain®**)	45'/35'	Broad-pyramidal
'Sterling'	45'/35'	Broad-pyramidal
Magnolias		
Cucumbertree – *Magnolia acuminata*	50-80'/40-60'	Upright-oval
Maples		
Black maple – *Acer nigrum*	60'/60'	Round-spreading
Freeman maple – *Acer × freemanii*		
'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
Hybrid maple – *Acer truncatum × platanoides*		
'Warrenred' (**Pacific Sunset®**)	30'/25'	Upright-spreading
'JFS-KW202' (**Crimson Sunset™**)	35'/25'	Upright-oval
Miyabe maple – *Acer miyabei*		
'Morton' (**State Street™**)	45'/30'	Upright-oval
'JFS-KW3AMI' (**Rugged Ridge™**)	55'/40'	Upright-oval
Norway maple – *Acer platanoides*		
'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

	Height/Width	Growth Habit
'Pond' (**Emerald Lustre™**)	45'/40'	Rounded
'Princeton Gold'	35'/30'	Oval
Red maple – *Acer rubrum*		
'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
Sugar maple – *Acer saccharum*		
'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		
London planetree – *Platanus × acerifolia*		
'Bloodgood'	50'/40'	Broadly-pyramidal
'Morton Circle' (**Exclamation™**)	55'/35'	Upright-pyramidal
Oaks		
Bur oak – *Quercus macrocarpa*	50-80'/40-80'	Spreading
'JFS-KW3' (**Urban Pinnacle™**)	55'/25'	Narrow-pyramidal
Chinkapin oak – *Quercus muehlenbergii*	45'/45'	Round
English/white oak – *Quercus bimundorum*		
'Crimschmidt' (**Crimson Spire™**)	45'/15'	Columnar
'Midwest' (**Prairie Stature™**)	50'/40'	Broadly-pyramidal
Hybrid oak – *Quercus ×*		
'Clemons' (**Heritage®**)	40-50'/40-50'	Broadly-pyramidal
'Long' (**Regal Prince®**)	45'/18'	Narrow-oval

	Height/Width	Growth Habit
Red oak – *Quercus rubra*	60-75'/60'	Spreading
Shingle oak – *Quercus imbricaria*	50'/40'	Broadly-oval
Swamp white oak – *Quercus bicolor*	60'/60'	Round
White oak – *Quercus alba*	50-70'/40-80'	Spreading
S weetgums		
Sweetgum – *Liquidambar styraciflua*		
'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.*

Deciduous Small-stature Trees	**Height/Width**	**Growth Habit**
Amur maackia – *Maackia amurensis*	20'/20'	Upright-spreading
Cherries		
Sargent cherry – *Prunus sargentii*		
'JFS-KW58' (**Pink Flair**®)	25'/15'	Upright
'Hokkaido Normandale' (**Spring Wonder**™)	25'/20'	Upright-spreading
Crabapples – *Malus* 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 – *Cornus mas*	20'/20'	Round-spreading
Gray dogwood – *Cornus racemosa*		
'Jade' (**Snow Mantle**™)	15'/8'	Upright-spreading
Pagoda dogwood – *Cornus alternifolia*	20'/20'	Spreading

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